CRITICAL COMMENTARY

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THE HISTORICAL GEOPOLITICS OF KNOWLEDGE

The problem of identifying the nature of modern science is so vast that it may fittingly be described as geopolitical. At its origins and in its daily manifestations, contemporary science appears to be overwhelmingly Western. Rather than being geopolitical, it appears to the Western eye to be at the most only ethnopolitical. Yet, because the scientific impulse is universally human, as critics have long noted, then what is the relationship of ethnopolitical science to the geopolitical? If we go back to the first conscious attempt of early peoples to understand and form a logical, mental picture of events observed in the world around them, and we work from there to Western 'modernity', our task becomes to understand how the geopolitical became imbedded in the ethnocentric (Schroedinger, 1957:86–88).

The modern non-western critic of science must examine the historical and ethnographic legacy in search of traces, evidence of the universally human. In effect, the non-western critic must look beyond ancient Greece, the ethnocentric starting point for most Western histories, and traverse a vast anthropological terrain. The case for the universal that lurks in the corpus of modern science must be argued at every turn. At moments I shall be historical, or descriptive, or theoretical, even polemical. Only the immensity of the problem presented by the search for universal elements, as well as for the distinctively ethnocentric circumstances of Western science, permits such a catholic and eclectic approach.

The goals of this essay are multiple and ambitious. Within the format and length permitted, I seek to reveal aspects of the geopolitical nature of modern science: (a) to describe evidence from other civilizational areas that questions the primacy of Greece as the only possible starting point, (b) to show that traffic of sophisticated knowledge occurred between regional civilizations and the European one, (c) to indicate that valid explorations of knowledge exist in the socially simplest of societies, (d) to discuss the class, gender, national, locational and historical influences on the construction of the present knowledge trajectory, (e) to indicate that non-western knowledge systems as well as the current Western one fit into a model of a civilizational construction of knowledge, and finally (f) to suggest how some of the non-dominant civilizational stores can be raided to expand the existing legitimised knowledge enterprise.

Evidence from other civilizational areas questioning the primacy of Greece as the only starting point for science

The anthropomorphic necessity to know physical reality had never been limited to the early Greeks. In fact, a vast set of starting points for potential scientific trajectories have now been laid bare by anthropological research in many parts of the world. Further, the broad Greek heritage itself has been pushed backwards and sideways and shown to have been socially constructed from contributions of diverse elements outside of Greece, especially those from Africa and Asia. This unravelling of a tight historical lineage of knowledge that was up to a generation ago the received wisdom in the West lays bare not only vast areas of already explored knowledge terrains in the non-western world, but also potential starting points for other knowledge trajectories.

Recent research indicates that the view of Greece as a particularly unique civilizational starting point was put in place only in the 19th century. Other historical research also indicates how some of the knowledge which was considered to be unique by Greek contributions was known to other contemporary civilizations at about the same time, or even earlier, and that considerable traffic of ideas existed between regions in the ancient world.

The many African roots of Greek civilization have been recently highlighted by Martin Bernal (1987). His still controversial views transferred to the history of science, alter considerably the well known tight Marxist-Eurocentric trajectory for science developed by his father J. D. Bernal (1956). Martin Bernal argues that the current concept of Greece was socially constructed in 19th century Europe. His argument highlights how the Greeks themselves including Herodotus, the father figure in Greek history, acknowledged their strong debt to Egypt. Bernal goes on from there, perhaps most controversially to argue that aspects of this Egyptian heritage of Europe were transmitted through the centuries without a break, from the times of the ancient Greeks through the Roman period, the Renaissance and the Rosicrusians of the 17th century to the Freemasons of the 18th century. Although his picture is far too driven by teleological notions of historical development and far too dependent on a postulated single line of development, elements of what he says offer a starting point through the ethnocentricity of the purely Greek model.

