

# SCIENCE AND MODERNITY

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Science and modernity are widely considered among the most celebrated features of contemporary human civilization. Increasingly they are taken as the defining elements that distinguish our times from the times gone by. At such a sweeping level, there can be many other ways to characterize the contemporary. One can, for example, refer to capitalism, market, globalization, democracy or nation-states. One can also include various critiques of capitalism and the widespread resistance to its hegemonic and imperialistic avatars among the characteristic features of our times. Such characterizations, however, belong to a layer of historical reality that is more systemic than civilizational. Science and modernity, especially when taken as a correlated pair, characterize our times at a deeper level. They have, so to speak, seeped into the subterranean layers of contemporary historical reality.

On the face of it, such an assertion would appear to be far removed from the actual state of affairs in the real world. It would be rare, for example, to find a person whose beliefs and practices are fully consistent with established precepts of science. Such a search would be a fruitless endeavour, more or less, in any society on the planet. A similar anomaly is apparent in the case of modernity too. One can safely say that an overwhelming majority of humans in the contemporary world does not live by the canons or conventions of modernity. While few may be completely untouched by the laws and institutions of a modern polity or by the processes and pressures of a modern economy, most live by traditions and practices that do not sit well with basic attributes of modernity.

It can, perhaps, be argued that rather than being an anomaly it is more a matter of the time lag that necessarily exists between sowing the seeds of a culture and their actual flowering into a civilization. One can perhaps claim that, with passage of time, both science and modernity are destined to get entrenched in diverse cultures and emerge as common and universal elements of all future civilizations. While such an argument cannot be refuted easily or decisively, it cannot be accepted as a self-evident truth either. The long course of history since the twin emergence of science and modernity in the middle of the last millennium has gone through such disturbing episodes that one would be justified to have serious doubts about any such claim.

One can take the example of religious sectarianism that appears too often in its fundamentalist and murderous forms. The onward march of science and modernity was supposed to have progressively undermined the basis of religion and other forms of unreason, which would have, eventually, put an end to the long history of religious wars, riots and genocides. It would be hard to claim that history has progressed along such expected lines during recent centuries. The infamous genocides and carnages, such as those of Bosnia, Rwanda or Gujarat, are not merely

the exceptions that spoil an otherwise pretty picture. They are the far end of the same spectrum that spans myriad forms of bigotry and superstition ailing even the most modern among societies. Combined with racism, patriarchy, misogyny, caste-ism and other longstanding ailments of similar kinds, these forms seem to make the world a dark place impervious to the values of reason, justice, equality and freedom. Can one really claim that humanity now has come under the sway science and modernity?

The picture is so murky that, even for the most erudite scholars, it is hard to decide whether it is the best of times or it is the worst of times. It may be interesting to recall that two competing theses became the talk of the intellectual town at around the same time and were discussed on the high tables of global policy makers. In the heady days of the fall of the Berlin Wall and the demise of the Soviet Union, one thesis announced “the end of history” and proclaimed the final victory for western liberal democracy.<sup>1</sup> In response came the other famous thesis that announced the onset of a new era of “clash of civilizations”.<sup>2</sup> The former rejoiced at humanity’s final arrival at the plateau of eternal bliss that had long been promised by reason and modernity as embodied in the liberal democratic version of capitalism. The last hurdle on this pre-ordained path that came unexpectedly in the form of “communism” had been removed. The latter, on the other hand, had ominous forebodings of far more dangerous times heralded by the conclusion of the clash of systems. Irreconcilable civilizations about which it had been said long ago – *Oh, East is East and West is West, and never the twain shall meet*<sup>3</sup> – were now to meet on the global battlefield of history.

If the success of science and modernity in reshaping human civilization along the promised lines is suspect in many eyes, it appears equally dubious in the realm of the parallel claim of creating a new human being – one who is liberated from the clutches of custom and superstition and equipped with unclouded reason and robust moral autonomy. If it is difficult to gain reliable knowledge of how the world works, it is even more difficult to assume the captaincy of one’s own soul.<sup>4</sup> Fathoming the depths of the human psyche has turned out far more challenging than conquering the expansive civilizational frontiers.

For those who would like to subvert the reputation of science and add grist to the irrationalist mill, there is nothing more sensational than the personal beliefs and practices of appropriately chosen scientists. A reasonably famous scientist, who may complain about public disinterest in his scientific achievements, can be certain of making it to the front page if he is caught in the act of praying or reading the daily horoscope. Newspapers, which seldom bother to inform the reader about the scientific content of the Indian space programme, do not fail to give prime space to reports about the space scientists making a visit to the Tirupathi temple prior to every launch “to have a “darshan” of Lord Balaji seeking his blessing by placing a replica of the rocket to be launched.”<sup>5</sup> If science cannot rid even the scientists of superstitions, what hope is there for it to give rise to a civilization steeped in science, reason and modernity?

Skepticism about the claims of science and modernity and about the desirability of their aspirations is not confined to the popular media. There has been a long philosophical-intellectual tradition of reason-bashing that flexes its scholarly muscles in casting doubts on the foundations, methods and competencies of science.<sup>6</sup> Recent decades have witnessed remarkable academic popularity of intellectual attacks on the ideals and practices of both science and modernity. Such arguments and studies in the fields of philosophy, sociology, cultural theory and ‘science studies’, which can often be identified by the prefix *post-* as in the *postmodern*, *post-structural*, or the *postcolonial*, invariably subscribe, whether unabashedly or with qualifications, to the *cultural relativist* and *social constructivist* attitudes and standpoints.

*Cultural relativism* generally holds that knowledge and values are generated within specific cultures or civilizations each one of which has its own cognitive-epistemological-normative universe. Being culture-specific, the cognitive goals and strategies or the moral values cannot be compared or judged across the cultural-civilizational boundaries.<sup>7</sup> *Social constructivism* asserts that all knowledge is socially constructed in which natural world has little role to play. In this scheme of unpacking what science *is* and what it *does*, social facts such as interests, values or prejudices are taken as primary and fundamental, whereas natural facts such as atoms, gravity or galaxies are secondary and derivative. Together, cultural relativism and social constructivism deny the possibility of trans-cultural knowledge of mind-independent and language-independent reality. In their strong versions they even deny the existence of such a reality. In any case, this kind of thinking strives to undermine all benchmarks of truth, objectivity and method created by science and adopted, even if partially and selectively, by modernity.

