

THE ROOTS OF MODERN SCIENCE: AN APPRAISAL OF THE PHILOSOPHY OF FRANCIS BECON

Francis Bacon was born in January 1561 in the Elizabethan England. His father Sir Nicholas Bacon held the office of the Lord Keeper, the highest judicial office in the Court of Queen Elizabeth. His mother, Anne, was the daughter of a man who had been tutor to Edward the Sixth. The family was closely related to the Lord Treasurer of the time. Anne's sister being married to the Lord. Born into this highly political family, the first love of Francis Bacon, it seems, was palace politics. After finishing his education from the Trinity College, Cambridge, at the young age of sixteen, and residing in France for four years under the care of Queen's ambassador to the French Court, he returned to England in 1580 to vigorously pursue a career in law and politics. Moving up in the political hierarchy, however, did not turn out to be too simple for him, in spite of all his high family connections. Nevertheless, Francis Bacon proved himself fairly adept and totally unscrupulous in the art and craft of palace intrigue. He shamelessly flattered those in a position to affect his career, and conspired against friends, going to the extent of prosecuting a personal benefactor, the Earl of Essex, and writing a pamphlet to defame the Earl after his execution, in order to please the Queen. Through such stratagems he slowly moved up in his career, finally rising to the position of Lord Keeper (later designated Lord Chancellor) that his father had occupied. He also managed to obtain the title of Baron Verulam and later that of Viscount St. Albans.

Lord Bacon in his high judicial offices is known to have misused his authority to torture prisoners and to issue injudicious monopolies to please and financially gratify his superiors in the palace. He even went to the extent of accepting bribes from litigants while occupying the highest judicial chair in England. For this last mentioned demeanour he was impeached by the Commons and sentenced by the Lords in 1626 to pay a hefty fine, to undergo imprisonment at the pleasure of the King and be banished from the court for life. The sentence was not fully executed. And Lord Bacon died in 1626.

It is surprising that in this hectic political career, Lord Bacon found time to write a number of literary and philosophical works. These works mainly preach a reorientation of learning. He wants to provide a new direction, organisation and method for the business of acquiring knowledge about the world. In this attempt he like Aristotle, wants to take all knowledge as his domain. In fact, it seems that his literary ambition was to be a new Aristotle even though he condemns and often abuses Aristotle in his work. Consequently, in his major work *Treatise on the advancement of Learning*, first written in English in 1605, and later expanded in the Latin version *De Augmentis*, we find him producing authoritatively on all subjects under the sky. This book largely defines the new direction and organisation that Bacon wanted learning to adopt. In this book we also find indications of the ethics and morals that Bacon's ideal society will exhibit. In his other major work *Navum Organum*, published in 1621, Bacon proposes to establish a new method for acquiring knowledge. Here he promises to give humanity a new engine that will simplify the art of discovery and quickly lead men to the final truths about nature.*

Bacon wrote his philosophical and literary works at the threshold of the so-called modern scientific revolution. It was a time when great changes were taking place in the Western society. And it seems that Bacon correctly caught the mood and direction

* For a quick survey of these aspects of Bacon's life see Mecauly's essay *Lord Bacon*, in *Critical and Historical Essays*. Vol.1 London 1864, pp. 346-414.

of his times. He was so correct in the apprehension of the future direction of Western society that soon in Europe knowledge was being organised the way he had suggested it should be and soon academicians everywhere were swearing by him. In fact, he very soon became the prophet of the new science and society that Europe was to build, and he still remains its major prophet. Much scholarship has been expanded on modern science since the time of Bacon, but all scholarship remains more or less true to the intent and purpose that Bacon ascribed to science and to the scholarship on it. So much so that the modern sciences that have developed since the 16th century are often known as Baconian sciences, and the modern scholars of science resolve their often irresolvable disputes about the nature and method of modern science by referring to the basic direction given to it by Bacon.**

That a corrupt judge and an unscrupulous politician should be the prophet of a whole science and a society is perhaps indicative of the science and society we are dealing with. In any case, it seems essential that for getting a clear picture of the basic tendencies and urges of modern science and society we should look at Bacon. This is a particularly revealing exercise because Bacon, at his time, does not feel the need to clothe his ideas in liberal political terminology and sophisticated scholarly jargon that has become common later. Perhaps Bacon could not have afforded to sound liberal and vague. That was the privilege of later Western philosophers and politicians who were writing at a time when the West and western science had already established their dominance over the world. Bacon at his time had to be clear and strong.

In the following we have tried to trace the roots of modern science as revealed in Bacon's work. We have relied mainly on his two major works; his work as a methodologist of a new science in *Novum Organum* and his work as a prophet of a new ethics of knowledge in *Advancement of Learning (De Augmentis)*. At the present time, when everyone talking about science is busy fudging around and clothing the basic tendencies of science in all sorts of verbiage, it is a pleasure to listen to someone as clear and as precise as Bacon. That is why we have often used his own terminology and have heavily quoted him. May be it will give the reader a flair of the type of minds from which modern science emerged.

I

Bacon: The Methodologist

Bacon saw himself, and is often seen by others, as a philosopher of science who revolutionised the method of gaining knowledge about the world. He was convinced that the ages before him failed to make any visible progress in science because they lacked the method. Thus in *Advancement of Learning* he declares:

Invention is of two very different kinds: the one of arts and sciences, the other of arguments and discourse. The former I set down as absolutely deficient. And as the immense regions of the West Indies had never been discovered. If the use of the compass had not first been known, it is no wonder that the advancement of arts hath made no greater progress, when the art of inventing and discovering the sciences remains hitherto unknown.

And again in *Novum Organum*

** See London School of Economic position paper in *Progress and Rationality in Science*. Ends G.Radlntzky and G.Andersen, Dordrecht Reidel, 1979.

* *Adv. of Learn.* Bk V. Chap.II

1st man, therefore cease to wonder if the whole course of science be not run, when all have wandered from the path, quitting it entirely, and deserting experience, or involving themselves on mazes, and wandering about whilst a regularly combined system would lead them in a sure track, through its wilds in the day of axioma . (1.82) **

He was also convinced that he had arrived at the correct method which would lead people in a sure track to the day of axioms and through the use of which, if we had but anyone who could actually answer our interrogation of nature, the invention of all causes and sciences would be the labour of but a few years . (1.112). He considered his methodological discoveries so important that he devoted a whole treatise, the *Novum Organum* to the subject, which he declared was more important than the rest . This is what he had to say about the importance of this treatise:

And as there are three ways of walking. Viz. either by feeling out one's way in the dark; or 2. When being dismighted another leads one by the hand; and 3 by directing one's steps by a light; so when a man tries all kinds of experiments without method or order, this is more groping in the dark; but when he proceeds with some direct and order in his experiments, it is as if he were led by the hand; and this we understand by learned experience; but for the light itself, which is the third way, it must be derived from the *Novum Organum* .

It is no wonder that Francis Bacon is often known merely as the author of *Novum Organum*, the treatise on the scientific method of discovery, or a new machine for the mind as Bacon himself prefer to call it.

