The Present Quantum In Societal Evolution

An Analysis Of Historical Indicators: Part 1

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Quantization in Nature and Society

Darwin shared with various of his contemporaries the traditional canon of *Natura non facit saltum* ("Nature does nothing by jumps"). Natural selection took advantage of slight successive variations. However, this insistence upon evolutionary continuity and gradualism was all but shattered by the researches of Weismann, Mendel, and de Vries. True, the germ cell transmits through reproduction a continuous stream of protoplasm from one generation to the next, and the hereditary characteristics carried by the chromosomes are unaffected by changes in the somatic cells (which die with the individual). But sudden and unpredictable mutations within the chromosomes can be transmitted by heredity to produce new species. In effect, within the over-all evolutionary continuum occur abrupt discontinuities. We contend in turn that the quantum phenomenon is found at all levels of organization, from the atomic to mankind's societal structures and behaviour.

The element of discontinuity involves the presence of boundaries of some kind, which may be spatial, temporal, or again conceptual. Students of historiography, for example, are familiar with problems of periodization: was there ever a "Renaissance" and, if so, what distinguishes it in time-space from yet another historical construct, the "Middle-Ages"'. Again, political and economic historians make frequent use of the concept of "revolution" though, as Crane Brinton has pointed out: "The physicist can measure boiling points exactly: the social scientist cannot measure change by any such exact thermometer, and say exactly when ordinary change boils over into revolutionary change"[1]. He likens the difference between a revolution and other kinds of societal change as nearer to that between a mountain and hill than to that between the freezing and boiling points of a given substance. Yet is this the kind of imprecision for which the social scientist must settle in his study of societal discontinuity and transformation? In our view, more satisfactory results can be obtained by adopting a systems approach to the question. This calls for regarding societies as sociocultural systems continuously equilibrating-both intra- and inter-systemically with their respective environments. From such a perspective, the concept of "revolution" involves a fundamental transformation of a system's existing parameters, accompanied generally by acceleration in the rate of systemic change. This transformational behaviour underscores the element of discontinuity, whether within The system itself or *vis-a-vis* its external environment in terms of both negative and positive feedback processes, so sociocultural systems in turn display stability (negative feedback dominant) and instability (positive feedback dominant). Hence we must recognize the correlative relationship of continuity and discontinuity in societal structures and behaviour. Inasmuch as all systems can be regarded as "bounded regions in space-time, involving energy interchange among their parts", we need to look further at the presence of boundaries throughout the phenomenal world and, in particular, examine how sociocultural systems equilibrate, that is, oscillate in a continuous state of balance/imbalance, within their "bounded regions in space-time". In employing quantum theory to explain the discontinuous nature of atomic spectra, Bohr reasoned that in circling its nucleus, an electron had a specific energy so long as it was restricted to a certain orbit; by making a single leap it could jump to another orbit, but in the process gave off or absorbed energy. Subsequently, as we know, Pauli showed that only a limited number of electrons can occupy each of the atom's concentric "shells", and that chemical properties derive from the number of electrons

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[1] Crane Brinton *The Anatomy of Revolution* Vintage Books, N.Y., revised and expanded edition, 1965, p.25.

in the outer shell. Do human societies in turn equilibrate within a given environmental "shell" which sets boundaries upon the activities of its members, so that to attempt unprecedented types of activity may require a quantum "jump" to yet another environmental framework. If so, can these societal discontinuities be historically delineated. In other words, while recognizing the presence of many more variables in sociocultural as compared with physicochemical systems, can we demonstrate that mankind's societal continuum has been marked periodically by "revolutions" (as we have defined that term) or quantization. We believe we can.[2]

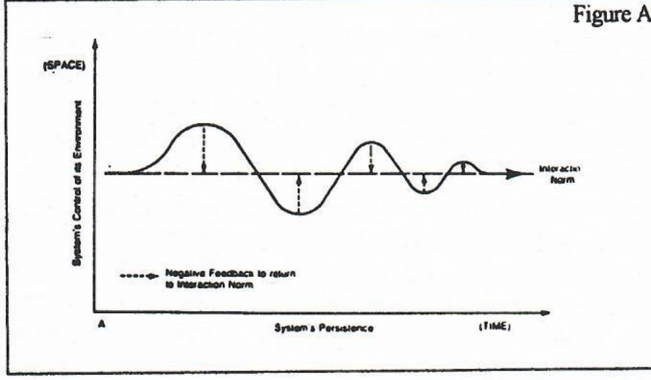
We might begin by more specifically correlating negative and positive feedback processes with systemic continuity/discontinuity. Continuity results when deviation-correcting mechanisms operate so as to ensure that structure and function remain viable within the given parameters of that system. Quantization occurs when deviation is amplified to the point where no deviation-correcting mechanism can prevent the rupturing of the basic systemic framework – in other words, when the latter can no longer contain and canalise the energies and thrust which have been generated. The overall result alters the relationship of that system with its environment, creating new spatio-temporal, structural, and functional boundaries. In short, the system is transformed to a new level of internal organization and environmental integration.