In the case of science such critiques and subversive strategies proceed along multiple lines. For example, history is summoned to expose the scandal associated with the birth of science. Unlike Athena who leapt out fully formed from the head of Zeus, science was an illegitimate child of religion which came through a very unclean birth soiled with magic, alchemy, astrology, sophistry, illogic, inconsistency, vested interests and myriad other forms of unreason. Along another line, the methodological promiscuity of scientists is cited as a proof that science can have no claim to a consistent and foolproof method capable of guiding it to correct conclusions and reliable knowledge. Yet another line of attack comes from sociological studies of scientists and their institutions. Such studies purportedly show that the primary reason for the emergence and existence of science is its usefulness in maintaining systems of hierarchy, power, exploitation and vested interests. At another front, evidence collected by anthropological-historical researches is marshaled to prove that all different cultures and civilizations have had their own indigenous sciences. Implicitly or explicitly as the case may be, this implies that western science, which was nothing but a product of European provinciality, could impose itself on rest of the world as universal modern science through the brute force of capitalism, colonialism and imperialism.

Modernity too has faced increasingly hostile reception in the academic-intellectual circles during recent decades. In fact, when compared with science, modernity can be attacked far more easily. Science in its abstract and general form is modeled on the natural sciences. The ultimate court

for trial of science is Nature itself. The charges against it are likely to fall flat if its assumptions, methods and conclusions are supported by evidence gathered from the natural world. That is why a key strategy of the prosecution has been to question the jurisdiction or impartiality of the court itself. If there is nothing like Nature with its mind-independent laws and if, instead, what is thought of as objective reality is nothing more than a social-cognitive construction, science, then, loses its most secure foundation. Nevertheless, the fact remains that the most convincing defense of science comes from calling upon Nature as an authority external to the society. Modernity, on the other hand, does not have an external support about which it can be said that it is unsullied, more or less, by social interests and historical contingencies. Despite the fact that it has borrowed certain elements from science, modernity is primarily a way of life. It is the philosophical-social-institutional infrastructure of the modern world. It is not surprising that it is deeply implicated in society and history and cannot easily extricate itself from all that has happened to humanity under its watch.

Most common critiques of modernity dwell on its being congenitally entangled with capitalism and colonialism. This entanglement has continued with the postcolonial avatars of western imperialism. An essential feature of such critiques is the viewpoint that a disembodied modernity is nothing but a figment of intellectual imagination. Its only existing form is that of capitalist modernity shaped in accordance with the logic and interests of capitalism and complicit in all the historic crimes of colonialism and imperialism. Postcolonial critiques form a part of this larger category. Invariably they consider modernity to be a pliant handmaiden of capitalism, fully complicit in the ideological justifications of colonialism and racism and utterly contemptuous towards non-western cultures. All such critiques ascribe unlimited powers to capitalism in shaping modernity to exactly suit its purpose and bestow universality on every particularity of a given embodied form of modernity.

In the real world, however, advancement of science and expansion of modernity have progressed unabated. Neither the plebeian resistance nor the cultivated critique has had much success in undermining the increasingly entrenched hegemony of science in the cognitive sphere or in arresting the spread of modernity as a worldview and as a way of life.

In the case of science, all relativist arguments deployed in exposing its inconsistencies and inadequacies fail to take notice of one simple thing – science works very well in the domain it rigorously defines for itself and claims as its own. Furthermore, it keeps on improving itself and goes on expanding this domain. In this it does not face any real competition. This glaring oversight of the postmodern skeptics and relativists was underscored rather bluntly by Richard Dawkins who is supposed to have said, “Show me a cultural relativist at thirty thousand feet and I will show you a hypocrite. Airplanes built according to scientific principles work.”<sup>8</sup> He could have added that so far there are no civilization-specific ways of flying – no flying chariot or *Pushpak Viman*<sup>9</sup> has ever been sited. One could perhaps also add that never since the days of the scholastics, who used to argue about how many angels can dance on the head of a pin, have so much scholarship and erudition been pressed into the service of sheer irrelevancies.

Similar disregard for facts is evident in most critiques of modernity and especially in their postmodern varieties, although it must be acknowledged that modernity has had a far rougher ride in the real world when compared with science. It is a fact, nevertheless, that systems with their economies and politics configured in accordance with ideals and values of modernity, even if only of the capitalist kind, have spread to the far corners of the world. Postcolonial societies, despite the varying degrees of hesitation and resistance they might harbour, have opened their doors to modernity. More importantly, this has happened in the period of decolonization when the newly independent countries have strived to rid themselves of the colonial imprint. Spread of modernity to these countries cannot be attributed exclusively to the strategies of appending the East to the empires of the West, although the latter may continue to nurse such desires and maneuver accordingly. In the western societies, on the other hand, a degree of fatigue in relation to modernity may be noticed in certain sections and resistance to its capitalist version may become intense from time to time. However, even in these cases, there is no serious challenge. No alternative to modernity as a way of life is visible on the horizons of the real society, except perhaps in the theoretical exertions inside the otherworldly precincts of the academe.

A robust understanding of science and modernity and of their historical as well as conceptual inter-linkages can be gained only by looking at them in relation to the real world. Like everything else in the real world, the situation here too is never clear-cut. Science has not taken all aspects of human life under its fold and it never will, but its supremacy in the sphere of knowledge and in dealing with Nature is undisputed. Cognitive values of the modern era increasingly conform to the scientific values and, despite the valid and necessary criticisms of positivism, many of the methods of dealing with social, systemic, psychological and cultural aspects of life continue to draw inspiration from the scientific method.

Science and the sum total of cognitive values, however, are not enough to constitute modernity. The latter encompasses a set of moral values and their cultural manifestations. Science is not enough to constitute a way of life, whereas modernity has definite prescriptions and recommendations in this regard. Modernity, therefore, is articulated much more directly and intricately into the progression of history. Science cannot dictate or fashion all elements modernity. The latter has its origins in a far larger domain of social life and human history. On the other hand, with its closer proximity to social life and historical reality, modernity is in a better position to link science with society. Indeed it has played the role of a conveyer-belt in transmitting the influence of science to the social world.

Our objective here is to cast a glance at science and modernity in this perspective. By reading what follows, no one will be able to learn actual science. What is intended here is to situate science in the larger context of human history and culture. We will sketch the progress of science as it has happened in history and distil from it what we can say about what it is. In case of modernity, we will confine ourselves to its abstract and general features, which too can be accessed only through distillations from actual history. Our focus will be on its linkages with science. This will require at least a cursory glance at its grand intellectual and cultural

architecture. Success or failure of science and modernity can be judged only if one has a sober and valid assessment of what they actually are and what should be expected of them. This is important for fixing our attitude towards them. Both science and modernity, eternally changing as they are, are going to be with us for a long time – possibly for as long as humans are going to exist. It is important for each one of us – whether scientist, scholar or layperson – to learn what to expect from them and how to make the best out of them.

