1895-1915 : The Second Renaissance

SEHDEV KUMAR

In western civilization, the Renaissance marks the high point of its creative expression. For over one century, in art and architecture, sculpture and music, human imagination sought and discovered new modes of expression. Amongst them was the discovery of the perspective; rendering three-dimensional space on the two dimensions of canvas, space not *as it is* but as ist *appears to be* to the observer from his position. The discovery of the perspective in painting had come to imply a subtle shift in philosophical sensibilities : absolutism and relativism, communal and the individual, subjective and objective, space and time. The communal 'points of view' gave way to an individual point of view' that created *The Birth of Venus* and *Mona Lisa*.

What did the Renaissance mean to the ordinary people - the peasants, the workers, the simple folk ? Perhaps not much, because unlike the scientific and industrial revolutions of the later periods, the Renaissance wrought no significant political or socio-economic changes. The Renaissance had created new ways of 'reflecting' on the world, but not 'changing' it.

In the history of ideas, however, the two decades, from 1895-1915, mark a far more crucial intermingling of abstract thought and concrete influences than almost two centuries of Renaissance. This Second Renaissance, if it may be so named, triggered an unprecedented perceptual revolution in our view of the world, not only of atoms and molecules, space and time, mass and energy, but also of the human mind, through a new understanding of the unconscious and of dreams, in psychology, art and literature. This Second Renaissance created a *Stream of Perspectives* which was unparalle impact on communal liefe, at all levels and for all generations to come. This paper outlines some of the features of this Second Renaissance.

I

The Second Renaissance started with physics, which became in the words of Jacob Bronowski, "the grlatest collective work of science -- no more, than that, the greatest collectice work of art of the twentieth century."[1]

There are many names associated with what came to be known as *Modern Physics* or *The Second Scientific Revolution*: Roentgen, Poincare, Bacquerel, Curies, Thomson, Planck, Einstein, Minkowski Bohr· Their work challenged the fundamental concepts of physical universe, believed to be true for over two hundred years. Mass and energy were interlinked, space and time became a continuum, waveparticee quality was established, energy was quantised. Atom had an intricate structure, radio-activity was discovered. With the invention of the x-rays, the Third Eye was opened, to reveal a world within a world within a world....

Any one or all off these could be regarded as hall-mark of the Second Renaissance, but the year 1900 should mark a definite turning point in this exhilarating voyage. In 1933, in an afternoon lunch walk, the German physicist, Max Planck remarked to his companion : "I have had a conception today as revolutionary and as great as the kind of thought that Newton had "[2] And so it was. In his famous paper "Zur Theorie des Gesetzes der Energieverteilung in Normal-Spektrum", Planck presented his revolutionary Quantum Theory, according to which, energy, like matter, existed in discrete packets or quanta. The size of the quantum for any particular form of electromagnetic radiation was in direct proportion to its frequency, expressed in the equation

$$\epsilon = h\nu$$

where h was Planck's constant, with a value of 6.61×10^{-27} erg seconds.

This is the fundamental law of Quantum Theory, and an undisputed foundation - stone of the new revolution in physics. Modern physics, with its genesis in 1900, would not without new forms of mathematical analysis involving quanta, this being referred to as qantum mechanics.

This radical departure from Newtonian physics encountered strong opposition. However, its successful explanation of black-body radiation spectra, its important role in Albert Einstein's explanation of the photoelectric effect in 1905, and its further development by Niels Bohr in his model of the hydrogen atom in 1913 finally estabished the validity of Planck's concept of the quantum.

Another gaiant of this Second Renaissance was Albert Einstein· His 1905 paper "Uber einen die Erzeugung und Verwandlung des Lichtes betreffenden Heuristischen Gesichtspunkt" (On a Heuristic Viewpoint Concerning the Production and Transformation of Light") was described by Einstein himself as "very revolutionary". The heuristic viewpoint of the titles was nothihg less thah the suggestion that light be considered a collection of independent particles of energy, which he called light quanta. Dismissing a century of evidence supporting the wave theory of light, Einstein's proposal of light quanta could immediately account for several puzzling prop rties of fluorescence, photoionization, and especially of the photoelectric effect. His quantitative prediction of the relationship between the maximum energy of the photoelectrons and the frequency of the incident light was not verified experimentally for a decade. However' with the introduction of the concept of the wave-particle duality Einstein extended Planck's concept of the quantum theory of matter to radiation, "a kind of fusion of the wave and emission theories".[3]

Here was another blow to 'classical' physics. Einstein regarded the separateness of the concepts electromagnetism and particle mechanics as the outstanding fault of physical theory. He did not, however, subscribe to the electromagnetic programme but originated new strategies for unifying the parts of physics; his 1905 light-quantum hypothesis and relativity theory were the traits of such strategies.