Nature of the Method:

The method that Bacon claims to have discovered is the dream method of a positivist; a set of mechanical rules which allows the understanding to proceed by a true scale and successive steps, without breach and interruption, from particular to the lesser axioms, thence to the intermediate (rising one above the other), and lastly, to the most general (1.104). And thus allows one to found a real model of the world in the understanding, such as it is found to be, not such as man's reason has distorted (1.124).

The method is such that it leaves no scope of freedom to the individual mind. It leads the mind along the correct path, not leaving it to itself, but directing it perpetually from the very first, and attaining our end as it were by mechanical aid. ** It is so mechanical as to leave little to the acuteness and strength of wit, and to rather level wit and intellect. For as in the drawing of a straight line, or accurate circle by the hand, much depends upon its steadiness and practice, but if a ruler or compass be employed there is little occasion for either, so it is with our method (61).

Bacon is quite aware that human understanding when left to itself does not act as mechanical engine. Man sees the world in his own image. And this image derives its features from the nature of the mind in general, from the idiosyncrasies of the individual, from the interaction of the individual with the others; and from the philosophical dogmas current at the time. Bacon realises that these various aspects of the human condition, which intervene between the world and man's understanding of it are important constraints on human knowledge. His discussion of these concepts under the famous doctrine of the Four Idols (1.39-68) is a highly incisive exposition of the constraints under which the human understanding operates. He calls the four aspects listed above the Idols of the Tribe. Idols of the Den, Idols of the Market and

** *Novum Organum* Bk.1 Aph. 82. All references to *Navum Organum* have been placed on this form in the text itself.

** Preface of *Navum Organum*

the Idols of the Theatre respectively. It is best to hear what he means by these in his own precise style.

The Idols of the Tribe are inherent in human nature and the very tribe and race of man all the perception both of the senses and the mind bear reference to man and not to the universe and the human mind resembles those uneven mirrors which impart their own properties to different objects, from which rays are emitted and distort and disfigure

them (1.41). He goes on to provide a long list of the features that define the structure of human understanding. It is tempting to quote at least a few of these features in order to illustrate how keenly Bacon is aware of the way the human mind constructs the world.

The human understanding from its peculiar nature, easily supposes a greater degree of order and equality in things, than it really finds. The human understanding is by its own nature, prone to abstraction, and supposes that which is fluctuating to be fixed. But it is better to dissect than abstract nature, such was the method employed by the school of Democritus, which made greater progress in penetrating nature than the rest. It is best to consider matter, its conformation, and the changes of that conformation. Its own action, and the laws of this action of motion, for forms are a mere fiction of the human mind unless you call the laws of action by that name (1.45 & 51).

The human understanding resembles not a dry light but admits a tincture of the will and passions, which generate their own system accordingly, for man always believes more readily that which he prefers (1.49).

Such are the Idols of the tribe which arise either from the uniformity of the constitution of main spirit, or its prejudices, of its limited faculties or restless agitation, or from the interference of the passions, or the incompetence of the senses, the mode of their impression (1.52).

The Idols of the den derive their origin from the peculiar nature of each individual s mind and body, and also from education, habit, and accident (1.53).

The Idols of the Market are formed in the reciprocal intercourse and society of man . This intercourse has to be necessarily carried out through the medium of words and names. And the idols of the market are the ones which have entwined themselves round the understanding from the association of words and names. For man imagine that their reason governs words, whilst, infact, words react upon the understanding (1.43-50).

Lastly, there are idol which have crept into men s minds from the various dogmas of peculiar systems of philosophy we regard all the systems of philosophy hitherto received or imagined, as so many plays brought out and performed, creating fictitious and theoretical worlds . These idols of the theatre are not innate, nor do they introduce themselves secretly into the understanding, but they are manifestly instilled and cherished in the memory by the fictions of theories and depraved rules of demonstration (1.44 & 51).

In this doctrine of the Four idols, Bacon carries out an incisive phenomenological exercise. He clearly lists the various ways through which human mind can colour human knowledge of the world. However, Bacon carries out this exercise not to point out the innate limitations of human knowledge, but to exhort us to get rid of them.

We have now treated of each kind of idles, and their quantities, all of which must be abjured and renounced with firm and solemn resolution, and the understanding must be completely freed and cleared of them, so that the access to the kingdom of man, which is founded on the

sciences, and resemble that is the kingdom of heaven where no admission is conceded except to children (1.68).

Bacon is not naïve enough to believe that these idols, some of which, according to him, are rooted in the very structure of the human understanding, can be got rid of on his mere exhortation. But he is convinced that the method of true induction which he has discovered is potent enough to free the understanding from these idols. In fact for him the formation of notions and axioms on the foundation of true induction is the only fitting remedy by which we can ward off and expel these idols (1.40). And this true inductive method, the *Novam Organum*, will help man move away from the idols of the human mind to the ideas of the Divine Mind—from idle dogmas to the real stamp of created objects as they are found in nature. Let us see how far this promise of a sure mechanical method is fulfilled in Bacon.

The Outline of the Method

Bacon gives us an outline to his conception of the scientific method in Book 1 (1.100-107). This method involves collection of particulars through observation and systematic experimentation (1.100), putting down this data in writing (1.101) in a proper and well-arranged fashion (1.102) deriving axioms by certain method and rule from the above particulars* (1.103), and finally deriving new particulars from these axioms so that the axioms may confirm their own extent and generality (1.106) Thus the scientific method in the Baconian conception is what all of us conceive of as the method; observation, induction of axioms from the observed and testing those axioms in further observation.

Our course and method, however (as we have often said, and again repeat), are such as not to deduce effects from effects, not experiments from experiments (as the empirics do), but in our capacity of legitimate interpreters of nature, to deduce cause and axioms from effects and experiments; and new effects and experiments from those causes and axioms. (1.117)

Bacon is varying of both the empirics who refuse to generalize beyond the limited particulars of their observation, and the sophists or theologians who make no or little contact with experiment. For him.

There are these sources of error and three species of false philosophy; the empiric and the superstitious Aristotle affords the most eminent instance of the first; for he corrupted natural philosophy by logic thus he formed the world of categories being everywhere more anxious as to definition in teaching and the accuracy of the wording of his propositions, than the internal truth of things. Nor is much stress to be laid on his frequent resources to experiments in his books on animals, his problems and other treatises, for he had already decided without having properly consulted experience as the basis of his decisions and axioms, and after having so decided, he drags experiments along as a captive constrained to accommodate herself to his decisions, so that he is even more to be blamed than his modern followers (of the scholastic school) who have deserted here altogether The empiric school produces dogmas of a more deformed and monstrous nature than the sophistic or theoretic school; not being founded in the light of common notions (which however poor and superstitious, is yet in a manner universal and of general tendency) but in the confined obscurity of a few experiments. We have a strong

* The certain method and rules are obtained by inventing a new form of induction (1.104-105) when will make the whole process positivistic. But that aspect we shall deal with when we come to book it.

instance of this in the alchemists and their dogmas; it could be difficult to find another in the age, unless perhaps in the philosophy of Gibert. The corruption of philosophy by the mixing up of it with superstition and theology is of much wider extent, and is most injurious to it both as a whole and in parts. Against it we must use the greatest caution for the apotheosis of error is the greatest evil of all, and when folly is worshiped, it is, as it were, a plague spot upon the understanding. Yet some of the moderns have indulged this folly with such consummate skill that they have endeavoured to build a system of natural philosophy on the first chapter of genesis (though) it is most wise to render unto faith the things that are faiths (1.62.64.68).