### **Science in History**

In a broad sense, humans have done science and invented technologies right from the time they became humans. The control of fire, for example, has been mythologized in many cultures. The ancient civilizations of Mesopotamia, Egypt, India, China, Japan, Mesoamerica, Greece, and Rome had significant scientific and technological achievements to their credit.<sup>10</sup> They were followed by remarkable achievements in the Arab-Islamic civilization in the medieval period (9<sup>th</sup> to 11<sup>th</sup> century AD), in China again during the 12<sup>th</sup> to 14<sup>th</sup> century AD, and in medieval Europe (mainly Oxford and Paris) in the 13<sup>th</sup> and 14<sup>th</sup> century AD.

However, the Scientific Revolution identified with names such as Copernicus, Galileo, Kepler, Boyle and Newton, which during the 16<sup>th</sup>-17<sup>th</sup> centuries inaugurated the era of modern science, turned out to be fundamentally different from all previous episodes in the history of science. It is not easy to put one's finger on what exactly this fundamental difference was. Not surprisingly, this has been a topic that has consumed enormous intellectual energies and generated a great deal of scholarly debate.<sup>11</sup>

In many ways it appears rather surprising that the Scientific Revolution, which gave birth to modern science, occurred in the Western Europe and that it had to wait till the 17<sup>th</sup> century. On the face of it, many earlier civilizations seem to have had a far greater potential for unleashing such a revolution. Accomplishments of the classical Greece and of the Hellenistic Greek diaspora by the closing of the ancient era, remarkable scholarly achievements of the Arab-Islamic cultures extending from "Near East" and North Africa to the Iberian Peninsula during the centuries at the transition from the first millennium to the second, or the awe-inspiring technological feats of the Chinese in the 12<sup>th</sup>-14<sup>th</sup> centuries, were far more impressive than anything that Europe at the threshold of the modern era could offer. Instead, the Scientific Revolution was consummated in the latter. The uniqueness of this great episode of human history is underlined by the fact that it inaugurated a period of uninterrupted progress of science that has continued to pick up speed ever since. Even more important, perhaps, is the fact that it could uncover the far more universal nature of modern science in comparison to any other branch of human knowledge or any other version of science as evidenced in earlier civilizations. Science in its modern form has been adopted by all cultures and civilizations. It is not surprising, then, that scholarly attention in more recent times has focused on studying the uniqueness of this episode.<sup>12</sup>

Typically, uniqueness of any kind arises when multiple causations, essentially distinct from each other, come together at some moment and jointly give rise to a phenomenon. Exceptional character of the Scientific Revolution can be attributed to such a convergence. At a very general level, the relevant causes can be separated into two broad categories. The first category consists of causes internal to the make-up of modern science. Can it be said that the pioneers of modern science in the period of the Scientific Revolution hit upon a way of doing science that turned out to be far more successful than any prior example in dealing with Nature and physical reality? The second category is of causes external to methods and practices of science. These can be the causes located in the social conditions of Western Europe during that period. Can it be said that the social upheaval, which is often summarized under the rubric of modernity's origins, created the conditions in which scientific values could be elevated to the status of being the canonical model for all cognitive values and the resultant social support and encouragement to the newly discovered ways of doing science ensured the survival and expansion of modern science?

Each of these two sets of causes is considered very special and there are tendencies that try to explain the uniqueness of the Scientific Revolution on the basis of the one or the other. There was a great deal of novelty – both in theoretical as well as practical domains – in the make-up of the emergent modern science that could be taken as the primary reason for its ascendance. On the other hand, the conditions that gave rise to capitalism, individualism, republicanism, democracy, and nation-state were quite unprecedented and they can be offered as the main cause for the acceptability, survival and sustainability of modern science. There is truth in both kinds of explanations, but a far greater truth is revealed when they are deployed in combination.

Elements of the theory and practice of modern science had been witnessed in parts during previous episodes in the history of science. The Greeks of the classical period, for example, were famous for their philosophy, logic and geometry, but there were examples in which they also connected their theoretical exertions with empirical observations as well as practical applications. Eratosthenes in the third century BC calculated the circumference of the earth with an accuracy that was within a few percent of the modern value and on this basis he went on to estimate fairly accurately the sizes of the sun and the moon and their distances from the earth.<sup>13</sup> Achievements of Hippocrates (5<sup>th</sup>-4<sup>th</sup> century BC) were so remarkable that he is considered the ancient father of modern medicine. Archimedes, Euclid, Eratosthenes and many others could have easily passed as scientists even on the modern criteria.<sup>14</sup> Similar examples, although not as famous as the Greeks and perhaps not at par with them, can be cited from ancient as well as medieval China and from many other civilizations.<sup>15</sup>

Why did these earlier achievements in the scientific field fail to give rise to an uninterrupted growth of science the way the Scientific Revolution of 16<sup>th</sup>-17<sup>th</sup> centuries did? Why were these earlier revolutions forgotten in the intervening periods and why were they followed by periods of decline? A large part of the answer comes from the role played by modernity which arose in Western Europe at around the same time as modern science was being born. But, before we come to modernity, let us summarize the distinct features of modern science which too played an

important role in its success and which may not have all come together in the instances of earlier scientific revolutions.

### **Science in Essence**

Modern science, as it emerged from the Scientific Revolution and assumed its authoritative form in Newton's hands, was in itself unique enough and a fairly plausible explanation of its success can be obtained from its internal make-up. Separate elements of this structure can be discerned in the earlier versions of science in different civilizations, but all of it came together, perhaps for the first time, in the aftermath of the Scientific Revolution. The birth of modern science, as mentioned earlier, was embroiled in religion and magic, in scholastic disputes and philosophical speculations, and in narrow utilities and mundane objectives far from the lofty pursuits of truth and knowledge. But, despite this less than immaculate origin, it was able to shed its natal entanglements and gain a clean and robust constitution. It soon acquired the status of being the sole reliable way to comprehend, describe, explain and manipulate natural phenomena.<sup>16</sup>

In understanding this history it is important to differentiate between two questions – *how* was modern science able to consolidate its position in the human civilization and *why* was it able to do so. The 'how' question takes the scholars to the details of social and political history in which non-scientific aspects played a role in putting science on a high pedestal. This is a legitimate exercise and it provides crucially important context to the internal history of modern science. It will be a serious mistake, however, if one were to accord all power to the context as if given the same context any other science would have succeeded just the way modern science did. The 'why' question is of central importance when one is trying to explain the success of modern science, and the answer to this question lies primarily in its internal structure.