The stated purpose of Einstein's first paper on relativity in 1935, "Zur Elektrodynamik bewegter Korper" ("On the Electrodynamics of moving bodies") was to produce a "simple and consistent theory of the electrodyramics of moving bodies based on Maxell's theory for stationary bodies".[4] But his work stemmed from the Michelson-Morley experiment of 1827. The experiment had been unable to detect any difference in the velocity of light with changes in its direction through the either. Einstein therefore began with the assumption that the velocity of light in a vacuum is always constant despite any motion of its source, or the person measuring the light. Furthermore he cancelled out the either as unnecessary by assuming that light travelled in quanta. Without the other, Einstein pointed out, there was certainly nothing in the universe that could be viewed as at 'absolute rest", nor could any motion be considered an 'absolute motion". Hence all motion is relative to the frame of reference.

He showed that from this simple assumption of the constancy of the velocity of light and the relativity of motion, the Michelson-Morley experiment could be explained and Maxwelly's electromagnetic equations could be kept. He also deduced that the velocity of light in a vacuum was therefore the maximum speed at which information could be transferred.

All sorts of peculiar results followed. The rate at which time passed varied with velocity of motion. Space and time vanished as separate entities and were replaced by a fused "space-time". This was presented in the "Kinematical Part" of Einstein's paper "On the Electrodynamics of Moving Bodies". Meaning of time in physics has been a subject relatively exempt from fundamental scrutiny because of the extraordinary strength of traditional intuitive beliefs. Einstein later acknowledged that his familiarity with the writings of David Hume and Ernst Mach had fostered the kind of critical reasoning underlying this part of his work.

The concept of absolute simultaneity, so "roote in the unconscious"[5] presented the most formidable psychological obstacle, and made his theory look so obscure and contrary to common sense. With this theory of interrelatedness of mass and energy through $E=mc^2$, it was no longer sufficient to speak of Lavoisier's conservation of mass or of Helmholtz' conservation of energy. Instead there was the greater generalisation of the conservation of mass-energy.

The universal implications of Einstein's theory were established in 1907 and 1908 by Hermann Minkowski. He argued that realativity implied a complete revision of our conception of space and time, and that this revision applied throughout physics and not just to electrodynamics where it originated. His four-dimensional formulation of the theory, his application of it to mechanics, and his advocacy generally had a decisive historical importance in winning physicts to the new theory and in clarifying its revolutionary significance.

Minkowski's point of view that space and time should be considered as forming one geometrical object, space-time, a four-dimensional flat space, led Einstein, in his General Theory of Relativity in 1915, to analyze the relations between the descriptions of phenomena in frames accelerated relative to each other. From these relations Einstein concluded that this four-demensional space cannot be flat, and that gravitation is the name given to those phenomena that appear because space-time is not flat And thus the curvature of space-time is due to its energy and mass content.

In the past six decades, since the enunciation of Einstein's theories, many observations have been made, and experiments performed to establish the validity of his theories. Through his work, all basic tenets of physical universe sought new relationships: mass and energy, particle and wave, space and time, gravitation and electromagneti.m. Many of these concepts are undoubtedly abstruse ahd 'abstract' but their 'concretisation' through nuclear power, in peace and in war, have created a new world, with far-reaching political and economic implications. Thus for once, it will be no exaggeration to suggest that the physical world--and through it other life--after Einstein was never the same again.

Perhaps it will be right to retrace a few steps and acknowledge the significance of the scientific groundwork that led to the theories of Planck and Einstein, and are part of the two decades, 1895-1815, of the Second Renaissance. On November 5, 1895. Roentgen discovered x-rays. As the first x-ray photograph of the hand of an octogenarian antomist, Kolliker, was taken on January 25, 1896, what had been created by Shakespeare three hundred years earlier, in the images of poetry, had become a reality:

Hamlet: Come, come and sit down; you shall not budge; You go not, till I set you up a glass where you may see the the inmost part of you.