The true Baconian method then avoids the pitfalls of both the empirics and the sophists and achieves a golden mean. Bacon expresses this conception of his method in his poetic phrase:

Those who have treated of sciences have been either empirics or dogmatical. The former like ants only heap up and use their store, the latter like spider spin out their own webs. The bee a mean between both, extracts matter from the flowers of the garden and the field, but works and fashions it by its efforts. The true labour of philosophy resembles hers, for it neither relies entirely nor principally on the powers of the mind, not yet lays up in the memory the matter afforded by changes and works it in the understanding (1.95).

It is obvious that the method as outlined above cannot be new. Men have always reasoned from particulars to the generalities, and no generalities which were not confirmed in their effects could have survived. In the England of Bacon which was just coming out of the scholastic age, his strong exhortation to men to come back to particulars and their regular series and order, and renounce their notions and begin to form an acquaintance with things, must have been of great value. It must have been important to remind the schoolmen that the human mind, if it acts upon matter, and contemplates the nature of things, and the works of God, operates according to the stuff and is limited thereby, but if it works upon itself as the spider does then it produces cobwebs of learning, admirable indeed for the fineness of thread, but of no substance or profit. But we cannot possibly accord any novelty to the method outlined above. Further, even if the method were novel it is just not good enough to fulfil the Baconian promise of a certain and sure method that will lead from the idols of the mind to the ideas of the Divine. The idols of the mind, some of which are so deep-rooted as to form the very structure of consciousness and of which Bacon offers such a clear analysis, cannot be wished away by merely an exhortation that one must always abstract from particulars to the generalities. Such idols will always intervene between the world and our conception of it, and as Bacon knows many theories can be deduced from the phenomenon of the sky (1.62).

Infact, Bacon is aware of both the above objections; the method is not novel, and it followed it need not lead to a unique result (1.25). His argument is that it is the new inductive method which will make the process of going from the particulars to the generals a smooth, mechanical process unaffected by any idols that the mind may harbour, unaffected by even the level of intelligence and wit of the individual applying the induction. It is this new induction which is to fulfil the positivistic promise at Bacon.

Infact the whole of Book 1 is in the nature of an introduction to the new induction that Bacon develops in the second book. And it is a moving introduction. Bacon surveys the whole field of thought, shows the incapacities it has been heir to, gives glimpses of the way he proposes to get thought out of these infirmities, lists the causes of the failure of the earlier times and the earlier people and the reasons of hope, the most important of them being that he can now bestow humanity with a mechanical method of discovery, an aid for the mind, an inductive engine the *Novum Organum*. By the end of this vast introduction one wants to rush and read the Book II and discover the method that will make the positivist dream come true.

The New Induction (Book II)

In the second book of the *Novum Organum* Bacon, after making a few rather abstruse remarks about the nature and objectives of knowledge quickly comes to the question of defining the rules of his induction. He begins by repeating the outline of his scientific method already given in Book I and it may be appropriate to repeat it here to make clear the important place that the rules for induction occupy in the Baconian framework. He defines the scientific method which according to him is the method that allows interpretation of nature as against merely anticipations of nature that have been obtained by the ancients, in the following words.

The signs for the interpretation of nature comprehend two divisions the first regards the eliciting or creating of axioms from experiment, the second the deducing or deriving of new experiments from axioms. The first admits of three subdivisions into ministrations: 1. To the senses 2 to the memory 3. To the mind or reason. For we must first prepare as a foundation for the whole, a complete and accurate natural and experimental history But natural and experimental history is so varied and diffuse, if al it confounds and distracts understanding unless it be fixed and exhibited in due order Even when this is done, the understanding left to itself and its own operation, is incompetent and unfit to construct its axioms without direction and support. Our third ministration, therefore, must be true and legitimate induction, the very key of interpretation/(II.10).

It is this induction therefore which is to help as a mechanical aid to understanding so that it does not fall prey to its usual in competencies, including its idols. Immediately after the aphorism quoted above Bacon starts writing down the various steps involved in this induction, which he illustrates by an investigation of the form of heat .*

The first step in the Baconian inductive process is the collecting of all instances that exhibit the presence of the nature being investigated. This collection is to form the Table of Existence and Presence. Their collection is to be made as a mere history, and without any premature reflection, or too great degree of refinement (II.11). Thus, for the example of heat. Bacon puts together in his Table of Existence, twenty seven instances of the presence of heat completely randomly. In this table we find instances as varied as the rays of sun particularly in summer, and even a severe and intense cold which also produces a sensation of burning.

The second step is to construct the Table of Deviation or Absence in Proximity. Under this table are to be collected instances, which agree with or are like the instances of the Table of Presence, but differed from those in that the given nature is absent. Thus the proximate instance wanting is the nature of Heat corresponding to the presence of it in the rays of the sun, particularly in summer and at noon , is afforded by the rays of the noon, stars, and comets which re not found to be warm to the touch .

The third step is to record the data on variations of the degree of the given nature in the same body at different times, and also in comparison with different objects. This is because, No nature can be considered a real form which does not uniformly diminish and increase with the given nature. This collection is to be called the *Table of Degrees*, Comparative instances. Armed with these tables, one is finally ready to start the process of induction. This is to be carried out through the *Table of Exclusions*,

* It is difficult to see what Bacon means by form or nature . We come across defining phrases like forms or true specific difference , or nature or source of emanation . We cannot give any definition except to point out that in the case of investigation of the form of heat , the given nature is heat.

keeping in mind that not only each table is sufficient for the rejection of any nature, but even each single instance contained in them. For it is clear that every contradictory instance destroys an hypothesis as to the form (II.18). Thus the next step in this method is formation of the Exclusive table. This table is supposed to indicate what phenomena are not essential to the form of the nature being investigated. For example in the case of heat the exclusive table tells us that:

1. On amount of the sun's rays reject elementary (terrestrial) nature .
2. On account of the expansion of the air in the thermometers and the like, which is absolutely moved and expanded to the eye, and yet acquire no manifest increases of heat (again) reject absolute of expansive motion of the whole (as the form of heat)(II.18).

The process of induction so far has proceeded more or less mechanically as promised. Though one suspects that mere listing of what instances agree in the form of heat, and what instances are wanting in the nature of heat, already requires some idea of what is heat and one is afraid that the so-called idols of the Market associated with the word heat may have something to do with the way these tables are formed. This seems to be the only way of explaining how instances like aromatic substances and warm plants . Creep into the Table of Presence of heat. Again in the formation of the Table of Exclusions one finds some evidence of the interference of the various idols of the mind. For example the rejection of the expansive motion of the whole in the example noted above does not seem to be so much indicated by the observation that the thermometers acquire no manifest increase in heat (they do 1); but by a preformed notion, which at this stage can only be called an idol of the theatre, that heat is not a uniform expansive motion of the whole, but of the small particles (not atoms or molecules, Bacon does not subscribe to that particular Idol¹) of the body (II.20). This Idol seems to have affected Bacon's observation. The important point is however not that in the drawing of these tables Bacon seems often wrong by our modern standpoint; but that even this mechanical process of first compiling the various tables does not seem to be free of the vitiating influence of the Idols that Bacon sets out to exercise.