The pioneers of the Scientific Revolution, cumulatively and collectively, hit upon a way of pursuing science that turned out to be far more effective in dealing with physical reality than any previous example. It did not all come together in the work of any one pioneer – be it Copernicus, Bacon, Galileo or Newton. But it did come together by the time of Newton and assumed a mature and consistent form in his work. There are many ways to describe its salient features. In a pragmatic way we will count the following as the key elements making up the essence of modern science, being fully aware that this list is neither unique nor exhaustive.

#### ***A Robust Ontology***

Ontology is concerned with what are taken as the most basic and fundamental constituents of reality. Any understanding or theory of the world carries within itself a specific ontology. In this sense it is not surprising that modern science too would have its foundational beliefs about what are the basic constituents of physical reality. In fact, it does not have a unique and unchanging ontology. In different times and in different theories of modern science there have been different ontological starting points and with further developments in a given branch of science the associated ontology kept on changing.



Cartesian ontology, for example, ruled out the existence of a true vacuum and considered space to be a plenum filled with continuous primordial substance that was at the root of all physical reality. The ontology underneath the Newtonian system, on the other hand, accorded fundamental status to particles of matter and to absolute and uniform space and time in which the material particles moved and gave rise to all physical phenomena. Leibniz had a synthetic ontology in which discrete individual particles as well as continuous plenum were both present as fundamental objects. Further developments in Physics, such as electromagnetism, relativity and quantum theory, have all come with their implicit but distinct ontological notions.

Across these multiplicities, however, modern science subsumes a basic ontological approach. It considers physical reality to be autonomous. The existence of physical reality and its laws are independent of anything external to itself. The task of science is to find the irreducible basis of reality and uncover the fundamental laws according to which it operates. The most religious and even the superstitious among the scientists, who may everyday seek the blessings of their favorite deities in their pursuit of scientific success and fame, do not invoke the deities while doing science. All supernatural powers external to physical reality have lost authority over the conduct of science and have been expelled from this domain. Science is scientific despite the scientists and their institutions. It is not merely what they think or do.

Robustness of this approach also came from the standpoint that Nature is same everywhere. The laws of Nature did not change from place to place and from one time to another. They were same in every corner of the universe and in every era. Furthermore, it was also believed that Nature was internally consistent. Its different laws did not contradict each other. In fact they fitted with each other and together they gave rise to the whole gamut of physical reality. Ontological assumptions about uniformity and internal consistency of Nature became powerful tools in further investigation of Nature and in the rapid development of modern science.

Obvious as it may now appear, it has been a long and arduous struggle to gain this robust approach to ontology and it has been far from a straightforward and predestined journey. The actual history of modern science has been replete with missteps, wrong turns and mistaken arguments. Erroneous models of reality behind phenomena were often proposed and fictitious processes were held responsible for real consequences. Nearly every major scientist or thinker who played a significant role in the liberation of science from religion, custom and other external authorities, was himself or herself afflicted with religious, superstitious or other non-scientific views. At every stage in its development, science has had, to one degree or another, faulty foundational beliefs. The details of the ontology kept on changing and they will continue to do so as science makes further progress. And yet, there is no turning back. The history of modern science so far is evidence enough that it will continue to improve upon itself in gaining an increasingly truer understanding of Nature and in finding better ways to deal with it. One key reason behind its remarkable achievement as well as its prodigious potential has been this robustly realist approach while laying its ontological foundations.

### ***Focus on Causality***

Modern science was not the first in positing causes behind phenomena. All sorts of explanations have resorted to the notion of causality. There have been elaborate discourses about it from the ancient times. Aristotle, for example, identified four different types of causes – material, formal, efficient and the final cause. Material cause is the material basis of existence as in wood being the material cause of a table; formal causes are structural causes implicit in the overall arrangement of things; efficient causes are the external causes that generate motion or change in an object; and final causes are the teleological ones which arise from the need of things to move towards their final state.

The strategic change that modern science brought about in this regard was to shift the focus from teleological causes, which were popular in the pre-scientific days, to the efficient causes. Of course, this focus on the efficient cause was progressively bolstered by supplementary recourse to the formal cause. The concept of the efficient cause is primarily concerned with the mode of transmission of the cause to the effect – how does a cause generate an effect. Focusing on the efficient cause had enormously beneficial consequences in the development of science. It became possible to relate the cause to the effect in a quantitative manner. The concept of *force* as the cause of motion in the Newtonian mechanics, for example, made it possible to calculate and predict the state of motion of an object in a quantitative manner provided the forces acting on that object could be identified and measured in an analogously quantitative way.

As science developed further during the 17<sup>th</sup> and 18<sup>th</sup> centuries, rich connections were found between the concepts of the efficient cause and of the formal cause. Arrangements of physical objects could be seen as resulting from combinations of forces acting on entities in such a way that stable arrangements required mutual adjustments of multiple forces with each other. This was a far richer understanding than the one in which a particular force gave rise to particular motion in a linear proportion. The structural properties of the entire arrangement became important in explaining the properties and the changes of the entire arrangement. A need for a fusion of the concepts of efficient and formal cause became increasingly obvious and it has been progressively accomplished. And this story is still unfolding.

### ***Mathematization of Nature***

The quantification of motion and change as well as that of causality required mathematization of modern science. As early as 16<sup>th</sup> century Galileo talked about mathematics being the language of Nature. He is also supposed to have said – *measure what is measurable, make measurable what is not*. Calculating, predicting, measuring and testing became the hallmarks of modern science. Mathematization played a role of fundamental importance in this regard.

But the role of mathematics in modern science went far beyond the instrumentalist approach of calculating in order to predict and measure, and measuring in order to test and prove. Mathematics was taken as more than just being the language of Nature. It did not just describe

Nature; it also explained it. A kind of correspondence was assumed to exist between physical reality and mathematics. Such a realist approach to mathematics inspired investigations of nature that went far beyond the technological limits on measurability. Mathematics turned out to be a powerful tool in identifying inconsistencies in existing theories of Nature. The theories could, then, be improved by removing such inconsistencies and new theories could be fabricated on mathematical grounds. Of course, the final validation of the mathematically constructed theories came from empirical testing and natural phenomena.

### ***Empirical Testability as the Bedrock***

Empirical testability is the bedrock of science. The most rational and mathematically consistent scientific theory will still be thrown into the dustbin if it is contradicted by facts observed in Nature at large or in empirical testing inside a laboratory. This is the most commonly known characteristic of science. And, yet, it is a very recent realization in the long history of science.