Queen: What wilt thou do ? Thou wilt not murder me,

Polonius: What ho ! Help, help, help !

(*Hamlet*, Act III, Scene 4)

Soon after, x-rays were being used for medical purposes. And the rest is history. And yet there was no convincing explanation for this remarkable phenomenon. However more observations were being made, and more things discovered. For instance Henri Poincare hypothesized in January 1896 that the glass wall of a Crookes tube struck by cathode rays are emitting "hyperfluorescence". Meanwhile Henri Bacquerel, on the Museum d' Historie Naturelle discovered that uranium salts shielded from light for several months spontaneously emitted rays related in their effects to Roentgen rays (x-rays). February 1896 thus marks the discovery of the phenomenon of "radioactivity". However, the term "radioactivity" was coined by M. and Mme. Curie on July 18, 1898 at the time of their discovery of polonium, named after Mme Curie's hometome in Poland.

Discoveries of Poincare and Bacquerel had made Marie and Pierre Curie question if there existed other elements capable, like uranium, of remitting radiation. In addition to polonium, in November 1898, they discovered radium.

That the Curies were able to isolate radium at all was in itself a remarkable feat in the state of chemistry at the turn of century. To obtain only one-tenth of a gram of the pure element required the chemical reduction of a ton of pitchblende, This new radiation from the newly discovered radioactive materials was baffeling. In Mme. Curie's words:

"...This teanacious property, which could not be destroyed by the great number of chemical reactions, we carried out, which, in comparable reactions, always followed, the same path, and manifested itfelf with an intensity clearly related to the quantity of inactive material retrieved, ...must be an absolutely essential character of the materal itself."[6]

The Curies were reasoning as chemists: the physicist's atom was still in limbo, although the connection between electricity and matter was being revealed, with the discovery of electron in 1897 at Cambridge by J. J. Thomson

By 1899 Bacquerel noted that the radiation could be deflected by a magnetic field so that at least part of it consisted of tiny, charged particles. In 1900 he decided that the part that was negatively charged consisted of spreading electrons, identical in nature to those of the cathode rays as earlier identified by J. J. Thomson.

What slowed the interpretation of the phenomenon of radioactivity, as even Mme. Curie herself acknowledged, was the experimental datum that the radiant activity of uranium, thorium, radium, and probably also of actinium, was constant.

The Rutherford - Soddy exponential law of radioactive decay was not applied by the Curies till 1906, when they observed: 'Every atom of a radioactive body functions as a constant source of energy...which implies a revision of the principies of conservation."[7]

So in one way or another, all researchers in physics at the turn of the century, were beginning to challenge the classical theories of physical universe. And what was seen as separate entities, gravitation, electro-magnetism--were beginning to be realized as inter-linked, and as insepaeable

Perhaps this brief chapter of the Second Renaissance can be coneluded with reference to Danish physist, Neils Bohr. Bohr's remarkable 1913 paper "On the Constitution of Atoms and Molecules" presented a new model of the atom, based on quantum physics. Thus heralding yet another intellectual breakthrough in search of the primary unit that constitutes the physical universe. This search for the structure and the nature of the 'elementary' particle was to continue for the next six decades - and has not been, by any means, concluded. Nevertheless, the new revolutionary laws and concepts, parallel in significance with Newton's laws of over two centuries ago, were well-established in the beginning of the 20th century.

II

Time is just a device from stopping every thing happening at once.

—Graffiti

It is curious that Jacob Bronowksi's notion of 'work of art' should be so deeply rooted in the genesis of modern physics For it was physicist Neils Bohr who in a conversation with Werner Heisenberg, the enunciator of principle of uncertainty, had once remarked: "When it comes to atoms, language can be used only as in poetry. The poet, too, is not nearly so concerned with describing facts as with creation images."[8]

Images! Well the images that emerged in art from the year 1900 are distinct from those before it. And if 'the whole history of art is", as according to Herbert Read, "a history of modes of visual perception of the vasious ways in which man has *seen* the woarld"[9]. then as in physics, the year 1900, marks a turning point in art.