The relation of non-human species to their environments is determined primarily by Darwinian, genetically-coded mechanisms, so that the evolutionary process at the subhominid level can be described as *adaptive* equilibration. This is because while the overall process is mutagenic and open-ended, and hence exhibits positive forms of feedback, negative feedback mechanisms dominate in the maintenance of individual species and their members. Conversely, organisms with sensory-cognitive properties are at the stage *of manipulative* equilibration to the extent that they possess deviation-amplifying capabilities. It is by "man the tool-maker" that the equilibrating process shifts progressively from a reactively adaptive to an actively manipulative role. Hence our approach recognizes a central function on the part of technology and science in the development and transformation of sociocultural systems from Palaeolithic times to the present. In other words, science and technology – which we designate *material technics* (t_m) – largely serve as positive feedback processes. Concomitantly, we recognize the role of societal institutions and mores to maintain continuity and persistence in any sociocultural system. In this respect, therefore, *societal technics* (t_s)can function as negative feedback processes to ensure overall stability and societal invariance under technological and environmental transformations.

To assist our examination of a societal system's capability to exercise environmental control and persist in time, we might set up a framework of spatial and temporal axes, by which a number of behavioural vectors can be plotted to describe major states of systemic balance/imbalance.

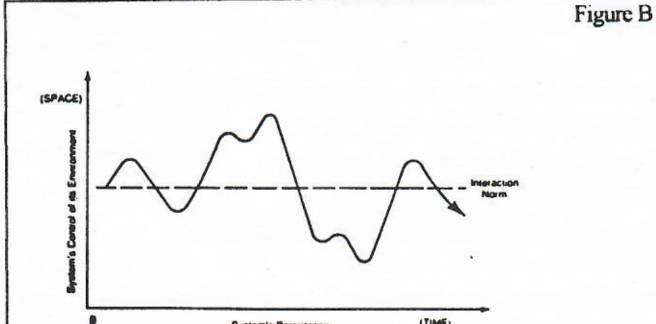
Stable equilibration (Figure A) shows a systemic state returning to a pre-existing norm after having been disturbed.

Figure A



A related type of equilibration is steady-state (Figure B), a form of system-environment interaction which may be variable between points in time but remains invariant if averaged over a given period. (Steady-state equilibration can be equated with "statistical equilibrium" in which the activities of population by aggregation can be plotted as norms despite the unpredictable actions of individuals.)

Figure B



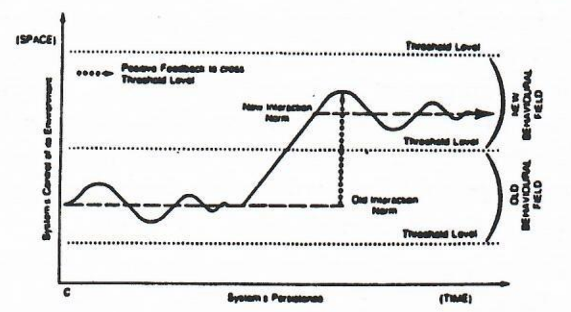
These two forms of equilibration describe societal systems marked by long persistence and the damping down of fluctuations by means of negative feedback mechanisms-such as strong societal technics. An example marked by unparalleled persistence, minimal impact upon the environment, and by the constraints of social tradition, is Palaeolithic society. Lithic communities tended to be structurally simple and environmentally

[2] For explication of a systems approach to societal structure and progress, see our monograph "Evolution-Revolution, General Systems Theory and Society" in *Evolution-Revolution* (R. Gotesky and E. Laszlo, editors); Gordon and Breach, New York, 1971, pp 99-139

homogeneous, and to experience low fluctuations, i.e., they were highly stable.