The next step in the Baconian inductive process is however, completely baffling. Having formed the *Tables of presence, Table of Absence in Proximity, Tables of Degree, and the Tables of Exclusions*, and yet not having arrived at an axiom about the form of the nature to be investigated, Bacon advises us now to leave the mechanical path and form what we call an hypothesis . Bacon calls it The First Vintage and gives an ingenious reason for now finally letting the understanding run free:

Since, however, truth emerges more readily from error than confusion, we consider it useful to leave the understanding at liberty to exert itself and attempt the interpretation of nature in the affirmative after having constructed and weighed the three tables of preparation, such as we have laid them down, both from instances there collected, and others occurring elsewhere. Which attempt we are want to call the liberty of the understanding or the commencement of interpretation or the first vintage II.20).

The first vintage that Bacon reaps from his elaborate inductive exercise on the form of heat is that:

* This method will not bring us to atoms, which takes for granted the vacuum, and immutability of matter (neither of which hypothesis is correct), but to real particles such as we discover them to be (II.8).

Earlier: Hence men cease not to abstract nature till they arrive at potential and shapeless matter, and still persist in their dissection, till they arrive at atoms; and yet were all this true, it would be of little use to advance man's estate (1.66)

Heat is an expansive motion restrained, and striving to exert itself in the smaller particles. The expansion is modified by its tendency to rise, though expanding towards its exterior; and the effort is modified by its not being sluggish, but active and somewhat violent . (II.20)

It is not important to discuss how correct this inductive hypothesis is in the light of modern physicist s conception of heat. In fact a comparison is impossible, because the modern physicist s world is peopled by atoms and molecules, while Bacon s smaller particles are not the very minutest particles, but rather those of some tolerable dimension . However, one thing is clear, an hypothesis like the above, claiming that heat is motion of the smaller particles , could not have been formed by someone completely free of all idols, and looking merely at the objective world before him. No amount of observation, negation and exclusion is likely to lead to such an hypothesis. Infact Bacon admits as much when he finally agrees to let the understanding be free and form its own hypothesis. And the hypothesis that he makes is, interestingly, a statement of the seventeenth century. Idol of the Theatre that insisted that the appropriate explanation of all phenomena is in terms of the size, shape, position and motion of the elementary corpuscles of the base matter.*

After explaining this step-wise induction process, Bacon in Novum Organum then goes on to provide a list of the remaining helps of the Understanding that are necessary for a true and perfect induction . These helps include:

1. Prerogative Instances, 2. Supports of induction 3. Connection of induction 4. Varying the investigation according to the nature of the subject 5. Prerogative nature, or what should be investigated first and what last. 6. Limits of investigation, or a synopsis of all natures that exist in the Universe 7. Application to Practice 8. Preparation of investigation 9. Ascending and descending Scale of Axioms.

Of these additional aids bacon deals with only the first, and the rest of the Novum Organum deals with Prerogative Instances, that are to help the understanding in the process of Induction. He isolates twenty-seven ranks of Prerogative instances, and gives example of each from various fields of sciences. The whole exposition is a longwinding, abtuse presentation quite unlike the crystal-clear, prophetic style of Bacon in the first Book and is full of factual errors. One is shocked to see that the Venerable bacon, the prophet of science, living at the time of Gilbert and Galileo both of whom he condemns was not aware of amny of the simple achievements of the science of his time. Mercifully, Bacon does not pursue his attempt of offering all his helps of understanding in detail, though he ends his Book II with a confident assertion that we must next, however, proceed to the supports and correction of induction (II.52). He never proceeds to these other parts of his induction, and here ends Bacon s methodological adventure.

What does one make of this elaborate exercise in methodology? The first question to ask is, does this new induction fulfill the purpose for which it has been invented, that of providing a mechanical aid to understanding so that it does not get impressed by its own idols and moves through certain method and rules to the ideas of the Divine mind . Is it the fitting remedy by which we can ward off and expel the idols ? We have partly answered this question above where we show that the method does deviate from its mechanistic ideal inviting the understanding to form an hypothesis, albeit after having looked at the tables of review and the exclusion. It is not obvious what makes sure that this exercise in hypothesis-formation which surely is non-mechanical, will not be vitiated by the prevalent notions** and it seems dBacon

* See Kuhn T.S. Structure of Scientific Revolutions, Second Edition, 1970, p.104

** Macaulay recounts a hilarious story of an eminent judge who was in the habit of jocosely propounding after dinner a theory that the cause of the prevalence of Jacobianism was the

himself was influenced in his hypothesis on the form of heat by the prevalent mechanico-corpuseular world-view of the seventeenth century. As one reads the second book of *Novum Organum*, one comes across more and more examples of observation being influenced by the hypothesis, of hypothesis being influenced by the prevalent notions, of the ambiguous meanings of words generating ambiguous experimnt and theory, and so on. I shall give here just, two examples which seem to be crucial.

First, in the First Vintage of the form of Heat, we find the following hypothesis . the motion of heat is both expansive and tending upwards . In support of this hypothesis Bacon quotes the following observations:

This difference is shown by putting the tongs or poker into the fire. If placed perpendicularly with the hand above, they soon burn it, but much less speedily, if the hand hold them sloping or from below .

From our modern vantage point the hypothesis about heat having a preferential direction of motion seems absurd. We know that heat does not exhibit any such behaviour. But, then how was Bacon able to confirm his hypothesis in experiment. Perhaps the explanation lies in the open fire furnaces that were the only sources of heat at Bacon s time and which do direct heat in the upward dirction. Today if we were to test Bacon s hypothesis we shall take pains to design a furnace that directs heat isotropically. Thus it seems Bacon was not wrong in his hypothesis. He simply was talking ab;out a different type of heat, the only type which would have been able to any experimenter unless he was already convinced that heat moves isotropically and went about designing a furnace that will prove this latter hypothesis. One is reminded of Kuhn s observation based on the history of Baconian sciences that the very experimental data on which a hypothesis is based starts changing when the hypothesis is changed. Thus, before Dalton s theory became acceptable, the chemists saw all sorts of ratios between the various elements forming a compound Proust s own measurement on the two Oxides of Copper yielded, for example, an Oxygen weight ratio of 1.47:1 instead of 2:1 demanded by the atomic theory. And proust was a fine experimentalist. By the time, however, the atomic theory was finally accepted, nature had been beaten into line to fit the theory. At the end of it, eaven the percentaage compostion of well-known compounds had changed.* Infact the meaning of the term compound itself had changed by then. Such is the influence of the idols that Bacon sets out to exercise, and fails.

For our second example, we shall take a prerogative instance of the sixth rank which includes instances which show physical parallels or resemblances with other forms (II.27). Talking of such instances Bacon proposes the following.

The acrotum of males and the matrix of females are also similar instances; so that the noble formation which constitutes the difference of the sexes appears to differ only as to the one being internal and the other external; a greater degree of heat causing the genitals to protrude in the male, whilst the heat of the female being too weak to effect this they are retained internally .(II.27).