He argues persuasively that the Greek model devised in the last century was an invention, deeply implicated in the rise of European racial and imperialist considerations. In his words, for "18th century romantics and racists, it was simply intolerable for Greece, which was seen not merely as the epitome of Europe but also as its pure childhood, to have been the result of the mixture of native Europeans and colonising Africans and Semites"(Bernal, 1987:2). With the onset of slavery and the emergence of colonial empires, dark skinned, African people as originators of Greek civilization were now considered incompatible with creativity and civilization.

Bernal's pushing back of the primacy of Greek civilization to older cultural roots in Egypt and also to earlier civilizations in the region, like those of the Sumer, does at least clear a path toward our recognizing how ideas from these older civilizations helped Greece. Other comparative historical research already done on other contemporary scientific traditions indicates that the primacy of Greece has to be considerably rethought. These studies indicate many parallels and antecedents with the Greek tradition. I will confine myself largely to parallels and antecedents of intellectual traditions of the Greek world and the South Asian worlds.

A similar exercise can undoubtedly be done comparing the Greek tradition with the East Asian one.

Traffic of sophisticated knowledge between non-European and regional civilizations – the example of South Asia

The conditions for a large scale traffic of culture and ideas between Greece and Asia were created when the Persian Empire became a bridge from the Mediterranean to the Indus (Rapson, 1914: 87–88) Possibly as a result, one sees South Asian concepts that arose between 700 BC and 500 BC in the later Vedic hymns, the *Upanishads*, and among the Buddhists and the Jains, echoing in later Greek thought.

There are striking parallels between the two traditions. The *Upanishads* seeks one reality which has its echoes in Xenophanes, Parmenides and Zeno, who as *ur-vaters* of Greek mathematics all sought the One Reality. One of the founders of Orphism, Pythagoras, is thought to have been influenced by the Egyptians, Assyrians and Indians - he is believed to have travelled widely. Pythagoras believed in the possibility of recalling of previous lives, a typical South Asian attitude. Pythagoras himself recalled fighting in the Trojan War. Pythagoreans abstained from destroying life and eating meat like Jains and Buddhists. The Pythagoreans expounded many theories in the religious, philosophical and mathematical sphere that were known earlier in 6th century BC India. In Plato's philosophy, the 'cycle of necessity', a concept similar to Karma was central; humans in the process being reborn as animals or as humans, a view paralleling similar ones in South Asia (Rawlinson, 1975: 427).

These parallels between Plato and Indian philosophy has been described in detail by Urwick (1920). A contemporary Greek scholar, Vitsaxis (1977), after careful examination has demonstrated that in structure and method, general approach, as well as in several specific points, the two approaches have many common points.

There are other parallels. Thus the earlier *pancha bhuta* of the Indian elements *prthvi, ap, tejas, vayu and akasa* – earth, water, heat (fire), air and emptiness (ether) have their counterpart in Empedocles who believed that matter had four elements – earth, water, air and fire. Furthermore, Xenophanes's view of God having an eternal unity has a strong South Asian flavour.

In the 3rd Century BC, the Mauryan court of Chandragupta, had Megasthenes as the ambassador of Seleuccus Nicator. He stated the parallels between the two traditions in the following words, "in many points their teaching agrees with that of the Greeks" (Dodwell, 1922: 419–420). The Greek-South Asian dialogue continued, through the 'Questions of Milinda (Menander)', in the Pali Buddhist literature.

There are some Greek sources which affirmed the influence of South Asian ideas on the Greeks. In the 2nd C AD Lucianus stated that before philosophy came to the Greeks, Indians had developed it. That Pythagoras learnt many things from the "Brahmins" was stated by Alexander Polyhistor (1st AD), Apuleius (2nd C AD) and Philostratos (circa 200 AD) (von Glasenapp, 1953).