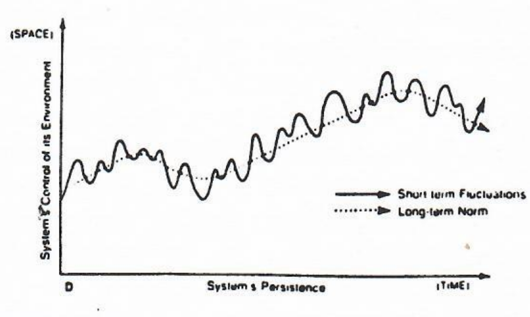
Metastable equilibration (Figure C) expresses the situation when a society invents new material and/or societal technics, formulates new goals, and alters its systemic structure and the environment in which the former "nests".

Figure C



At one stage of systemic organization, the societal system utilizes negative feedback for self-stabilization; in a second time-frame, a technological discovery, a new, revolutionary form of government, or the formulation of different socio-political goals may act as a catalyst to cross the "threshold level" which nullifies the overall effects of the system's existing negative feedback processes. As a result, the system is reorganised internally, and quantizes to a new level of integration with its environment, which in turn is altered. In a dynamic equilibrium situation (Figure D), we encounter both short-term fluctuations (as in steady-state) and also changes in the longer-term average state of system-environment interaction.

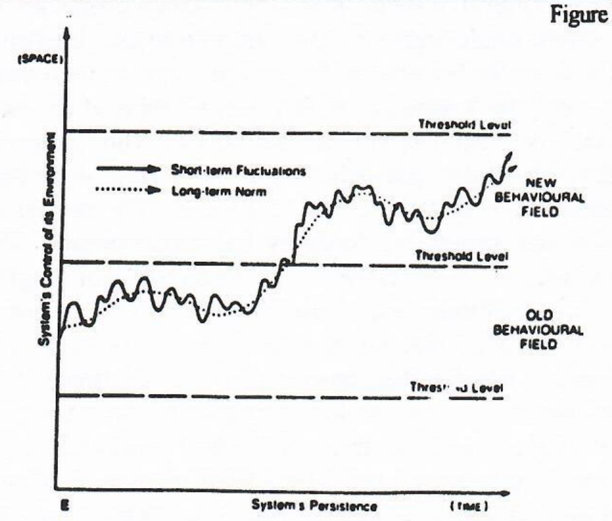
Figure D



The short-term fluctuations plot this interaction as a result of the society's utilization of both more and less successful material and societal technics, while the undulating long-term vector is the cumulative average of these short-term fluctuations.

The final model (Figure E) is premised on the assumption that the long-term vector of the interaction between a sociocultural system and its environment cannot always be extrapolated solely from the cumulative average of short-term fluctuations, but must also be able to account for fundamental systemic and environmental transformations.

Figure E



Hence we require a synthesis of those models conceptualizing dynamic and metastable forms of societal equilibration. This combines the averaging process with sociocultural or geopolitical quantum shifts in systemic complexity and environmental control – whether "leaps" (say as the result of the "Neolithic Revolution", for example), or "drops" (as with the "fall" of the Roman Empire in the West). If, as empirical evidence and conceptual innovations together seem to attest, we are currently in the midst of a pervasive and accelerating societal quantum, our choice of equilibration model to account for our contemporary paradigmatic and behavioural shifts might appropriately be that diagrammed in Figure E. However, in order to test our thesis that we are indeed moving across a permeable societal-environmental threshold to a new level of systemic organization, we have to answer two basic questions: Did such quantizations occur in the past and, if so, in what circumstances. As a corollary, can factors or indicators common to all of these quantum shifts be identified?

Historical Resumé of Quantum Shifts

Inasmuch as "manipulative equilibration" comprises an active rather than reactive adaptation to the environment (as in the case of other species), this means that human societies will reflect the extent to which material and societal technics are able to free their members of the constraints of their physical habitat and engage in activities which maximize the prospects of physical survival and, in addition, satisfy supra-survival needs and goals. The question of delineating the number and categories of organizational levels of the stage of manipulative equilibration must largely depend upon one's particular conceptual approach and purpose. From the standpoint of our thesis, we are looking at the man-environment nexus in terms of "environmental *control* systems" and inputs made thereto by technologies and societal institutions.