Take the example of Aristotle's law of falling objects. He said that heavier objects fall faster. Perhaps he had seen rocks falling fast and straight whereas bird feathers fell slowly and dancingly. For two thousand years no one thought of testing this law by dropping stones of different weights. It took the genius of Galileo to actually do this simple testing. It is said that he dropped different weights from the leaning tower of Pisa and found that everything falls at the same rate near the surface of earth. It is resistance of the air that does tricks with falling feathers. Stones are practically impervious to such tricks.

Why did, for two thousand years, no one think of testing Aristotle's law the way Galileo eventually did? In most of human history, authorities – religious, customary, political or philosophical – have been far more important than facts of life and of Nature. It is only in the modern era that such authorities have been challenged and progressively replaced by the authority of facts.

It should be kept in mind, however, that empirical testability is one among many characteristic features of science. If all facts of Nature were to be added up, one will still not recover science. Science requires a definite kind of ontology and method. Facts by themselves do not generalize to other facts and predict new phenomena. For that one needs a definite ontology positing uniformity and internal consistency in Nature or in reality and a method that enables one to generalize from known facts and predict new facts.

### **A Two-Way Street between Science and Society**

These distinct elements combined to produce the uniqueness of modern science. None of these, however, was a completely new thing unknown before the advent of modern science. Leucippus, Democritus and Epicurus in classical Greece, and Kanada in ancient India, had conceived of an ontology not very different from the modern one of atoms and void constituting the sum total of physical reality. Aristotle and many others in the ancient world had underscored the importance

of causes while locating the sources of phenomena. Pythagoreans and Platonists had believed long ago that Nature obeyed mathematics. Archimedes of the Hellenistic Greece was a master of manipulating Nature and knew the importance of empirical testing, as did many of the innovators of medieval China. Yet all of these elements did not come together the way they did in the Scientific Revolution. Coming together of these elements was at the root of the power and success of modern science.

Success of modern science in dealing with Nature did buttress its claim to being the only path to reliable knowledge. It paved the way for natural science to become the model for all knowledge and for the scientific values to become the model for all cognitive values. The philosophical-ideological churning of the 17<sup>th</sup> century and of the subsequent Age of Enlightenment drew sustenance from modern science. John Locke described himself as under-labourer of Newton and the natural philosophers<sup>17</sup>; Voltaire was regaling France with tales of Newton and his philosophy<sup>18</sup>; Immanuel Kant kept his philosophical concerns close to natural science and strove to provide metaphysical foundations to Newtonian physics<sup>19</sup>. This intellectual revolution was also contemporaneous with the Industrial Revolution, which, riding on steam and steel, transformed the way necessities of life were produced and upgraded. Technologies emerging from modern science laid the material foundations of modern life.<sup>20</sup>

There is little doubt that science played a decisive role in the advent and advancement of the modern era. And yet, by itself it could not have shaped the modern social order. Other forces, far more potent in many ways, were at work in the epochal transformation of Western Europe at the onset of the modern times. Religion – the dominant force in the social as well as intellectual life of the pre-modern times – began to develop internal fissures just as it was beginning to be challenged from without by science and by political developments. The split of Christianity and the religious wars in the first half of the 17<sup>th</sup> century were a clear sign of crisis.<sup>21</sup> In the political sphere, the rise of republicanism and democracy and the decline of absolutism – through a zigzag course of history in which the French Revolution was followed by Restoration and by strings of wars and failed revolutions in the 19<sup>th</sup> century – were reshaping the political order in Europe. Political transformation was driven by the new economy of capital, wage labour and market, and by the overall systemic imperatives of ascendant capitalism nourished by the colonial empire. The capitalist system – the economy and the polity – were, in turn, accelerating the social, intellectual and cultural churning process.<sup>22</sup>

All this played a crucial role in engaging modern science with the processes of social transformation. While the advent of modernity could not have occurred without the contributions of modern science, the ascendance of the latter as a key element of human civilization was greatly facilitated by the former. The internal make up of modern science, in which all its basic components came together, was the source of its intrinsic strength. This intrinsic strength was a prerequisite for its success in the aftermath of the Scientific Revolution. But its nearly universal acceptance in the larger cultural-civilizational milieu as the model for all cognitive values and as an exemplar of how best to attain a given objective could not have happened in the absence of

the historical processes of modernity. Science went into the making of modernity; modernity made science an integral part of the culture and civilization. Modernity paved a two-way street between science and society.

The symbiosis between science and modernity has been a combined result of their respective characters. We have already seen the essential features of science. Let us now summarize those of modernity.

### **The Concept of Modernity**

*Modern* is a very common adjective used with a wide variety of nouns – such as, civilization, society, culture and way of life, science and technology, political and economic systems, art, architecture, literature, music and even sartorial tastes and designs. It is nearly impossible to squeeze from such a diverse collection the common juice that makes each one of them modern. Our concern in the present context is with the advent of the *modern era* in the long sweep of history. This delimits the subject to manageable proportions but does not make the squeezing of the juice any easier. Furthermore, an attempt to distill essence from phenomena is controversial among philosophers and theorists. For many of them it is a destructive, if not futile, process arising out of an illegitimate desire. Phenomena, according to them, are inherently corporeal and contingent and nothing is to be gained by squeezing them for essences or underlying causes. They are what they are and that is all there is to reality.

It is not possible to settle this controversy and then proceed with our account. The best one can do is to state one's assumptions and conceptual starting points. These can be evaluated in the light of the veracity or plausibility of the entire account. Nor is it possible to rehearse here the process of distilling the concept of modernity from actual history. Instead we will start with stating the concept and move on to discuss its domain of applicability. Rather than handling the raw historical modernity as it emerged from the great transformations of the modern era, we will be dealing with a readymade version of conceptual modernity described by its basic constituents and their mutual interactions.