At the beginning of the new century European art had reached a stage which is best described by the French phrase, *reculer paur mieux sauter.* At the Great World Exhibition in Paris in 1900, the Impressionist and post-Impressionists had been admitted in strength. But already something new was beginning to germinate. The notion that there is an underlying structure, a world within a world of the atom, captured the imaginatioh of the artist. Modern art, it has been suggested, therfore starts at the same time as modern physics.[10]

However, just a month after the discovery of the x-rays, in December 1895, Lumiere Brothers - August and Louis - in Paris and Edison, independently, in the United States, invented a revolutionary new mode of perception and expression : the motion - picture. The movies, of course, recorded the motion - and hence time - but as the syntax for the language-struecture of cinema developed through the use of close-up parallel-cutting, dissolves, pans, flash-backs, flash-forwards; etc , the emerging montage created new timespace relationships, or what may be termed a 'stream of perspectives'. With every new perspective, a new set of spatial, temporal and experiential co-ordinates with reference to the observed. Theoretically, each separate frame of the motion-picture-24 separate pictures in one second could be a unique temporal-spatial perspective, creating what James Joyce called in 1924 'a stream of consciousness.'

Indeed Joyce's writing, so cinematic' in character, owed much to the invention of cinema; Joyce being one of the first owners of a movie-house in Dublin in 1906.

Like x-rays, here was a new mode of 'seeing'. In the words of D.W. Griffith, the foremost inventor of the language of cinema : "The task I nm trying to achieve is above all to make you *see*" (1913). Here was an echo of the words of Joseph Conrad in his preface to *Nigger of the Narcissus* (1897) : "My task which I am trying to achieve is, by the power of the written world, to make you hear, to make you feel - it is, before all, to make you *see*."

So with this new perceptual mode of temporal-spatial perspectives, inspired by the inner structure of the atom and the crystals, the artist's interest shifted from the skin and the features to the underlying geometry, whether in natural forms as in Juan Gris' *Still Life* or Umberto Boccioni's *The Forces of a Street* or in human form in their *Pierrot* or *Dynamism of a Cyclist* respectively.

This is believed to be the beginning of Fauvism, and soon after. of Cubism, the latter considered by most arthistorians as the most significant, complete and radical revoluation in painting since the Renaissance. Beginning with Pablo Picasso's *Demoiselle d' Avignon* (1937), the geometrical 'structurization' of the constituent planes of a Cubist painting, becomes increasingly a montage of shifting temporal-spatial perspectives as in a film. No longer the line of vision between the paints and the model was fixed. No longer did the finished work represent a frozen instant or a momentary impression of a passing world. Instead it movod in space with time. Duchamp's *Nude Descending the Staircase* (1912) or Braque's *Woman With a Guitar* (1914) or Gris' *L'Homme a' la Pipe* (1911) or Leiger's *Les Fbmeurs* (1911) or Picasso's *Harlequin* (1913) were not merely a new play of light and shade or colour or planes, but a consistent artistic endeavour to reduce to two fixed dimensions of canvas the three dimensions of space and infinite moments of time. The results were often bold, intriguing, novel, but rarely--as must be expected--easily ' comprehensible". Not without significance however many of the distinguished physicists were attracted to the new art-form Neils Bohr owned Jean Metzinger's *Woman on a Horse* and Franz Marc's *Deer in a Forest* was a favourite with the scientists.

It would be fair to mention that the entire question of influences and origins of cultural or artistic movements cannot be precisely determined, and is even antithetic to the creative spirit.

Picasso himself has defined Cubism as "an art dealing primarily with forms, and when it is realized, it is there to live its own life". The aim is not *analyse* a given subject : in the same statement Picasso disowned any idea of research, which he saw rather as 'the principal fault of modern art'. Cubism, he said, has kept itself within the limits and limitations of painting as always practised - only the subjects painted might be different, "as we have introduced into painting objects and forms that were formerly ignored." But "Mathematics, trigonometry, chemistry, psycho - analysis, music and whatnot have been related to Cubism to give an easier interpretation. All this has been pure literature, not to say nonsense, which brought bad results, blinding people with theories".[11]

As mentioned earlier, I believe, it is not possible to determine the source of cultural and artistic expressions in any precise, mechanistic manner. One can, borrowing E.M. Forster's phrase — 'only connect' seemingly unrelated things with perhaps some degree of plausibility. As instance, rumblings of Einsteinian notions to the manifesto of Futurist movement in painting in 1910 ; "objects in motion multiply and distort themselves like vibrations passing through space."