The first level of sociocultural organization comprises the greatest single segment of human time-space. It extends for some 99 per cent of the three or more million years since *Homo's* appearance, and over all areas of the earth that were then accessible to the species. This comprises the Palaeolithic age, where man is a hunter-fisherman equipped with a stone and flint technology marked by structural simplicity, durability and conservatism. This technology developed slowly in the direction of progressive specialization and miniaturization with the invention of microliths. But the capacity of our Palaeolithic forebears to manage their environment was stringently constrained by the tool-making limitations inherent in flint and bone, the small amount of energy produced by human muscle-power, and by the fluctuations in food supplies available in a hunting-fishing economy. Such societies had to spend the preponderance of their time and energies just to maintain the struggle for physical survival. What technological innovations did occur took place over a vast Palaeolithic time-scale and within a societal organization that was structurally simple, highly conservative in its societal technics and mores, and hence resistant to change. And because a food-gathering economy can sustain only a small population and low demographic densities, these societies have minimal contacts-and therefore minimal cross-fertilization of ideas-in comparison with those at more advanced societal stages. In effect, it remained for hundreds of thousands of years at a stage largely akin to adaptive equilibration.

However, as men and women develop technics of one kind or another to obtain greater environmental control, they make possible a move towards a more advanced level of societal organization-and as a consequence, the lower level then serves as "mechanism" while the emergent, more complex level assumes responsibility for purpose and direction. This occurs with a major quantum, at once societal and environmental, which has been described as the "Neolithic Revolution". This term suggests a qualitative transformation of society, accompanied by a dramatic increase in energy and food sources, and therefore in turn of environmental control. This major shift occurs with the domestication of certain wild grasses and animals – and, so far as we know, independently in the Old and New Worlds – thereby augmenting the technology already acquired at the lower, or Palaeolithic, stage. (If space permitted, this stage could be subdivided in turn into horticultural and pastoral socio-economic forms of societal organization.) No longer must all members of the species remain food-gatherers; a growing number become food-producers. This increased technological capability-which includes the tapping of new sources of energy in the form of animal muscle-power permits man henceforth to "stay put", that is, to localize his environmental control and to become sedentary, which inter alia calls for village nodes of settlement and new domestic crafts (such as weaving, basket-making and pottery). A more reliable and greater food supply enables a larger population to be supported, while the village node helps create new societal attitudes and institutions, and a more complex division of labour. Whereas food-gathering peoples are linked primarily by ties of kinship, the man-environment nexus has now assumed a less "biological" in favour of greater "territorial" Significance. However, at this stage of incipient agriculture, limited water sources in Southwest Asia, for example – such as at Jericho and Jarmo – set rigid limits upon societal development and transformation of the landscape.

A further systemic quantum leap occurred when these technological advances were applied to a different kind of environment. The transplanting of agricultural innovations to the rich bottom lands of the Nile, Tigris-Euphrates, Indus, and Huang-ho yielded a hundredfold increase in food harvests, making possible what has been described as a "social surplus". This raised population numbers and densities unprecedentedly, and freed many persons to work in occupations and localities at some distance from the fields. Hence the rise of towns, accompanied' by more complex governmental and administrative structures, hierarchical elites, etc. In short, the "Urban Revolution" describes systemic quantization and environmental transformation. It is marked by the shifting of the socio-political centre of gravity to the cities which henceforth control the "lower order" countryside. From an anthropo-geographical standpoint, the technological capabilities of this environmental stage may be described as one-dimensional. They control the length of a river valley, but are still so relatively weak as to be limited laterally to the river and its immediate hinterland (where irrigated by canals and ditches). These fluvial societies, sometimes referred to as "hydraulic civilizations", eventually reach a plateau of stabilization because of the constraints inherent in the surrounding environment. By our standards, they are noteworthy for their longevity and conservatism alike, though they are also marked by important technological and conceptual advances. These include the use of metals (in particular, bronze), the invention of the calendar, the advent of writing, and what has been described as "proto-science". In this stage, too, societal organization and control have acquired a preponderance of "territorial" over "biological" factors, so that the concept of community is now coterminous with the extent of the land where the ruler's writ runs. And as these societies are theocratic world-states, territory is conceptualized as a sacred land belonging to the gods who have incarnated as pharaohs in Egypt or, again, as the "Middle Kingdom" from which the Chinese emperor mediates between heaven and the remainder of the earth.