Conceptual modernity as distilled from history, especially of the modern period, consists of two basic elements – *autonomy* and *rationality*. Autonomy refers to the emergence of the human being from the shadows of religion, tradition, custom and communities. Rather than thinking as religion would have them think, humans began to think for themselves; rather than living as tradition would prescribe, they began to live in newer ways; rather than remaining subsumed in the community, they began to emerge as individuals. Immanuel Kant described it as humanity's *gaining of maturity*.<sup>23</sup>

Rationality, on the other hand, refers to organizing the society and the way of life according to the principles of *reason*. Philosophers differ about the nature, the source and the seat of reason, but there is enough agreement about what it is and how it can be contrasted with dogma, faith and superstition. More importantly, the understanding of reason has kept evolving through the

history of modern philosophy. Cartesian paradigm of *subject centered reason*, with the solitary thinker as the source of trustworthy knowledge, continued as the dominant paradigm all the way to Kant for whom knowledge, in spite of its connections to the external world, remained grounded in the consciousness of the *individual self*. Hegel questioned this subjectivist orientation and argued that *structures of consciousness* are socially and historically constructed. *Reason*, of a given era or at any given time, is the historical and social achievement of humanity and it is going to continually improve through the dynamics of history driven dialectically by the defects of contemporary reason as compared to the perfect one – the latter, according to Hegel, being encoded in the Absolute Idea waiting for humanity at the end of history. Discounting Hegel's philosophical idealism and his political conservatism flowing out of a method in which history always justifies the *present*, his contribution was to put real flesh on the emaciated *subject centered reason* of Descartes and Kant.<sup>24</sup>

In the story of *reason*, if Kant brought in the *individual* endowed with the critical faculties and freed from custom and community and Hegel brought in *society* and *history* as the makers of the social individual, then Marx completed the picture by bringing in *Nature* and the *entirety of the material world*. He insisted that “mind is not the ground of nature but nature that of mind; he stressed that human consciousness is essentially embodied and practical and argued that forms of consciousness are an encoded representation of forms of social reproduction.”<sup>25</sup> The source of intelligibility of the world is located, in the final analysis, in the world itself. Reason cannot be conceived without mind but mind cannot be conceived without the world.

Autonomy and rationality combine in the human subject who draws knowledge from the world in order to remake it. This is the essence of modernity. The entire dynamics of modernity operates through the three interlaced layers of reality – *individual*, *society* and *Nature*. The individual is social and, in part, socially constructed. Society is coming together of the socialized individuals (*social relations of production*) to deal with Nature and with the material world to ensure reproduction of material and social condition of life at a progressively higher level (*development of productive forces*). Nature, society and individual are ceaselessly interactive and operative in making and remaking each other. In this process, the *totality*, consisting of all the three layers, keeps constituting and reconstituting itself.

*Conceptual modernity* is complete, consistent and transparent. All three layers of reality interlace with each other and cooperatively constitute the totality. There is no place for error, discordance and unreason. This would be enough to convince anyone that such a thing cannot be real. Everyone knows that the real world – even the most modern one that one knows or can imagine – is full of error, discord and unreason. Why is *the world* so different from *the concept*? And what purpose can the concept serve if it is so different from the world?

The problem arises from the opacity of the process of distilling the concept from the world. If the process is not described in its entirety, as is the case with our account, the domain of applicability of the distilled concepts will not be demarcated. If one is presented with the juice

without witnessing the process of squeezing, one may completely miss the fruit. The fruit is much more than merely a juice container. One way to remedy this shortcoming is to revisit the world in the light of the concept.

### **Mutant Modernities and Their Environs**

Conceptual modernity is an abstraction. All *actually existing modernities*, as embodied in modern societies, differ from the abstracted concept in significant ways. The differences are twofold. First, embodied modernity differs from the conceptual one because the processes of modernity unfold differently in different environs. The body is much more than the genetic code. The genetic code of modernity, so to speak, does not by itself make a full-bodied modernity. All actually existing modernities are *mutant modernities*; there is no *typical* member of the *species*.<sup>26</sup> Second, even an embodied modernity does not make a full society. A society is much more than the elements that can be categorized as modern or non-modern. A modern society, for example, is the sum total of embodied modernity, its social and natural environment, and their mutual interactions. Modernity may encroach upon the environment and feed upon it, but it cannot subsume the environment fully and completely into itself.

The separation between modernity and its environment resides in all three layers of social reality – *the individual*, *the social*, and *the natural*. As discussed above, the *rational* is a defining feature of modernity. One can see the proof of separation between modernity and its environment by following the make-up and the *modus operandi* of *reason* at the respective levels.

In case of the *individual*, reason resides in the mind, but it does not ever succeed in taking full control of it. Consciousness is a repository both of reason and unreason. In fact only humans are capable of doing *unreasonable* things. No other part of Nature can *err*. Furthermore, the *conscious* is not the only part of mind. There is the *unconscious* as underlined in the Freudian psychoanalytic theory. Science, as yet, is far from fathoming the depths of human psyche, but there are tantalizing hints of a large mental environment that envelops the rational part of the mind. Much of this environment lies outside the conscious part. In all likelihood, the rational part interacts with this environment. It may even attempt to encroach upon it. There is little likelihood, however, that the rational part can grow to take over the entire mind. The rational will always sit along with the non-rational within the mind. Furthermore, there will be parts that cannot be categorized as rational or non-rational. These parts will merge seamlessly with Nature, which, in itself, cannot be described as rational or non-rational.

In case of the *social*, the separation between modernity and its environment manifests largely through the separation between the *system* part of the society and the rest of it. The system part consists, largely, of the economy and the polity. This part can be modern or non-modern. For example, the capitalist system in its idealized form is a modern system. Socialist system too is supposed to be a modern one. In comparison, the systems of the ancient and medieval worlds were non-modern systems. Modernity resides primarily in the system part of modern societies.

The non-system parts, consisting mostly of the cultural-civilizational aspects, form the environment of modernity within the modern societies. In the realm of the *social*, however, all boundaries are blurred. The system and the non-system parts may not be cleanly identified from each other within the boundary regions. In any case, both these parts of the *social* strongly interact with each other. *The economic* and *the political* sit in the lap of *the cultural* and *the civilizational*. It is because of the blurred boundaries that one is able to speak of modern or non-modern cultures. In the overall picture, however, only the system part of society can be categorized consistently and rigorously as modern or non-modern. Modernity resides in the system; the system is enveloped by the cultural-civilizational environment; the former is articulated into the latter and it feeds upon the latter.

In case of *Nature*, the concept of modernity is applicable in a limited and specific way. After all, one cannot divide Nature into modern and non-modern parts. One can, however, deal with Nature in a modern or a non-modern way. Science – more accurately, modern science – is the modern way to deal with Nature. Characteristic features of modern science have been discussed above. Of relevance here is the separation between humans and Nature. The question of dealing with something arises when the *subject* is separable, at least relatively, from the *object*. There is difference between being part of Nature and being able to deal with it in a conscious manner. When humans stepped away from the *animal kingdom*, they gained a relative separation from Nature – *relative*, because it is impossible to separate from Nature in an absolute sense. This separation enabled them to *deal with* Nature in a conscious and pre-meditated manner, which in due time paved way for being able to deal with it in a modern way. This is how modern science came into existence. The linguistic conflation characteristic of the mystics and romantics notwithstanding, there is no modern or non-modern way of being part of Nature. Only the ways of dealing with Nature can be characterized as modern or non-modern. In this case, being part of Nature functions as the environment for the act of dealing with it. The act can be modern or non-modern whereas the environment itself is neutral.