Over the years, cinema itself has been experimenting with 'time', to create a sort of 'cubistic cinema' and from the early magical, experiments of George Melles, to the contemporary cinema there have been many innovative attempts to represent the psychological and objective multi-dimensions of time. Alain Resnais' *Last Year at Marienbad* (1961) or *Hiroshima Mon Amour* (1956), Norman McLaren's *Pas De Deux* (1967), Fellini's *8 1/2* (1964) are imaginative experiments in exploring new modes of perception. They create another 'stream of perspectives', filled with dreams, flash-backs, flash-forwards, and fragment of imagination, exploring all levels of consciousness and memory. It was this possibility of cubistic evolution of cinema that made W.B. Yeats see the movie as a world of Platonic ideals with a film projctor playing "a spume upon a ghostly paradigm of things".

Both motion-pictures and Cubism were attempts at representing time, adding a temporal dimension to spatial perspective. The space-time continuity, subject-object equation, relativism and absolutism, all of immense exploration in physics, sought and discovered their parallel in art and cinema. Like x-rays, atomic structure and radioactivity, cinema too has had far-reaching influences on many facets of the twentieth century.

III

And the seasons they go round and round,

And the painted ponies they go up and down,
We' re riding on a carousel of time
We can't go back
We can only look behind from where we came
and go round and round and round in the circle game.

— Joni Mitchell

One of the more naughty problems in contemporary biology is the nature of biological rhythms. Many of the living organisms, heart-beat or pulse rate, for instance, display some kind of diurnal, circadin, lunar or solar cyclic behaviour. The term ' living clock" has often been applied to repetitive cycle of events in time. However, there is a certain imprecision in that use. A rhythm is not necessarily a clock. Many of the rhythms observed in plants and other living organisms are indeed in phase with lunar or solar cycles. But from that it cannot be inferred that they have a "sense of time", or that they can "tell" time. German botanist, Wilhel Pfeffer, in his monumented study *Handbuch der pflantzenphysiologie* in 1897, presented the first major study cf 'living clocks'. He observed that plants display daily sleep movements, their leaves being elevated by day and drooping at night, with such sleep rhythms persisting even when light and temperature were kept constant. At about the same time, Georges Bohn working in Paris in 1903, made some significant discoveries that anticipated some of the most striking work on the lunar rhythms of marine organisms.

The interest in rhythmic behaviour of living organisms has existed since ancient times, comprising the substance of much folk-lore. Aristotle, for instance, wrote of the swelling of the ovaries of sea urchins at full moon; he even described these tiny creatures in such detail that their chewing organ is known to zoologists as Aristotle's lantern.

Towards the end of the nineteenth century, however, there seems to emerge a more concerted attempt to understand not only how nature's rhythms influence living organisms but also how organisms mark the passing time. Charles Darwin's pioneering work *Power of Movements in Plants* (1880) addressed itself to such questions as *why do plants sleep ?* It seems to have laid the foundation for all later studies about rhythms in living nature.

At the Nobel Institute for Physical Chemistry at Stockholm, at the beginning of the century, Svante Arrhenius studied data on the periodic occurence of bronchitis and on the periodic variations in birth and death rates. He noted the lunar periodicity of mensturation in the human female and even suggested the periodic onset of epilepsy. Earlier in 1890's he had suggested that biological rhythms might be caused by the tides in the cosmic forces that surround the earth.[12]

Karl von Frisch at the University of Munich in 1910's did pioneering work on communication among bees and the ways they orient themselves in flight. This sense of time of the bees, and navigation of birds are amongst some of the most crucial aspects of the study of biological rhythms that continues to be of an increasing interest to biologists.