At a later period, Plotinus, the father of the Neoplatonic school, in a search for Indian philosophy took part in the military campaign against the King of Persia hoping to come into contact with the region. Neoplatonism recommended abstention from sacrifice and meat eating. Neoplatonism, *vedanta*, yoga systems, and Buddhism all have strong similarities. In the 2nd Century AD, Clement of Alexandria spoke often about the existence in Alexandria of Buddhists, being the first Greek to refer to the Buddha by name. He was aware of the belief in transmigration and the worshipping of *stupas*. Clement was unequivocal on the South Asian influences on Greek thought stating that the "Greeks stole their philosophy from the barbarians" (Rawlinson, 1975: 436).

During the Roman Empire too, contacts between the two regime continued. Zarmanochegas (probably Sramanacarya in Sanskrit), an Indian ascetic was recorded at this time in Athens. An Indian delegation visited Europe in Emperor Antoninus Pius' reign, the philosopher Bardesanes obtaining details of Indian thought from this mission. In the reverse direction, Apollonius of Tyana travelled to India (Rawlinson, 1975: 227).

These repeated interactions between the two regions probably resulted in the traffic in some key concepts from South Asia to Greece. On the basis of probable prior developments in South Asia., one can suggest a few such examples of such traffic. For example, the five-element *concept of panchabhuta*, which parallels the Greek tradition's elements was in place earlier in South Asia. A similar situation occurs in atomic theories. 'An atomic theory being taught by Pakudha Katyayana, an older contemporary of the Buddha, and was therefore earlier than that of Democritus' (Basham, 1953: 497). The Buddhists had more sophisticated discussions prior to Heraclitus around the concept of everything being in a state of flux. Buddhists and Ajivakas added joy and sorrow to the five elements which is earlier than Empedocles's views that love and hate acted mechanically on the elements (Basham, 1953: 497).

The Buddhists and others taught a doctrine of the mean several centuries earlier than Aristotle, (340 BC). In medicine, the Hippocratic treatise *On Breath* deals in much the same way with its pneumatic system as we find in the Indian concept of *Vayu or Prana*. On the other hand, in his Timaeos, Plato discussed pathology in a similar way to the doctrine of *'tridosa'* (Bose, 1971: 582).

The above examples, of probable or suggested traffic of concepts from East to West at this early date, should not distract from transmissions in the opposite direction. The ancient world had much cross flows of intellectual traffic. A well known example of traffic from Greece to South Asia are ideas on geometry and astronomy.

When the Classical age collapsed, European and South Asian contacts went on in the Middle Ages, carried on by Arab intermediaries. One could enumerate a few examples of these possible transmissions during the period: the place notational system in arithmetic, the concept of zero, aspects of algebra and trigonometry (Lach, 1977: 399) (some of these algebraic results appearing in Europe in the 18th Century much later than their emergence in South Asia); and significant parts of the standard Middle Ages European medical book. With the Renaissance, one could enumerate the use of a new element salt, earlier than that ascribed to Paracelsus (Bose, 1971: 334 – 338) and an impetus theory. During the colonial encounter the transmissions and parallels, though less, continued. These include plastic surgery in the 18th Century (Alvares, 1979: 63) in the formal study of language (Wiener, 1973: 67), and in the l9th and 2Oth Centuries in philosophy and psychology (Maslow, 1968).

These examples drawn largely from the ancient and medieval world already suggest a much more geopolitical understanding of Western science than is commonplace in textbooks or in everyday descriptions of our common scientific legacy. They also indicate that a further search within non Western traditions could reveal a rich range of useful facts, metaphors, concepts, and solutions that could still be fruitful. But these antecedents to modern science, these multicultural roots, still do not bring us to a geopolitical understanding. We must go back to 'primitive' peoples where we will find the impulse to be scientific universally present.

Valid explorations of knowledge exist in the socially simplest of societies

We can find Northern Amerindians who observe and systematize scientific facts about reptiles with painstaking care. This interest in classification is purely intellectual because the animals do not afford any direct economic benefit to this culture (Speck, 1923: 273).

This systematic observation and process of classification is not a static one but is based on constant experimentation and expansion of the existing knowledge base. Ackernecht (1958) put this strongly "in my investigations, I have found that there is more than enough evidence to indicate that experimentation in the old fashioned trial and error system is not unique to Western European societies or even to civilized societies" (but is wide spread in the socially smallest of societies).