How many idols have gone into making this absurd observation:

practice of bearing three names. He could perfectly well build the tables of presence of absence in proximity, of the degree and of exclusions to arrive at the above result (See Macaulay, Op.cit.)

* See, Kuhn, Op.Cit.p.134-5

- a) An attempt to see a higher degree of order and equality in things than really exists. An attempt to force resemblances: An idol of the Tribe. (I.45)*
- b) An attempt to explain diverse phenomena through his pet theory of heat as an expansive motion: An idol of the Den(I.54).
- c) An equation of heat with vitality, derived from usual usage of the word heat: As idol of the Market (.59).
- d) An assumption that the heat of the female is weaker than that of the male, obviously derived from the current world view: An idol of the Theatre(I.62).

Thus one sees Bacon, in spite of his method, falling into the trap of the idols which he himself has analysed. Incidentally, we happen to recognise the influence of these idols in the above not because we have a superior method, but because we have stopped believing in the particular idols which were current at Bacon's time. We have our own idols now, and only those who are free of them will be able to see the flaws in arguments that we take for granted now. In spite of Bacon and his method we have to live with the knowledge that our knowledge of the world is always tinged with the peculiar idols that we hold. There are no royal roads to the ideas of the Divine. In fact, no roads royal or other wise. We as humans can aspire only to human knowledge. However it may be, one thing is clear: Bacon's method does not come up to the positivist's dream. It does not lead to certain indubitable knowledge. It does not free man from his idols. It could not even free Bacon from his.

Now let us turn to that other claim of Bacon, that of having discovered a new method. Is the new induction described above really new? The answer depends upon how you view this method. If it is to be taken as a prescription as to how to proceed while making an induction. If an actual drawing up of the tables of review and exclusions, below going to the exercise of constructing an hypothesis, is to be taken as a necessary component of induction, then the method is obviously new. Nobody before Bacon followed this prescription, but unfortunately nobody after him followed it either, not even the Western scientists who claim to be carrying on the tradition of Baconian science. Bacon can claim novelty, only at the cost of becoming irrelevant. However, one can look at the method merely as an advice that one must keep all the experimental information, summed up in the various tables, to mind while indulging in induction. In that case the induction Bacon is talking about turns out to be a very ordinary affair. As Macaulay rightly and quite picturesquely describes in his Essay on Bacon, induction is something.

Which we are all doing from morning to night, and which we continue to do in our dreams. A plain man finds his stomach out of order. He never heard of Lord Bacon's name. But he proceeds in the strictest conformity with the rules laid down in the second Book of *Novum Organum*, and satisfies himself that minced pie have done the mischief. I ate minced pies on Monday and Wednesday, and I was kept awake by indigestion all night. This is the *Table of Presence*. I did not eat any on Tuesday and Friday, and I was quite well. This is the *Table of Absence in Proximity*, I ate very sparingly of them on Sunday, and was very slightly indisposed in the evening. But on Christmas day I almost dined on them, and was so ill that I was in great danger, This is the *Table of Degrees*, It cannot have been the brandy which I took with them. For I have drunk brandy daily for years without being the worse for it. This is the *Table of Exclusion*. Our

* The attempt at seeing the higher degree of generality than actually exists which Bacon himself castigates simply (I.45 & 55) seems a peculiar weakness of Bacon. Thus in the first chapter of Book III of *Adv. of Learning* we find him constructing his philosophic prima on the basis of all sorts of spurious analogies in morals and music to mathematics and ethics and so on.

invalid then proceeds to what is termed by Bacon as the First Vintage, and pronounces that minced pies do not agree with him .*

True that the invalid has performed all these steps without being aware of them. We can give Bacon the credit for making these steps explicit, for perhaps being the first to have analysed induction in the Western tradition, for having done for induction what Aristotle had done for logic. But Aristotle did not discover logic, and we cannot allow that Bacon has discovered any new induction.

Once we realize that Bacon's method is to be looked upon not as a new method but as an analysis of the inductive process, then we begin to see that Bacon has been quite perspicacious in this analysis. He already strongly emphasises the importance of the negative instance in carrying out a true induction, an emphasis out of which Popper later constructs a whole theory of falsifiability. In fact, Bacon's whole grouse against the induction prevalent till then seems to be that it does not accord sufficient attention to the negative instances, and proceeded to induce axioms from what Bacon calls simple enumeration. This process Bacon declares is wrong because:

From a bare enumeration of particulars in the logical manner, follows a wrong conclusion, nor does such an induction infer anything more than a probable conjecture. For who will undertake, when the particulars of a man's knowledge of memory appear only on one side, that something directly opposite shall not lie concealed on the other?

In *Novum organum* he expresses the same sentiment more picturesquely:

It was well answered by him who was shown in a temple the votive tablets suspended by such as had escaped the peril of shipwreck, and was pressed as to whether he should then recognise the power of gods, by an enquiry. But where are the portraits of these who have perished in spite of those vows (I.46)

This insistence on giving emphasis to the negative instance in induction is perhaps quite important. But, if we take Bacon's insistence on the negative instance as seriously as Bacon himself takes, that each single negative instance must be sufficient to reject an hypothesis (II.18), we find that the method is novel, but nobody follows it. If we take it as an analysis of the inductive process where negative instances are generally important, then there cannot be anything new in it. One cannot think of anyone inducing an hypothesis which is patently negative even before being established, even though Bacon claims that before him all induction was mere simple enumeration.

Thus whichever way we look at the new induction presented in *Novum Organum*, we cannot accept that any new methodological concept is being brought out by Lord Bacon at the beginning of the so-called Scientific Revolution. Nor can we accept that this new method was such that it would lead to ultimate truths, to truths uncoloured by the social and individual perceptions of reality, to truths to which the people before Bacon had no access because of their lack of method. If Bacon is to be supposed to have heralded a revolution in human knowledge which he undauntedly did standing and philosophising as he does at the door of the Western Scientific Revolution which unabashedly acknowledges him as one of its prophets it cannot be because of the methodological contributions of Bacon. The elements of this revolution must be searched for elsewhere in Bacon's thought, in his ideas about the organisation of science and society, in his ideas about the objectives of knowledge, in his ethics and in his politics to which we now turn.

* Macaulay, Opt.Cit. p.381

** Adv.of Learn, Bk V.Ch 2.

However, in this elaborate methodological exercise that he considered to be more important, than the rest of this work we can already see a major element of the Baconian conception of science. He wants the new science to be seen as a faithful representation of the truth about the world, as a transcript of the Divine Mind. Even though Bacon failed to produce the promised new engine that shall lead the human mind from merely human knowledge to the ideas of the Divine, yet the idea of constructing epistemologies that shall somehow prove the unique absolute truth of the Baconian sciences has remained with the philosophers of science. And while the philosophers have been expending prodigious amounts of effort to produce a methodology that may show the Baconian science to be true or not. Thus, though Bacon failed in his methodological exercise, he yet succeeded in establishing the idea of according a mere human discipline the sanctify of divine truth. Even that idea was perhaps not very new in the Western world seeing that, just around the time of Bacon, the American Continent was being decimated in the name of absolute truth of Christianity. However he successfully channalised this idea of the absolute truth into a new direction. Giving a clear exposition of the new direction that the Western idea of absolute truth was to take is what has made Bacon the prophet of industrial society. We shall now talk about this prophetic aspect of Bacon.