It is not without significance that at about the beginning of the century, cyclical behaviour of nature began to fascinate the historians, who saw in history a kind of temporarl botany and zoology. Oswald Spengler's great work *The Decline of the West* appeared in 1918, but the book was finished before the war began in 1914. Spengler was not the first modern writer to notice the phenomenon, real or apparent, of cyclical time. In 1911 the historian and archeologist Sir Frinders Petrie pointed out cyclical patterns in Western civilization, but he drew no conclusions from these patterns. Spengler was the first to treat cyclical time and seasonal development as the evidence, the key to a naturalistic science of history. He was also the first to expand this would-be science to cover world history. Most importantly he wrote with such cloudy brilliance, such a vivid sense of detail and destiny that *The Decline of the West* has become a phoenix book. Initially burned by historians for its frequent blunder and reborn with enquiring readers for its ability to do what Bocan said poetry could do - "to submit the shows of things to the desires of the mind".

Again, at the beginning of this century, Henri Bergson and Samuel Alexander began to explore the nature of time and memory, and were the first philosophers, in the words of Alexander, to "take time seriously". In 1910, in his *Time and Free Will* Bergson presents two possible conceptions of time. One is that of duration as "the form which the succession of our conscious states assumes when our ego lets itself *live*, when it refrains from separating its present state from its former state." The other conception of time arises when "we set our states of consciousness side-by-side in such a way as to perceive them simultaneously, no longer in one another, but alongside; in a word we project time into space, we express duration in terms of extensity, and succession thus takes the form of a continuous line or chain, the parts of which touch without penetrating one another."[13]

The greatest and most revolutionary finding of modern psychology, it has been suggested is the discovery of the unconscious by Sigmund Freud, ie, that realm of the psyche which manifests itself relatively independently of the structure of our conscious mind. It is the "time-binding machinery" in which the evolutionary history of events and the experiences and reactions to them are carefully filed. It is the plastic expression of man's biological history, or what Wilder Penfield calls, 'the built-in tape-recorder of strips of time', which may be triggered by stimulating the temporal lobes in the brain and thus unlocking the past.[14] Meerloo has susgested that Man, when expressing himself, makes use of a "kinetic melody", a symphony of functions, in which the whole organism is mobilized.[15]

An individual's evolution is not only along his anatomical forms and functions, but also along his awareness of time, his awareness of becoming, of growth of duration and his reactions to his involvement in time and history.

It was this attempt at unravelling the multi - dimensionality of human - consciousness, that got Freud into the study of dreams, "the most valuable of all discoveries it has been my good fortune to make. Insight such as this falls to one's lot once in a lifetime". *The Interpretation of Dreams* remained Freud's favourite book. The manuscript on the book was finished in 1898, but Freud was so convinced that his discovery was such a revolutionary breakthrough in the realm of ideas, that he wanted the book to bear its publication date as 1900, to mark the beginning of a new century. Alas, in the first decade of its publication, it sold only a few hundred copies.

In a letter to his friend Fliess, Freud described a return visit to the Bellevue hotel in vienna, where he had had his famous Irma dream, asking, "Do you suppose that someday a marble table will be placed on the house, inscribed with the words - "In this House on July 24th 1895, the Secret of Dreams was revealed to Dr. Sigmund Freud", adding, "at the moment there seems little prospect of it".

Since 1900, of course, both the psychological and pysiological research about dreams, has evolved significantly. However, Freud did unmistakably, open a new window on the human - mind, and exerted, for better or for worse, an unprecedented influence on literature, art and human-mores With the publication of Havelock Ellis' *Studies in the Psychology of Sex* (1897 - 1900) and Freud's *Three Treatises on the Theory of Sex* (1905) playwrights, novelists and artists took another flight of fancy. In dramatic literature, for instance, although the dream motif has appeared for a long time, the first to put on the stage a dream world, with overtones of sexuality, in the spirit of contemporary psychological thinking was August Strindberg. The three parts of *To Damascus* (1898-1904) are masterly transcriptions of dreams and obsessions. Writings of Proust, Thomas Mann, D.H. Lawrence, James Joyce and Strindberg bear the unmistakable influence of contemporary 'scientific' meanderings in the human-psyche. As if, each one of them, in his own way, were *seeing* through the same window that Freud - and a little differently, Jung - oad opened against the Victorian age. Freud had provided a new mode of perception, a new set of "x-rays", another way of "seeing". As a reaction against the long victorian era, the 1920's, with their manners and mores, art and fantasies, set out to represent all--with much distortion and popularisation-that the new psychology. physics and art had created.