Putting all the layers together, one can say that modernity cannot cover the whole of social reality. What can be characterized as modern or non-modern will only be a part of the social reality. The rest of it will be the environment. Modernity constitutes itself according to its own rules and deals with its environs in a specific way, but it can never constitute the whole. Max Weber's worries about the *iron cage* of a completely rationalized society were highly exaggerated.<sup>27</sup> Modernity by its constitution cannot colonize the whole of social reality and it does not aspire to create *the one dimensional man*.<sup>28</sup> Capitalism, of course, has such ambitions. Modernity, however, should not be blamed for the crimes or the aspirations of capitalism.

The case of the superstitious scientist sheds much light on what modernity is and what it cannot be. The fact that there are scientists who are strictly rational while doing science but resolutely irrational in many of their personal beliefs should be no cause for wonder and should not be taken as a weakness or defeat of science. No one can be fully rational in all aspects of life and in every corner of the mind. If parts of reality fall beyond the boundaries of reason, and hence of



modernity, it is neither a negation of science nor of modernity, nor does it spell their doom. The boundaries of science or of modernity should not be mistaken for either of them being faulty or undesirable.

Superstition is no cause for glory in any case, let alone in the case of the scientist. But, perhaps, one can nonetheless heave a sigh of relief that reason and science, by their own make-up, do not and cannot take over life in its entirety.

### **Science, Modernity and Life: Concluding Remarks**

Life is prior to science and modernity. For most of the hundred or two hundred millennia of their existence, humans have lived without either of them. Obviously, science and modernity are nothing like preconditions of human life.

Life is not only prior. It is also larger. It far outstrips the domains of science and modernity. The latter are specific products of the former. Even in this modern age there are large domains of life that fall outside the purviews of both science and modernity.

And yet, science and modernity have come to form the core of human civilization. Their emergence, perhaps, is the most significant development in human history after the separation of humanity from the animal kingdom.

Actually, emergence of science and modernity is intimately connected with the emergence of humanity out of the animal kingdom. *Reason* and *human agency* are the seeds from which science and modernity are bound to sprout sooner or later. The same seeds are also the drivers of humanity's separation from the animal kingdom.

The flowering of science and modernity, however, has taken time. It had to wait till the onset of the modern era. Their mutual interaction played a decisive role in their simultaneous flowering. Science provided intellectual foundations as well as practical tools for modernity to overcome pre-modern systems and ideas. In turn, modernity helped science gain wider cultural acceptance and intellectual authority.

No one can argue that the modern times have been an era of unadulterated bliss. On the contrary, it has been an era of capitalism, colonialism, imperialism and wars – an era driven by exploitation and domination and suffused with inequality, oppression and injustice. It is a historical fact that modernity has been entangled with capitalism from birth. This makes it all the more necessary to disentangle them. One should not throw the baby with the bathwater.

Science is a human product but the final arbiter for its claims and methods is Nature. It is historical but its deeds are judged in a court that is trans-historical. The sociological studies of scientists, who are immersed in the *system* through their interests and institutions, can be useful for many other purposes, but not for uncovering the basic nature of science.

Modernity too is historical, and much more so than science. In this case a trans-historical court of judgment is not available. Modernity must be judged in the court of history. It must, however, be differentiated from the *system*. It cannot be convicted for the crimes of the *system* it lives under. There can be a good modern system and there can be a bad one. The former realizes the potentials of modernity better than the latter. A bad modern system must be replaced by a good modern system. Ailments of capitalism and its tyrannies do not originate in science and modernity. They originate in the logic of capital. This is what needs to be replaced.

Science and modernity have cleared large patches of ground – both natural and social-cultural – for humans to walk free. They have also enabled humans to claim and exercise this freedom. This is much more than the pre-moderns could have ever imagined. But humans often decide to wear chains on their feet when walking the ground cleared for their freedom. They create systems of unfreedom that enchain them; they turn science and modernity into instruments of capital and empire. Of course, it is not the doing of all humanity. A large part of it is forced into it. But, looking at it from another vantage point and in the final analysis, history is the making of entire humanity. Science and modernity are historical and in this sense products of humanity. If their full potential for enlarging human freedom is not realized, the responsibility must lie with humanity. It cannot be put at the doors of science and modernity.

Just as the proverbial scientist-believer who creates science but chooses to wrap himself in faith and superstition, humanity has created, through science and modernity, conditions for freedom, but chooses to walk in chains. But, then, humans are known as much for their follies as for their triumphs. And, often, they make history and notch further triumphs by fighting their own creations and overcoming their own follies.

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<sup>1</sup> Fukuyama, Francis, 1992, *The End of History and the Last Man*, Free Press, New York. The book was expanded from his famous article, “*The End of History?*”, published in the journal *The National Interest* in 1989.

<sup>2</sup> Huntington, Samuel P., 1996, *The Clash of Civilizations and the Remaking of World Order*, Simon and Schuster, New York. This book was expanded from Huntington’s article, “*The Clash of Civilizations?*”, published in the journal *Foreign Affairs*, Vol. 72, No. 3, Summer, 1993.

<sup>3</sup> Kipling, Rudyard, 1889, *The Ballad of East and West*, available on various online sites.

<sup>4</sup> Henley, William Ernest, 1888, *Invictus*, available online; the last stanza of the poem has the famous phrase:  
*It matters not how straight the gate,  
How charged with punishment the scroll.  
I am the master of my fate:  
I am the captain of my soul.*

<sup>5</sup> Deccan Herald, Bangalore, <http://www.deccanherald.com/content/26942/F>

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<sup>6</sup> See, for example, Gellner, Ernest, 1992, *Reason and Culture: The Historic Role of Rationality and Rationalism*, Blackwell, Oxford, for an accessible and witty account of the intellectual history of Reason, although it is not free from prejudices against thinkers like Hegel and Marx.

<sup>7</sup> Cultural relativism in its general meaning can be taken to include both cognitive and moral relativism. Our concern here is primarily with cognitive relativism.

<sup>8</sup> As quoted in Norris, Christopher, 1997, *Against Relativism: Philosophy of Science, Deconstruction and Critical Theory*, Blackwell, Oxford, p. vii.

<sup>9</sup> The flying machine in which Lord Ram is supposed to have returned to Ayodhya with his wife after defeating Ravana and rescuing her from captivity.

<sup>10</sup> Science and technology in ancient civilizations constitute a vast area of scholarship with voluminous literature. For a short account see, for example, Olson, Richard G., *Technology and Science in Ancient Civilizations*, 2010, ABC-CLIO, Santa Barbara, USA.