II

Bacon: The Prophet

While Bacon's claim to be the methodologist of the new science that was emerging in Europe during his time is often disallowed, this position as the prophet of a new culture in which the new science was to take root is universally acknowledged. Even Macaulay who so forcefully ridicules Bacon's methodological claims and who shows nothing but righteous indignation and contempt for the many mean acts for which Bacon was responsible as a lawyer and a politician even he, seems to be spellbound by the prophetic moral and intellectual constitution which enabled Bacon to exercise so vast an influence on the world. Even he allowed that he (Bacon) was one of these few imperial spirits whose rare prerogative it is to give the human mind a direction which it shall retain for ages.* Bacon's fame as a revolutionary prophet of a new culture was already so wide spread at the time of Macaulay that in the faraway India. Raja Ram Mohan Roy, in his moving petition to the Governor General for the provision in India of a new Education that would instruct the natives in the subtleties of the new culture, was referring to Lord Bacon as the dividing line between the old and the new. Infact his protest against the Sanskrit schools, that the pupils will thereby acquit what was known two thousand years ago, with the addition of vain and empty subtleties since produced by speculative men, such as is already taught in all parts of India, echoes Bacon in both style and content. Raja Ram Mohan Roy adds more explicitly, according Bacon the status of a prophet for Britain as well as India: If it had been intended to keep the British nation in ignorance of real knowledge, the Baconian philosophy could not have been allowed to displace the system of the schoolmen, which was the best calculated to perpetuate their ignorance. In the same manner, the Sanskrit system of education would be the best calculated to keep this country in darkness if that had been policy of the British Legislature.**

This fame of Lord Bacon as the prophet of the new culture of the west has persisted to our day. Thus Farrington writing at a different age (1951) from a different continent

* Macaulay Op.Cit.p.387

** See. Raja Ram Mohan Roy, English Works(1906) p.471-4

devotes his popular book on Bacon to undoing the impression of Bacon as the failed methodologist of the new science and to assigning him his rightful place as the founder of English materialism.^{*} Therefore, to understand Bacon, and the scientific revolution he presaged, it is important to look at the new moral, ethical and cultural ideas that he was preaching.

The first element in the Baconian cultural-ethical complex is the freeing of knowledge from the constraints of the prevalent ideas of good and evil. Bacon declares this freedom of knowledge in the first few pages of his major work, *Advancement of Learning*. And curiously, he manages to have his God on his side in this plan to make human knowledge irresponsible to the prevalent ideas of human good. The oft-quoted words in which this declaration of irresponsibility is made are:

It was not the pure knowledge of nature, by the light whereof man gave names in all the creatures in Paradise, agreeable to their nature, that occasioned the fall; but the proud knowledge of good and evil, with an intent in man to give law to himself, and depend no more upon God.^{*}

This advice to split pure knowledge from ethics, an advice that becomes more explicit later in *Novum Organum*. There we find Bacon strongly censuring those who tend to mix natural philosophy with religion and faith; They celebrate the union of faith and senses as though it were legitimate, with great pomp and solemnity, and gratify men's pleasing minds with a variety, but in the mean time confound most improperly things divine and human (I.89). And he exhorts all to free natural philosophy from this corruption while rendering unto faith the things that are faith's (I.65); though, as we shall see later, the things that are faith's in the Baconian conception turn out to be precious few.

Though splitting knowledge from ethics is a basic component of the Baconian culture, it does not amount to making a separation between facts and values as it is often portrayed and understood.^{**} Bacon does not want that knowledge should be pursued for its own sake, that it should be freed from all values. Having freed knowledge from all constraints of good and evil, he then subjects it to a new overriding constraint, that it should generate power. Power and utility are in fact the keywords of Bacon's thought. These words appear as the principal values in everything that Bacon has written. For him the value of power and utility is so great that often truth, power and utility become identical concepts in his perception. Thus we find him saying in *Novum Organum*:

Truth therefore, and utility, are here perfectly identical, and effects are of more value as pledges of truth than from the benefit they confer on man (I.124).

And again:

There is a most intimate connection between the ways of human power and human knowledge and that which is most useful in practice is most connect in theory (II.4).

^{*} Farrington Francis: Bacon. The Prophet of Industrial Science: See preface to the English Edition. 1974

^{*} Adv. of Learn. Preface to Bk. I

^{**} See for example Uberoi J.P.S. Science & Culture Oxford

Thus, since knowledge and power acquire an identity in Bacon's perception, he does not see the commandment that knowledge be exclusively directed towards gaining power, as a new value being imputed upon knowledge, free of all idols of the understanding—a value-free knowledge, in more modern terminology. However, we, looking at the revolutionary change in the moral, ethical and intellectual standards of the Western world that took place with Bacon's philosophy, cannot but see that this assertion of the identity of knowledge and power is a new idol.

We cannot see the change as a split between facts and values, opening the way to value-free factual knowledge. On the other hand we can only see the older values of good and evil being replaced by the new values of useful and useless.

Using Bacon's own categorization of the idols that beset human understanding, we are tempted to call this new idol of power/utility an idol of Bacon's den, seeing that this idol had taken hold of him rather early in his life*. But this idol of his den is also an idol which was fast becoming the idol of the Western tribe. Bacon was formulating this thesis of the identity of knowledge and power and of the freedom of knowledge from all ethics, when Christian monasteries—the custodians of the prevalent ethics—had already lost out to the new temporal powers. It was also a time when, as Farrington says, the Christian ideas of mercy and love had to take a back seat in the face of the lucrative possibilities of plunder and slavetrade made possible by little vessels, like the celestial bodies that sailed around the whole world, and by the power of gun powder. And all the wealth, from whatever source it came—distribution of monastic lands, plunder of the treasure ships of Spain, or the new and lucrative trade in black slaves—was being invested in industry** to further increase the hold of the temporal powers. It was only a matter of time before the intellect would have aligned itself with these new powers. It was only a matter of time before new idols of the tribe and the theatre would have emerged.

Therefore, it is not an exaggeration to say as Will Durant said that the real nurse of Bacon's greatness was Elizabethan England the greatest age of the most powerful of modern nations.*** However, though Bacon only expressed an idea that was already in the air, an idea whose time had come in the Europe of his time, yet the expression is all his own. He offered a complete justification for all the hankering after power by declaring that truth is power; and he sanctified all the misery being inflicted upon whole continents—African and American—by declaring that truth which is power has no business to bother itself about what is good and what is evil.

Bacon even went further, he sought to cement the union of knowledge and temporal power by insisting that knowledge in the pursuit of power ought to be organized by the King. All his books are addressed to the King. But in the second book of the *Advancement of Learning* we find him making specific recommendations to the King for organizing knowledge for the sake of power. The sycophantic words in which he opens this appeal to the King are particularly interesting in the context of Bacon's concept of knowledge being a handmaiden of the powers that be:

* Dr. William Rawley, his private secretary has recounted that "Whilest he was commorant in the University, about sixteen years of age, as his lordship hath been pleased to import unto myself, he first fell into dislike of the philosophy of Aristotle; not for the worthlessness of the author, to whom he would even ascribe all high attributes, but for the unfruitfulness of the way; being a philosophy, (as his lordship used to say) only strong for disputations and contentions, but barren of the production of works for the benefit of the life of man, in which mind he continued to his dying day." (Quoted in Farrington, *Op.Cit.* p.23-24 emphasis added).