As from the second millennium B.C. especially, we find a new pattern of environmental control beginning to take shape. For example, Indo-European speaking peoples fan out over much of southern and western Eurasia, equipped with an iron technology. Through the development of maritime technics, the Mediterranean with its hinterland becomes the setting for a number of maritime states (thalassocracies:– Phoenician, Lydian, Helladic, and, subsequently, Hellenic, Hellenistic, Carthaginian, and Roman. Because of the maritime technology, accompanied by the opening up of the Mediterranean hinterland and, in Roman times, of trans-Alpine Europe by means of a remarkable road and transportation network, this stage of societal organization acquires a capability to control the terrestrial environment on a broad scale-in short, in terms of two-dimensional "flat earth". This process of exploring, mapping, and controlling the earth's surface was intimately connected with the Greeks' discovery of the scientific method of higher-order abstractions, so that Euclidean geometry could be employed by Eratosthenes to compute the earth's circumference (to a remarkable approximation) and by him and Ptolemy to apply a grid system to the construction of maps, thereby placing cartography for the first time on a scientific basis.

In the millennia which follow the era of classical societies, this two-dimensional control is extended from maritime to oceanic environments (markedly as from the fifteenth century A.D.)

Meanwhile, during the latter part of the Middle Ages, the development of wind and water as prime movers had enabled these energy sources to be employed in a number of repetitive operations, thereby laying the foundations of a machine technology. (The stages of this machine technology have been defined by Patrick Geddes and Lewis Mumford as "Eotechnical" – occurring in the late Middle Ages; "Paleotechnical" – synonymous with the "Industrial Revolution"; and "Neotechnical" – the advances of technology and applied science in the century that followed.) With the acquisition of an oceanic technology, involving the construction of new types of vessels equipped with navigational aids such as the compass and astrolabe and possessing cannon, Europeans on the Atlantic set out on globe-girdling voyages of exploration, followed by the establishment of overseas commercial and colonial empires. This geopolitical development went hand in hand with the emergence of the new nation-state with its assumptions of independence and sovereignty – a process which resulted politically and juridically in the maturation of the nation-state system at the end of the Thirty Years War (the "logic of Westphalia").

In the seventeenth, eighteenth, and nineteenth centuries, science and technology transform mankind's relationship to its terrestrial environment as well as its understanding of the nature of the phenomenal world. The invention of the telescope permitted the mapping of the heavens, while the microscope revealed new insights into the structure of matter. Science was placed on a "modern" basis by Galileo and his contemporaries, while a succession of conceptual innovations culminated in the Newtonian synthesis with its unifying model of celestial mechanics. Technologically, the era of wind and wood gave way to that of steam and iron, that is, to the advent of the Industrial Revolution with its reliance upon a new prime mover steam – its creation of new forms of socio-economic organization and the establishment of new factory towns, and the creation of an intercontinental capitalism by which the new products from every quarter of the globe were shipped to the factories of Manchester and other Western industrial centres, to be manufactured into new products which were then shipped to consumers throughout the world. A steam-and-steel rail technology opened up for massive economic exploitation and settlement of the vast continental hinterlands of the two Americas, Africa, Australia, and much of Asia. This process of two-dimensional expansion and progressive environmental transformation culminated around the end of the nineteenth century with the "conquest" of the two Poles by Peary and Amundsen. At this juncture, mankind has run out of *terra incognita*, so that immigration laws are now being enacted to screen and restrict the movement of peoples. These restrictions are the harbinger of a growing awareness in our century that the planet is finite in its dimensions and resources alike.

Factors responsible for (or indicative of) Societal Quantization

This brief historical overview has for its purpose to underscore our contention that while we can agree with Heraclitus that change is always taking place, at various junctures in the man-environment nexus a convergence of factors can quantize that changing relationship to the point of propelling human society across the existing environmental threshold so as to create a new sociocultural system and also profoundly modify the terrestrial landscape (as diagrammed in Figure E above). We have taken account of a number of factors which can be regarded as "transformational" common denominators that from a geographical standpoint have had a global impact on societal evolution. This global dimension is essential for the purposes of our thesis which is emphasizing processes that have had a universal effect. Selftransformation may result from a quantum occurring in one or two apparently independent loci-as in the case of the "Neolithic Revolution" – but such quantization to a new level of systemic organization in time reorganizes other societies across a planetary horizon. Our resume also demonstrates an acceleration in the tempo of societal quantization and a progressive environmental control capability – which at the beginning of our century, however, was still limited to two-dimensions, i.e., to the surface of the earth (and which was traditionally, and appropriately, conceptualized in cartography by the Mercator Projection with its parallels drawn as straight lines and intersecting at right-angles).

In the second part of this paper, to be published in the December 1997 issue of these Proceedings, we list, and briefly comment upon, the factors which have been found to be present in all our previously-discussed stages of societal transformation.□

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