There have been two broad opposing positions in the explanations given to these biological classification systems of indigenous peoples. One, the utilitarian, and which has lost ground recently, assumes that there is no special innate curiosity in indigenous people for deciphering nature and that their classification systems are purely motivated by the need to know the biological items that will be used for practical purposes. The second, on which an increasing body of knowledge is fast accumulating, holds that indigenous people have a natural thirst for knowledge and that they engage in classification, largely out of an intellectual urge. There is thus, in these classifications, an attempt to get at the structure and inherent order of the biological system irrespective of any mundane practical use (Berlin, 1990: 19).

The different organisms on earth number in the millions and *no* system of classification including the contemporary scientific, can be entirely comprehensive. For the indigenous people, who sample a relatively small area and for whom, the larger part of the world's flora and fauna remain unknown, the organisms classified, have therefore by necessity, to be small(Berlin, 1990:20).

Just like the Western trained scientist, an indigenous biologist sees many of the animals and plants and develops an implicit system of classification. He uses exactly the same types of clues as the Western scientist about similarities and differences to recognize a particular organism and then to categorise and name it as belonging to a particular grouping. When the Western scientist and the indigenous classifier sees the same species, the two both classify based on the amount of difference and similarity between species. And if they are classifying in a given area the same animals, their grouping should closely parallel each other, and the two resulting taxonomies would then closely correspond to each other. Further, in such a case, the scientific system could be used to predict the classification of organisms in a given area in the folk system and vice versa.

Berlin, a researcher into plant classification systems, has tested the latter hypothesis in the field and shown that it corresponds closely to actual cases (Berlin, 1990:19–35). The difference then, between a Linnaeus and a folk classifier, becomes at least partly, one of degree, helped by the former's access to a wider store of plant samples brought about by the European expansion into the rest of the world.

The world is thus littered with many indigenous starting points for potential trajectories of biological knowledge and by extension of other forms of knowledge. Trajectories, which if they were developed, would have given different explorations of physical reality. The existence of all this anthropological evidence does not solve the problem of Western ethnocentricity or of the distinctive rise of Western science, but it does help to further problematize it.

The class, gender, national, locational and historical influences on the construction of the present knowledge trajectory

The rise of Western science has to be connected not to some supposed innate superiority but to major shifts in the socio-economic and cultural systems of early modern Europe. Such shifts can produce strong repercussions on the universally human impulse to create science. Studies in this long-range macro perspective have attempted to relate the emergence of mathematized science in the sixteenth and seventeenth centuries to the Renaissance and mercantile capitalism (Needham, 1976); Newtonian optics and ballistics to the social needs of the early mercantilist period and its interests in navigation (Hessen, 1930) and the emergence of quantum theory in post-World War 1 Germany to social and intellectual conditions in the Weimar Republic (Forman, 1971). These macro cognitive shifts such as the emergence of Newtonian or quantum physics corresponding to macro social changes are more difficult to prove than the social impacts at the level of the nation or that of the small group. Yet, they are suggestive.

The emergence of European economic hegemony and its associated social institutions thus precede the emergence of Western science and provide the framework for it. While the cultural impact of such a large economic transformation, affecting a whole Continent is difficult to demonstrate, evidence for this economic/cultural model does come from contemporary examples we have from this century. If science has been influenced in our time by the social and economic, may we not reasonably argue that at its origin similar pressures helped to create Western science?

Some of these studies show the influences of national factors on science. According to one empirical study, science and technology practices of the US, Japan, Britain, France, Sweden and Germany vary depending upon such factors as the country's history, funding sources, R&D allocations and coordinatory mechanisms (Lederman, 1987: 1125–1133). Yearley has shown how science in Ireland was shaped by a variety of social factors, including its peripheral position *vis-a-vis* the rest of Europe (Yearly, 1987: 191–210). Many other examples could be cited in national variations, including in publication behaviour.