** Farrington *Op.Cit.* p.46

*** Will Durant, *Story of Philosophy*, 1947.p.106

It is befitting, excellent King, that those who are blessed with a numerous offspring, and who have a pledge in their descendants that their name will be carried down to posterity, should be keenly alive to the welfare of future times, in which their children are to perpetuate their power and empire. Queen Elizabeth, with respect to here celibacy, was rather a sojourner than an inhabitant of the present world, yet she was an ornament to her age and prosperous in many of her undertakings. But to you Majesty, whom God has blessed with much royal issue, worthy to immortalize your name, it particularly appertains to extend your cares beyond the present age, which is already illuminated with your wisdom, and extend your thoughts to those works which will interest remotest posterity .

And then he proceeds to give a blueprint of an organization of knowledge which sounds like a description of the modern organization. He advises the establishment of schools and universities, of endowments, privileges and charters, of libraries and of professorships etc. He advises improvement in the salaries of the lecturers and professors. He advises establishment of contact between all universities of Europe. And he advises generous grants for the Establishment of laboratories: And if Alexander placed so large a treasure at Aristotle's command, for the support of hunters, fowlers, fishers, and the like, in much more need do they stand of this beneficence who unfold the labyrinths of nature . And therefore as the secretaries and spies of princes and states bring in bills for intelligence, so you must allow the spies and intelligences of nature to bring in their bills, or else you will be ignorant of many things worthy to be known .

Bacon's advice to the temporal powers to take knowledge under their wings was soon heeded. The Royal Society was founded in 1662, and its founders named Bacon as their model and inspiration. And soon knowledge was being organised all over Europe on the model proposed by Bacon. The split of knowledge from ethics and its custodians, the monasteries, was thus complemented by a marriage of knowledge with power and its nascent repository, the secular state.

To sum up then, the Baconian new idea which makes him the prophet of the scientific revolution was that knowledge ought to be organised under the tutelage of the temporal authority for the exclusive purpose of gaining power without regard to the question of good and evil.

To complete the picture, however, we must also answer the question: Power for whom and over what? Nominally Bacon's answer to this question is that knowledge is the power over nature for the benefit of mankind. Thus in a much quoted passage of *Novum Organum* Bacon states:

it will, perhaps, be as well to distinguish these species and degrees of ambition. First that of man who are anxious to enlarge their own power in their country, which is vulgar and degenerate kind; next that of man who strive to enlarge the power and empire of the country over mankind, which is more dignified but not less covetous; but if one were to endeavour to renew and enlarge the power and empire of mankind in general over the universe such ambition (if it may be so termed) is both more sound and more noble than the other two (I.129).

It is this universal aspect of Bacon's ethics that has made him the prophet of almost the whole mankind since the scientific revolution. It is this aspect which allows Raja Ram Mohan Roy to advocate Baconian ethics for his people, even when those people are being reduced to misery by Bacon's compatriots armed with power acquired through the Baconian sciences. Yet this statement that power should be exercised over

* All quotations are from Adv. Of Learn, Bk II, Ch.I

nature for the benefit of whole mankind this crucial assumption, which alone can make Baconian ethics a universal ethics as distinct from the ethics of a plundering nation this statement does not seem to be borne out by either the general tenor of Baconian philosophy or by Bacon's own practice in life. Let us take these two aspects separately and see how far we can find support for them in Bacon.

First let us take the statement that Baconian Science is a search for power over nature and not over man. It is true that in Baconian philosophy the major attack is aimed against nature. In fact nature appears almost as an enemy that is to be dissected, tortured, put on the rack and so on, in order for it to yield its secrets. For as a man's temper is never well known until he is crossed; in like manner the turns and changes of nature cannot appear so fully, when she is left at her liberty, as in the trials and tortures of art.* And it is from this stress on torturing and vexing nature to gain power over it that the much vaunted Baconian stress on unbridled experimentation follows.

Thus a reading of the explicit statements of Bacon does support the view that the Baconian search for power is to be addressed against nature. However, interestingly, in Baconian conception, nature includes man, not only his body but also a large part of his soul. Thus while talking about human soul in Book IV Chapter III of *Advancement of Learning*, he classifies the doctrine of the human soul into two parts: the doctrine of the inspired substance (proceeding from the breath of God), and the doctrine of the produced or the sensitive soul. He then generously grants that the former may, with some reservations, be turned over to religion, and thus be left out of the pale of experimentation for the sake of gaining power over it. The latter, however, is to be fully subject to the human intervention in the Baconian way; it may, like all the rest of nature, be coaxed, vexed, tortured etc. in order to yield its secrets.** This part of the soul, even its substance, may be justly enquired into. And what does this part of the soul contain: The faculties of the soul are known viz. the understanding, reason, imagination, memory, appetite, will, and all those wherewith ethics and logic are concerned. In the doctrine of the soul the origin of these faculties must be physically treated (Book IV. Chapter III). Having brought all this to the level of nature and subject to the same treatment to which nature is liable to be subjected one wonders what exactly has Bacon so magnanimously left to religion.

Man, then, for all practical purposes is part of the nature over which power is to be acquired through knowledge. In fact in *Novum Organum* Bacon states clearly that most of the mental and social faculties come within the province of the method that he develops for learning about nature.

Again, some may raise this question rather than objection, whether we talk of perfecting natural philosophy alone according to our method or the other sciences also, such as logic, ethics, politics. We certainly intend to comprehend them all For we form a history and tables of invention for anger, fear, shame, and the like, and also for examples in the civil life, and the mental operations of memory, composition, division, judgement, and the rest, as well as for heat and cold, light, vegetation and the like (I.127).

Thus the search for knowledge as power is to extend over all aspects of human life. Incidentally, Bacon is not satisfied by merely stating that his method may be used for acquiring knowledge of and hence power over man. In the *Advancement of Learning* (Book VIII Chapter II) we find him giving a long recipe on the art of rising in life,

* Adv. of Learn, Bk. II. Ch. II

** It seems Bacon in his legal profession was not above personally using the rack to extort confession from prisoners under his care. (See Macaulay Op. Cit.) He at least, was consistent in his practice and precept.

where he teaches how one is to acquire power over others by knowing them: Men may be known six different ways, viz. 1. by their countenances 2. their words 3. their actions 4. their tempers 5. their ends 6. by the relation of others .

In the next chapter of the same work (Book VIII ch.III) we find a long essay ;on The Military Statesman, or a specimen of the Doctrine of Enlarging the Boundaries of Empire ; where we find him preaching fairly logically that, inter-alia, no state (may) expect any greatness of empire, unless it be immediately ready to sieze any fast occasion of war . In fact Bacon s writing in these two essays is so Machiavellian that he himself is so moved to add an apology at the end of the first of these essays that: It must be observed that the percepts we have laid down are all of them lawful, and not such immoral artifices as Machiavelli speaks of . Well the percepts laid down are all indeed lawful in the England of his time which does not make them less Machiavellian. From all these observations the conclusion is clear: Bacon s nature includes man; and when he talks of knowledge as power over nature; it also implies power over man and other nations.