Another coincidence of great minds during the period 1895-1915 occurred in the social sciences. Coming from widely disparate backgrounds, often having little contact with or knowledge of the others, perhaps a score of men forged those ideas and methods which today dominates the fields of economic and political science, and psychology and sociology. Their names are less familiar than those of Comte and Spencer; few people speak knowingly of Gaetano Mosca and Vilfredo Pareto, E. A. Ross and William McDougall, George Simmel and Georges Sorel. It is their more famous contemporaries--Ivan Pavlov and his concept of 'conditioned reflex', William James' *The Principles of Psychology* (1890), and *The Varieties of Religious Experience* (1902), James Watson-- the father of behaviourism, Thorstein Veblen and Max Weber, Sigmund Freud and Emile Durkheim who are today regarded as the founders of modern psychology and sociology.

Perhaps it will be important to mention that the triumphs of physics served to lure the 'objectification' of psychology. For instance, the associationist school of Herbart, the Mills and Bain, regarded the self or ego not as a pre-existing source of psychological representation as did the older orthodox view, but as pieced togeter by the association of discrete ideas. The physiology of the "conditioned reflexes", initiated by Pavlov, carried this line of thought further, and led naturally to the psychology of behaviourism developed by James Watson in 1914 and the following years. The fundamental ideas were outlined in 1894 and 1900 by Lloyd Morgan, a British psychologist who founded the American school of animal psychology.

These investigators broke away from the prevalent interpretation of the actions of animals in terms of supposed consciousness, and set to work to observe their behaviour, and later on that of men, "objectively" as the facts of physics and chemistry are observed. It is unfortunate, I believe, that though physics has undergone revolutionary philosophical changes since

1900, social sciences, psychology amongst them, have tended to become increasingly mechanistic.[16] Nevertheless, just as x-rays had created a new mode of "seeing" the inner structure, Freud's interpretation of dreams provided a new window on the 'unconscious'. In truth, all attempts whether in sociology, psychology, biology or politics, were beginning to unravel the structural components of the organic, inorganic or human systems. And it was during this Second Renaissance, that the foundation stone of such enquiries was laid.

IV

Like H.G. Wells' *Time Machine* (1895), Lumiere Brothers' cinematograph 'played with time', thus creating a new mode of perception. However, there were two other revolutionary inventions during the Renaissance of 1895-1915 : one was wireless telegraphy and radio, and the other was the flying machine. These too became new modes of perception, experientially altering our concepts of space and time in radical new ways.

Marconi's wireless telegraph, and our present-day radio and television, trace their origins directly to Maxwell's theory of the electromagnetic field and ether waves, followed by Hertz's experimental proof of the theory. The works of Maxwell and Hertz gave Marconi, in his own words; "the greatest insight into the hidden mechanisms of nature which has yet been made by the intellect of man".[17] In 1895, Marconi sent his first wireless telegraphic message. The wireless communication across the English channel was sent in 1899, and two years later, on December, 1901 from southwest tip of England to Newfoundland. In 1900, R.A. Fesenden sent out the first sound - wave signals from the Massachusetts coast, and the wireless receivers picked up the music. Today the entire space all around us is permeated with myriad criss-crossing radio waves, carrying music, messages and pictures, to be captured instantaneously, at great heights or immense depths, by receivers moving at phenomenal speeds. Indeed, we are a part of a 'globalvillage' not through phsycial proximity or social concern but because the waves engulf us, one all.

This instantaneity can and has become a new tool of manipulation and control, a new Faustian power in the hands of those whose fingers are on all the crucial buttons. But whereas there is no going back on the awe - inspiring inventions of Marconi and Fessenden, there are still many political and cultural alternatives open in their use.[18]

In addition to the waves criss—crossing our space, there are flying machine hovering in the sky. For long assumed impossible, it was in the beginning of the century, on December 17, 1903, that Wright Brothers, Wilbur and Orville, flew the first power-driven heavier-than-air machine in free, controlled flight. In their plane *Kitty Hawk*, the Wright Brothers 'made history'. In their four flights that day, Orville was up in the air for 12 seconds, and Wilbur in the last and longest flight for 59 seconds. What had started out with Samuel Langley on May 6, 18:6 in a steamdriven unmanned model aerodrome of 14-foot wing spread, had now come to be a new reality. Alexander Graham Bell was one of the observer at Langley's flight. He wrote : "... it seems to me that no one who was present on this interesting occasion could have foiled to recognize that the practicability of mechanical flight had been demonstrated."[19] In 1908 as Orville Wright carried two occupants in his machine over a closed 125 mile course, at a speed of 42 miles per hour, a new era had begun. Like the invention of the wheel, this new invention too had farreaching implications.