But let us take the argument further, in the direction of micro-examples. Such studies are impossible for any period earlier than this century; the evidence is simply lost. But I am arguing here that they permit us to pursue the geopolitical case by showing how the construction of science is so deeply related to material circumstances. Detailed case studies done over the last decade and a half have discussed in considerable detail how the construction of science takes place within the small groups that actually 'do' science. These small groups include members of laboratories, networks of practitioners or theorists constituting 'invisible colleges', and key gate keepers in a discipline, such as editors and referees. Sufficient case studies now exist to describe in detail the social and contingent nature of the knowledge so produced.

Among such key studies, should be mentioned the seminal work of the Polish Ludwig Fleck nearly 50 years ago on the formation and development of scientific facts (Fleck, 1979) Latour and Woolgar (1979) have followed in this general direction and explored the social construction of scientific facts within the laboratory. They demonstrated how laboratory scientists negotiate on the meaning of scientific facts and then come to a conclusion on what these facts are (Shinn et al., 1983). Other workers within the social construction of science approach have given additional evidence of the micro social conditioning of science in a variety of scientific fields.

Other descriptions of the social conditioning of science come from feminists, who have argued that males and masculine metaphors – gender – dominates science (Hallberg, 1990). Modern science according to this view has ingrained in it the exploitation of nature and the stigmatization of motherhood.This patriarchal world-view delivers a science that rests heavily on linear thinking, quantification and reductionism, in preference to many other ways of obtaining and organizing information (Jansen, 1990).

The sub-culture of a scientific discipline because of this research, it now appears, "is far more than the setting for scientific research; it is the research itself" (Barnes, 1982: 10). Science thus manifests itself as a social field consisting of struggles, forces and relationships, that govern the practices and results of science (Bordieu, 1991). As nations are not social islands and are porous to cross border influences, these social forces are ultimately geopolitical forces.

Again these micro studies permit our argument to be made: the preconditions for scientific culture exist universally: only social, economic and institutional circumstances limit the sites where scientific activity will flourish. The historical geopolitics of science are influenced by wealth, access to resources, institutional arrangements and cultural givens. In the ancient world there were many such potential sites. Since the emergence of Western hegemony and its world wide sponsorship and legitimation, there have been fewer such places.

Non-Western knowledge systems as well as the current Western one fit into a model of a civilizational construction of knowledge

These social processes that influence the development of science give a particular perspective on the historical evolution of knowledge. In such a view, a knowledge tree evolves buffeted by social forces in the social environment as well as within the scientific community itself. In doing so, it takes facts including those from the laboratory and other observations, and combines them with concepts to give a cognitive window to the physical world. Such a social evolutionary perspective provides for an enlarged, civilizational view on the social nature of science, than do other formulations. I will summarize broadly here such a larger view of civilizational knowledge, which I have also sketched elsewhere (Goonatilake, 1982).

If one considers the 'whole' of physical reality as some sort of blackboard, then the scrawls which a historically developed knowledge branch makes are only one possible exploration of this physical reality. Thus, the particular knowledge tree that science has delivered to us since the 18th century becomes but one particular tree. Given a different set of starting points for the knowledge tree, and given different 'historical runs', – that is, different communities of knowledge makers, different conceptual elements and different histories, – one would conceivably have different sets of knowledge trees.

Thus, if modern science emerged on the shoulders of other regional civilizations different from Europe, (of say West Asia, South Asia or East Asia), and developed under different historical circumstances, one could have different 'historical runs' of knowledge. Different knowledge trees would then emerge, corresponding to each region. The form, content and areas of reality that would have been explored would be different in each hypothetical 'historical run' and so would the ensuing body of scientific knowledge. In fact, the different contemporary national profiles of science, which we have already alluded to, show how even in the present era, certain aspects of the science knowledge tree develop differently in different geo-cultural territories.