The second assertion of bacon that power is for the benefit of mankind in general seems as nominal as the first that power is to be exercised over nature in Bacon s scheme of things the world is to be ruled by a small elite who has the power and the knowledge, and who works in the service of the temporal powers, preferably the King,. Common man has no place in this dispensatopm exce[t as the jewers pf wppd etc/ This is the social structure that Bacon found in his society and worked for. And this is the structure that he envisages for his scientific utopia that he sketches in the *New Allantis*: A King, a scientific elite in the service of the King and the people.* It is not obvious how the benefits of power acquired by this elite over man and nature are supposed to be the benefits for mankind, except nominally. In fact, in practice, at Bacon s time, as now, the benefits always accrued to the elite at the cost of the mankind, with the added provision that the elite was mostly white and the mankind mostly other colours. Bacon never found anything wrong in this dispensation. In fact he gloated over it.

Again let anyone but consider the immense difference between man s lives in the most polished countries of Europe and in any wild and barbarious region of he new Indies he will think it so great that man may be said to be a God unto man, not only on account of natural aid and benefits but from their comparative states the results of arts, and not of the soil or climate .(I.129).

The arts were of course the true arts of gaining power over man and nature, mostly the former in his time at least. In fact, two of the three discoveries Bacon chooses for reference in aphorism(I.129), where he declared that power over nature is better than that over man, are gun powder and compass the two objects which served no conceivable purpose of gaining power oer nature at his time, but indeed vastly increased man s power over man. In fact Bacon anticipates this objection against his ethics, and he goes on to add:

Lastly, 1st none be alarmed at the objection of the arts and sciences becoming deprived to malevolent and luxurious purposes and the like, for the same can be said of every worldly good, talent, courage, strength, beauty, riches, right itself, and the rest. Only 1st mankind regain their rights over nature, assigned to them by the gift of God, and obtain that power whose exercise will be governed by right reason and true religion (I.129).

* This threefold division of society seems an essentail ingrediant of the positive vision of society. Thus as Uberoi(Science and Culture, 1978) points out the first official postivist St.Simons envisages

It is curious that Bacon should at this point refer to right reason and true religion while he himself has hounded out all religion (except to study the inspired substance, which is to have no social or psychological reality) and almost all reason except the reason of power.

In fact, it seems that this whole ideal of Baconian science generating benefits for all mankind is a misreading of the prevalent idiom of the time of Bacon. It seems for him the mankind meant the gentry of Britain and other groups similarly placed in other societies. This was the accepted usage of the term mankind in his time. The Oxford Dictionary in earlier Editions defines gentlemen as those who were entitled to have a coat of arms, and there were 12000 gentlemen in the England of 1696.* It is these gentlemen who seem to constitute mankind of the time, and Baconian idea that science will generate power for the benefit of mankind refer to these 12000 souls.

We have now sketched almost all parts of the Baconian ethics. To summarise, the new ethics requires an unbridled search for power over man and nature and equates truth with power. It advises infinite intervention with nature and man, in the search for this truth that is power. It envisages a small group of elite scientists, who acquire this power in collaboration with the ruling elite. And for his labour and missies it offers man the hop that at some future date he shall get the benefits of this power.

This Baconian project of orienting all knowledge towards a search for power, towards control over both man and nature, and at the same time insisting that this new knowledge of control is synonymous with absolute truth, has explosive political potential. It gives the participants in this project the power to control, and the licence to use this power indiscriminately in the name of the truthfulness of the knowledge from which the power flows. It is no wonder, therefore that Francis Bacon who, as we have seen, rejoiced over the power being acquired by Europe over the rest of humanity through the use of true arts like that of the gunpowder and the compass**, also often recommended to the King various ways of expanding the empire. And in these recommendations he reminded the King that this expansion was good both for acquiring material benefits and for acquiring the honour of civilizing the barbarians through the spreading of truth and casting out of superstition***. Bacon's compatriots, even the liberals like Macaulay, who is disgusted with the morals of Lord Bacon in his personal life, continued this exercise of civilizing others with the truth they had found. The exercise in a way continues till today with the Baconian sciences and corresponding social norms making incursions into all other knowledge systems and societies. It is also not surprising that Hobbes, one-time secretary of Bacon, in Leviathan expanded Bacon's ideas in the political domain to show that no man has the right to challenge the absolute authority, the absolute truthfulness, of the existing powers, and he arrived at the logical conclusion that in a Baconian society, the virtuous man, the one who claims to know his own truth, is the most dangerous person. The new orientation, it seems, continuously worked towards reducing the freedom of men and nations.

* See for example, Gragory King: *Natural and Political Observations and Conclusions Upon the State and Condition of England*, London 1696.

** It is perhaps besides the point that these two and many other artifact that the West used for acquiring control over the rest of the world were actually discovered elsewhere. For those other people these artifacts did not have the status of the true arts and they did not therefore go about imposing their truth on others. See in this connection Needham J. Grand Titration: Allen & Unwin 1969, Ch.II.

*** See for example, Bacon's Certain considerations touching the plantation of ireland presented to His Majesty in 1605.

This union of truth with power of the good with the useful , that lies at the root of Baconian reorientation of learning is perhaps not original to Bacon. Perhaps the idea of this union belongs to the Western tradition, and Bacon only gave it a new articulation and a new life. However, it should be remembered that this idea is in no way universal to the human mind. For example, for the Indians, this union is a simple confusion between what they call *vidya* and *avidya*. Isopanishad seems to be issuing a warning against this type of confusion when it states:

*Anyadevaahuravidyaya anyadashuravidyayaa/
Itisusrumadhirranaam yenastadvicacaksire/!**

It needs to be added, that the fact that *vidya* and *avidya* are defined to be different does not mean that either of the two is neglected. Infact the two are said to be equally important for a full life, because *avidya* is what gives the knowledge for competently living in this transient world, and *vidya* is what leads to the knowledge of the absolute truth. Thus Isopanishad goes on to add

Vidyancaavidyanca yastadvedobhayamsaha/

*Avidyayaa mrtyum teertvaa vidyayaa mrtamasnute/!***

A science of the world that emerged from such clear understanding of the difference between the absolute truth and the knowledge necessary for living in the world must be quite different from the Baconian science that begins with a confusion in these two aspects of knowledge. It should be interesting to know what these other sciences that started with a diametrically opposite conception of knowledge, from that of Bacon, look like. However, a priori it can be assumed that these sciences must be no less competent than the Baconian sciences, because those who postulated the clear difference between *vidya* and *avidya* also declared that neglect of either in favour of the other leads to total darkness:

Andham tamah pravisanti ye avidyaamupasate/

*Tatobtuya Iva to tamo ya u Vidyayaam rataan/!**

What is the extent of darkness in which those who do not even know the difference between the two live?

J.K.Bajaj

* One result they say is obtained by *vidya* and quite another by *avidya*. Thus we have heard from the wise who explained it to us.

** He who understands both *vidya* and *avidya* attains to the nature of immortal through *vidya* having conquered death by *avidya*.

* Those who worship *avidya* (alone) enter into blind darkness. Into darkness still greater than that as it were ; do they enter who delight in *vidya* (alone).