There is much that has been written about the economic and political conditions that spur personal and collective creativity. In discussing the Rise of the Medici and the birth of Florentine Renaissance, Will Durant writes :

> "... it took more than a revival of antiquity to make the Renaissance. And first of all it took money--smelly bourgeois money : the profits of skillful managers and underpaid labor; of hazardous voyages to the East, and laborious crossings of the Alps, to buy goods cheap and sell them dear; of careful calculations, investments, and loans; of interest and dividends accumulated until enough surplus could be spared from the pleasures of flesh, from the purchase of senates, signories, and mistresses, to pay a Michelangelo or a Titian to transmute wealth into beauty, and perfume a fortune with a breath of art. Money is the root of all civilization."[20]

The genesis of creativity for the Second Renaissance was quite different. There were no patrons--rich or bourgeois--for Planck or Einstein, Lumiere or Wright Brothers, Freud or Pavlov, Curies or Picasso. Most of them worked against an indifferent or hostile environment, in smelly, ill-equipped laboratories or studies, on no or meagre salaries. No doubt all of them were amply awarded with honour, and some with money, after their theories were well-established. It seems there was a tide in the affairs of men', a Zeitgeist--spirit of the era--that permeated all creative endeavours. In the history of ideas, these two decades 1895-1915 remain quite exalting. If the original Renaissance is marked by the discovery of perspective, this Second Renaissance may perhaps be known by the discovery of 'stream of perspectives'.

Notes and References

1 Bronowski, J. *Ascent of Man* (Toronto : Little Brown & Co.), 1973, p. 346.

2 *Ibid., p. 336.*

3 Einstein, Albert, "Autobiographical Notes" in P. A. Schilpp, Editor, *Albert Einstein : Philosopher-Scientist* (Evanston, Illinois), 1949, p. 52.

4 *Ibid.*, p 51.

5 *Ibid.*, p. 51.

6 Quoted in *Dictionary of Scientific Biography,* Vol. III, Ed. C.C. Gillispie (New York : Charles Scribner's Sons), 1971, p. 499.

7 *Ibid* , p. 498.

8 Quoted in *Ascent of Man, Ibid.,* p. 340.

9 Read, Herbt *A Concise History of Modern Painting* (London : Frederick A. Praeger), 1959, p. 12.

10 Bronowski, J. *Ibid.,* p. 346.

11 Originally an interview with Picasso (in Spanish) translated by Forbes Watson, *The Arts,* May 1923.

12 Svante Arrhenius : "Die Enwirkung kosmischer Einglusse und physiologische Verhaltnisse", Skandinavisches Archiv fur Physiologies, Vol. VIII (1898), pp. 367-416. Quoted in *The Living Clocks* : Ritchie Ward, Mentor Books, p. 74.

13 Bergson, Henri. *Time and Free Will* (New York : McMillan), 1910, pp. 100-101.

14 Penfield, W. "Symposium on the Brain and Mind", *A. M A. Arch. Neurol.* and *Psychiat.*, Vol. 87, 1952.

15 Meerloo, J.A.M. "The Time Sense in Psychiatry", in *The Voices of Time*, Ed. J.T. Fraser (New York: George Braziller), 1966, pp. 235 252.

16 Kumar, Sehdev. "Ecological Psychology : Images of Childhood", sent for publication. This paper discusses in detail the influence of 'hard' sciences on the methodology of social sciences.

17 Marconi, G. "Wireless Telegraphy", published in *Smithsonian Treasure of Science*, Ed. Webster P. True, Vol. I (New York : Simon & Schuster), 1960.

18 Kumar, Sehdev. "The problems of Cultural Autonomy : Mass Media in Third World" sent for publication.

19 Langley, S.P. "Story of Experiments in Mechanical Flight", published in *Smithsonian Treasury of Science, Ibid.*, Vol. I, pp. 1056-1074.

20 Durant, Will. "The Story of Civilization : Part V" *The Renaissance* (New York : Simon & Schuster), 1953, pp. 67 68.