Knowledge of the physical world, because it is a product of particular historical trajectories must, therefore, be by necessity always incomplete. Scientists selectively choose, explicitly as well as implicitly, certain facts and concepts to fit into a prevailing social situation, leaving out other facts, areas of enquiry, and conceptual elements. There are thus by definition virtually large areas of physical reality not covered by any given historically derived knowledge tree, and which are thus potentially open for exploration. But given this impossibility of ever knowing socially the total of physical reality, is there a means of enlarging the existing stock of our (-albeit-) incomplete knowledge?

Feminists have also argued for transforming and enlarging the historically derived existing science system to incorporate and encode the experiences of women (Dugdale, 1988), exploring in the process a variety of scientific practices (Keller et al., 1988). Still in the process of operationalising their approaches to build new domains, feminism's epistemological contribution points from the direction of another group's excluded knowledge, to both the need as well as to the possibility of enlarging the present knowledge tree -derived as it is through a particular history (Harding, 1991; Haraway, 1988).

Suggestions for raiding some of the non-dominant civilizational stores

The new ways of knowing the world were built up initially in Europe from the assembly of cultural elements from within Europe itself as well as from those transmitted to it from outside. Since then, external contributors to this stock of knowledge have diminished. Yet, useful extra European knowledge still exists as exemplified by 'lost' knowledge in regional civilizations and ethnobiology. Bringing in knowledge to the dominant knowledge tree can be accomplished in two broad ways, – one is to splice-in directly existing material that has demonstrable direct validity. The second would be to bring as metaphors, elements from other traditions that could nudge the imagination and give rise to new concepts. The first attempt would be like the splicing-in to the European tradition of say the knowledge of the compass, gunpowder, or mathematics and knowledge of flora and fauna that occurred during Renaissance and immediately after. The second attempt would be like the many transfers of metaphors that have been constantly used in building the scientific enterprise.

The field of ethno-biology alone provides a large reservoir for enlarging the knowledge base by 'splicing-in' techniques. Over three fourths of the 121 plant derived compounds in the (developed) world's pharmacopoeia has been derived from plants used in developing countries (Joyce, 1991). These figures give the enormous potential that these plants have for human life, and hence the enormous potential of ethnobiologists' contribution.

A large reservoir of both empirical knowledge, as well as metaphors and theoretical constructs is present in the civilizations outside the European area. One could point to the potential of this store by briefly referring to South Asia. Other regions such as West and East Asia, could bring in similar, if not greater possibilities. In the South Asian classical literature, especially in the medical one, large areas of potentially useful empirical knowledge reminiscent of ethnobiology exists. Classical texts like those of Charaka, Atreya and Susruta deal deeply with diagnosis, therapies and surgery. Some of these are already being researched into by the contemporary Western medical tradition. But as a sharp contrast to the immediate empirical data of ethnobiology, a set of more theoretical contributions are deliberately chosen and discussed here. They can be especially useful if viewed as a store of metaphors.

Daniel Rothbart (1984) has argued that the formation of concepts in science is largely a metaphoric process. Thus, mechanical metaphors and models were imported to economics and economic models were imported to analysis of electrons (Studdert-Kennedy, 1975: 217); Clerk Maxwell compared tubes of forces in electromagnetism to muscles (Agassi, 1973); and Oersted's discovery of electromagnetism was influenced by the *Naturphilosophie* idea of polarity (Thuillier, 1990). Generally speaking, metaphors implicitly transfer semantic features from one semantic field to another, entirely different one (Rothbart, 1984).

Judge (1992) has suggested several guidelines for using such metaphors from other conceptual domains by 're-reading' them. Re-reading existing conceptual patterns as metaphors one could mine the South Asian intellectual past for useful 'fossilized knowledge'. This is exactly the manner by which the existing scientific tradition has regularly mined the Western past for fresh insights (Goonatilake, 1984). In what follows, I indulge in a speculative exercise of the imagination of the possibilities that could exist for such mining.