<sup>11</sup> See, for example, Gaukroger, Stephen, 2006, *The Emergence of a Scientific Culture: Science and the Shaping of Modernity, 1210-1685*, Oxford University Press, Oxford. This is the first volume of a projected five volume study.

<sup>12</sup> Gaukroger, Stephen, *op. cit.*

<sup>13</sup> See, for example, Singh, Simon, 2004, *Big Bang: The Most Important Scientific Discovery of all Time and Why You Need to Know about It*, Harper Collins, London, Chapter 1, *In the Beginning*, pp. 4-37

<sup>14</sup> There is a view that holds that the scientific revolution actually occurred in Greece of the classical and Hellenistic periods and the modern scientific revolution was more like reclaiming it in the period of Renaissance after having forgotten about it for a millennium and a half. See, for example, Russo, Lucio, 2004, *The Forgotten Revolution: How Science Was Born in 300 BC and Why It Had to be Reborn*, Springer-Verlag

<sup>15</sup> For a comparative study of ancient China and Greece, see, Lloyd, G. E. R., and Nathan Sivin, 2002, *The Way and the Word: Science and Medicine in early China and Greece*, Yale University Press, New Haven and London

<sup>16</sup> Literature on the Scientific Revolution of the 16<sup>th</sup>-17<sup>th</sup> century is truly vast. Physics formed the core of this revolution. For reasonably accessible account of revolution in Physics, see Cohen, I. B., 1980, *The Newtonian Revolution*, Cambridge University Press, Cambridge, U.K. A more elaborate account can be had from, Cohen, I. B., 1985, *Revolution in Science*, Harvard University Press, U.S.A. For an account focusing more on the scientific content, see, Holton, Gerald and Brush, Stephen G., 2005, *Physics, the Human Adventure: From Copernicus to Einstein and Beyond*, Rutgers University Press, New Brunswick

<sup>17</sup> John Locke, the famous philosopher, was a contemporary of Newton. In 1689 he wrote, "The commonwealth of learning is not at this time without master-builders, whose mighty designs, in advancing the sciences, will leave lasting monuments to the admiration of posterity: but everyone must not hope to be a Boyle or a Sydenham; and in an age that produces such masters as the great Huygenius and the incomparable Mr. Newton, with some others of that strain, it is ambition enough to be employed as an under-labourer in clearing the ground a little, and removing some of the rubbish that lies in the way to knowledge ..." Locke, John, *An Essay Concerning Human Understanding*, edited by Peter Nidditch, 1975, Clarendon Press, Oxford, pp. 9-10

<sup>18</sup> Voltaire, 1738, *The Elements of Sir Isaac Newton's Philosophy*, and 1733, *Philosophical Letters*, in Barber, W. H., ed., 1992, *The Complete Works of Voltaire* (The Voltaire Foundation), Oxford

<sup>19</sup> See, for example, Wartenberg, Thomas E., 1992, *Reason and Practice of Science*, in Guyer, Paul, ed., *The Cambridge Companion to Kant*, Cambridge University Press, pp.228-48

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<sup>20</sup> See, for example, Deane, Phyllis, 1979, *The First Industrial Revolution*, 2<sup>nd</sup> Edition, Cambridge University Press, Cambridge; see also Bernal, J. D., 1965, *Science in History Vol. 2 – The Scientific and the Industrial Revolution*, 3<sup>rd</sup> Edition, Penguin, Harmondsworth, for a classic account; for the relationship between the scientific and the industrial revolutions, see, Jacob, Margaret C. and Stewart, Larry, 2004, *Practical Matter: Newton’s Science in the Service of Industry and Empire 1687-1851*, Harvard University Press, Cambridge

<sup>21</sup> See, for example, Hsia, R. Po-Chia, editor, 2004, *A Companion to the Reformation World – Blackwell Companion to European History*, Blackwell Publishing, Malden, for a collection of articles on various aspects of Reformation; see also, the voluminous study of subsequent centuries of Enlightenment by, Israel, Jonathan I., 2006, *Enlightenment Contested: Philosophy, Modernity, and Emancipation of Man 1670-1752*, Oxford University Press, Oxford

<sup>22</sup> For a comprehensive account of European History of the later modern period, see the first three volumes of the four volume study by Hobsbawm, E. J., 1962, *The Age of Revolution: Europe 1789-1848*; 1975, *The Age of Capital: 1848-1875*; and 1987, *The Age of Empire: 1875-1914*, Little Brown, London; see, also, Israel, Jonathan, 2010, *A Revolution of the Mind: Radical Enlightenment and the Intellectual Origins of Modern Democracy*, Princeton University Press, Princeton, which focuses on the relationship between the intellectual and the political processes, although one must be aware of its excessive emphasis on mind and ideas, rather than material conditions, being the driving force of social change.

<sup>23</sup> Kant, I., 1784, “An Answer to the Question: “What is Enlightenment?”” in *Kant’s Political Writings*, Hans Reiss (ed. and trans.), Cambridge University Press, Cambridge, 1970, pp. 54-60. Kant was talking about Enlightenment and not explicitly about Modernity, but the difference can be taken as nominal.

<sup>24</sup> The literature on Kant and Hegel fills entire libraries. For short accounts relevant for the present purpose, see Habermas, Jurgen, *The Philosophical Discourse of Modernity*, translated by Frederick G. Lawrence, The MIT Press, Cambridge, 1987, Chap II, “Hegel’s Concept of Modernity”, pp. 23-44, and Pippin, Robert B., *Modernism as a Philosophical Problem*, Second Edition, Blackwell Publishers, Malden, 1999, Chap 3, “Idealism and Modernity”, pp. 45-77

<sup>25</sup> McCarthy, Thomas, “Translator’s Introduction” to Jurgen Habermas, *The Theory of Communicative Action*, Volume One, Polity Press, Cambridge, 1984, pp. xi-x.

<sup>26</sup> Sinha, Ravi, 2012, *Mutant Modernities, Socialist Futures*, Center for Scientific Socialism, Occasional Lecture Series – 3, Acharya Nagarjuna University, Nagarjuna Nagar, Andhra Pradesh

<sup>27</sup> Weber, Max, 1930, *The Protestant Ethic and the Spirit of Capitalism*, tr. Talcott Parsons, The Routledge Edition, 2002, London and New York, p. 123

<sup>28</sup> The phrase is borrowed from Marcuse, Herbert, 1964, *One-Dimensional Man: Studies in the Ideologies of Advanced Industrial Societies*, Second Edition, 1991, Routledge, London

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**Lucknow**  
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