As suggestive of the possible uses of South Asian knowledge, one should note here Glasenapp's observation that ancient South Asian discussions on fundamental issues had several parallels with those in modern science. Some of these parallels are: (1) an infinite number of worlds exist apart from our own (in Buddhism, and Puranas), (2) worlds exist even in an atom (in Yoga, Vasistha), (3) the universe is enormously old (in Buddhism and the Puranas), (4) there are infinitely small living beings parallel to bacteria (in Jainism), (5) the subconscious is important in psychology (in Yoga), (6) doctrines of matter in both Samkhya and Buddhism are similar to modern systems, (7) the world that presents itself to the senses is not the most real, and (8) truth manifests itself differently in different minds giving the possibility of a multiplicity of valid truths (Gilsenap. 1953)..

As a nodal point of growth, the Greeks set some of the problems, tone and nature of discussion on key foundational issues such as logic, the nature of matter and time. With a different set of such nodal orientations, one could have different knowledge explorations and trajectories. The non-Greek traditions have many such sets, many foundational variations existing in South Asia alone.

Thus, as opposed to the Aristotelian two fold logic, ('X' is either 'A' or not 'A') there are four-fold logics in the Buddhist tradition and a seven-fold logic in the Jain tradition. In the Buddhist four-fold logic, for example, there are four categories; "X is neither A, nor non – A, nor both A and non-A, nor neither A nor non – A" (Jayattileke, 1967) In Jain's seven-fold logic this is expanded by adding three other categories (Bohm, 1957; 1958) That these nodal orientations could have modern uses are suggested in epistemological problems such as in quantum physics, where a particle is considered to both exist as well as not exist, and which seem to defy simple Aristotelian two-valued logic.

In an equally modern concern, that of time, there are suggestive South Asian discussions. The many different *philosophical* discussions on *Samsara* (as opposed to the popular ones) have many debates on what could be termed the nature of long duration processes (Panikkar, 1972). According to some Jain views, time was one of the casual factors in the evolution of nature (Kalupahana, 1974) And Buddhism alone has a very large tapestry of conceptions of time (Panikkar, 1974).

One of these Buddhist approaches developed an elaborate theory not only of atoms but also of moments – chronons, with different versions – some schools recognizing four types of moments and others three. Chronons in some discussions were related to atoms and 'moments of thought'. Other theories were also proposed by different schools to relate the theory of moments to the fact of continuity of temporal events (Inada, 1974:185). These varied discussions on logic, matter and time illustrate that a dense seed bed of fertile ideas and metaphors exist in the South Asian tradition, seeds that could provide for new conceptual elements for future growth.

There is also a very long tradition, in South Asian knowledge systems of very complex and sophisticated debates and discussions on epistemology (Mohanty, 1979). It has been suggested that there exists the potential for a fruitful interaction between these and the contemporary study of the mind, including the philosophy of language, methodology, ontology and metaphysics (Rose, 1979). South Asian discussions in psychology have also given a wide variety of constructs that rival in their richness and empirical spread the contending systems that came to being in the West in the 19th and the 20th centuries and associated with such writers as William James, Freud, Jung or with schools such as the Humanist Psychology one and the more recent Artificial Intelligence (AI) influenced, cognitive science approaches. That a search for Eastern empirical and conceptual seeds would not be a spurious exercise is seen also in the existing comparative studies literature which has brought out many parallels between Asian and Western concepts (Riepe, 1967).

Thus, memory, motivation and the unconscious are shown to have parallels in both the theories of Freud and Jung, as well as in Patanjali. Similarities have also been observed between Vedanta and Existentialism; Heidegger and the thought of Krishna in the Bagavad Gita; Husserl, Sartre and Vedanta on consciousness (Coward, 1983); Descartes and Sankara (Scharfstein et al., 1978); Kant, Hegel and Nagarjuna (Hoffman, 1978); and Kant, Heidegger and the Upanishad philosophers (McEvilly, 1963). Similar parallels have been noted, between the psychoanalytical theorists, Heinz Hartmann and Erik

Erikson, and the Hindu theory on the stages of life (Kakar, 1968); Buddhism and early 20th Century analytical thought (Price, 1955), psychoanalysis, existentialist theory, and Humanistic Psychology (DeSilva, 1979); – Maslow the most prominent Humanistic psychologist flatly declaring of his psychology – 'our goal is the Eastern one' (Maslow, 1968).

Apart from direct uses in epistemology, ontology, psychology, Artificial Intelligence (the attempt to mimic human thought in computers), and cognitive sciences, theories of mental phenomena can also have a powerful impact on a host of disciplines as illustrated by the case of David Hartley's (1749) concept of the association of ideas and its impact on the development of the human and biological sciences. This gave a mechanism for the concepts of adaptation and utility, which when extended beyond the individual experience, was a useful mechanism for ideas of evolution and progress. These ideas influenced a large number of theorists in a variety of fields, including Joseph Priestley, Jeremy Bentham, Adam Smith, James Mill, J. S. Mill, Condorcet and William Paley in their various social, psychological and economic theories; Lamarck and Erasmus Darwin in evolution and directly and indirectly the psychologists William McDougall, C. S. Sherrington, I. P. Pavlov, Freud, W. Wundt, William James and George H. Mead. Clearly, a core idea can infiltrate several domains and have a strong ripple effect (Young, 1973).

If the potential exists for raiding extra-European knowledge stores, are there already any examples?

Ethnobiological knowledge is already being made use of in biotechnology. In a programme termed "chemical prospecting", companies and organizations such as Merck, Monsanato, Shaman Pharmaceuticals, Conservation International, and the US National Cancer Institute specifically collect material from tribal groups that have knowledge of the uses of tropical plants for biotechnology, a most modern knowledge enterprise (Joyce, 1991).

In the case of "civilizational" knowledge too, many examples already exist in the medical field of items taken from the Asian pharmacopoeia and used successfully. Other attempts in medicine also include the fields of bio-feed back, and recent work on the relationships between body and mind, which followed well established Asian paradigms and techniques, including those using classical Asian meditation methods.

A major current formal attempt in using Asian concepts is one by a group of Indian scientists sponsored by India's major scientific bodies. Here, scientists trained in the Western tradition are attempting to mine traditional knowledge for the Western scientific enterprise. This programme is making a wide-ranging exploration in the fields of mathematics, logic, linguistics and cognitive sciences for possible knowledge transfers (Singh, 1990; 1991). As an example, members of the programme has pointed out that the Jain tradition had developed a separate system of transfinite mathematics different from the West, which could have contemporary uses. In another practical example, Indian researchers in collaboration with American ones have successfully used the approaches of the 5th C BC grammarian Panini to develop software for machine translation, transforming knowledge representation techniques in grammatical Sanskrit to the Artificial Intelligence field (Briggs, 1985; 1986).

Francisco Varela, a leading theoretical biologist and student of cognitive science and AI, has used Buddhist insights in extending the limitations of both the neo-Darwinian adaptation in biological evolution and of the current paradigm in cognitive sciences. Having noted that in Buddhist discourse, classical Western dichotomies like subject and object, mind and body, organism and environment vanish; Varela successfully applies these discourses to several frontier problems where these dichotomies have traditionally appeared. These areas include cognitive psychology, evolutionary theory, linguistics, neuro-science, Artificial Intelligence and immunology, in whose subject matter issues of organism and environment, body and mind, and subject and object have structured discourse (Varela et al., 1991).

Varela has stated that the infusion of Eastern ideas into the sciences of the West would have as much an impact as did the Renaissance rediscovery of Greek thought. How far this may be true is for the future to decide. However, inputs of regional civilizations' and ethno-knowledge into modern science is probably in the making. This would help make the present legitimised knowledge system more universalistic whilst still maintaining the rigour developed in the last few centuries. It would both help enlarge the knowledge terrain covered by the present system as well as retrieve what is relevant from other traditions.

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