THE INSTAURATION OF HUMAN DOMINION OVER NATURE IN FRANCIS BACON *NOVUM ORGANUM*

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Abstrak:

Keberhasilan Kristophorus Columbus menemukan dunia baru dengan pelayarannya sampai ke kepulauan Bahamas 1492 membuka cakrawala baru. Penemuan baru ini dimungkinkan berkat penemuan-penemuan sebelumnya dalam ilmu pengetahuan. Terobosan ini membuat orang bertanya, mengapa selama berabad-abad sebelumnya tidak terjadi penemuan baru dalam ilmu pengetahuan dan kondisi apa yang memungkinkan orang untuk menemukan hal-hal baru dalam ilmu pengetahuan. Francis Bacon (1561-1626) dalam buku *Novum Organum* menemukan bahwa ilmu pengetahuan yang diwariskan sampai saat itu tidak menghantar orang pada penemuan-penemuan baru, karena ilmu pengetahuan tersebut memiliki cacat fundamental. Bacon ingin memulai restorasi total terhadap ilmu pengetahuan. Untuk itu ia merumuskan filsafat alam yang baru yang mencoba menggabungkan rasio dan alam dengan instrumen yang baru sebagai metode ilmiah, yaitu metode induksi. Upaya restorasi total ini tidak lain adalah upaya untuk mengembalikan kemampuan manusia untuk mengontrol alam.

Keywords:

ilmu pengetahuan, kekuasaan, penemuan baru, restorasi, rasio, natur, metode induksi.

1. Introduction

The success of the voyage of Christopher Columbus (1451-1506) to the Bahamas Islands on 12 October 1492 opened a new horizon in Europe. New possibilities emerged, and what people never dreamt of, became thinkable and even possible. The discovery of the new continent, however, came as a result of some previous important discoveries, i.e. the printing machine, the gun powder and the compass. The compass was the most important tool for navigation. With it Columbus could make a voyage beyond Europe to discover a new world.

The discovery of the new continent awakened people from a long dogmatic sleep. People began to ask how new discoveries were possible. How no new discoveries were made during twenty five centuries before? Something might be wrong with

the previous knowledge that has to be corrected. If the prevailing knowledge came from the Greeks, there must be something fundamentally wrong with the Greeks' knowledge, since it led to no new discoveries. They found the Greeks' knowledge thus to be sterile, useless and even dangerous. The question went further. How can man construct new knowledge that would lead to new discoveries? What kind of new assumptions can man construct in order to lay a true foundation for knowledge? What kind of scientific method can man use in order to make knowledge fruitful for human beings?

In this occasion, I would like to present the thought of Francis Bacon (1561-1626) in *Novum Organum*. Bacon had a great ambition to renew knowledge totally. He wanted to restore human knowledge and power with the method of induction. The main question is: what does his plan of instauration mean? I will argue that the instauration of human knowledge and power is the instauration of human dominion over nature.

2. Criticism to the Traditional Philosophy

For Bacon, the prevailing knowledge is sterile for new discoveries, so that it is not useful for human beings. It came from the Greeks, especially from Aristotle. The problem was that they did not base their knowledge on nature, but rather on arguments that produced only controversies.

2.1 The Traditional Knowledge as Sterile Knowledge for New Discoveries

Bacon saw that there was no new development in science. For 2500 years there have been only three good periods in science. The first period was among the Greeks, the second was among the Romans, and the third was among the West European nations. Each period lasted only two centuries.[1] Usually they grew in the beginning, reached a climax, and then declined. Outside these periods, there were only fables and rumors of antiquity, no products that could improve the human condition.[2] The philosophy and science were consequently like statues: they were venerated but produced no positive results.[3] This meant that there was something wrong in the philosophy and science that had to be corrected.

According to Bacon, almost all sciences came from the Greeks (with some insignificant addition from the Romans and the Arabs).[4] Bacon tried to search for the source of the defect. He classified the Greek philosophers into three groups.[5] The *first* is that of the Sophists like Georgias, Protagoras, Hippias, and Polus. The *second* is that of Plato, Aristotle, Zenon, Epicure, Theophrastus, Chrysipp, Carneades and so on. The *third* is that of Empedocles, Heraclites, Democritus, Anaxagoras and Parmenides. The first and the second belong to the same group, namely the Sophists. The only difference is that the second group did not move around asking for a fee, but founded schools. The third group is the pre-Socratic philosophers and

Bacon gave them a good note. They dedicated themselves to the search for truth and the study of nature without fuss. After the arrival of Aristotle, the third group was soon forgotten. After Aristotle there was none better than him. Philosophers after Aristotle based themselves on Aristotle and searched only for a consensus around him. Aristotle monopolized philosophy and he is therefore the most dangerous among philosophers[6].

If knowledge was sterile[7], it meant that the logic was wrong too. In ordinary logic almost all efforts were concentrated on syllogism.[8] Bacon refused the results of syllogism. Through the observation of particulars using the senses and through simple enumeration, man leaped to the most general conclusion to form a major premise. After that, one formed a minor premise by means of a deduction to obtain a conclusion. This method is not adequate to obtain a good result.[9] *Firstly,* the impressions from the senses are themselves inadequate, because senses can deceive us. There are many things that cannot be perceived by senses maybe because the object is too small, too far, too fast and so on.[10] *Secondly,* notions are poorly abstracted from sense impressions so that man cannot define them exactly (for example, the notion of heat, cold, weight and so on is different from one man to another). *Thirdly,* the method is too poor if it is based only on simple enumeration without the use of exclusions and proper analyses of nature. *Fourthly,* the method of discovery, which first sets up the most general principles, and then compares and tests the intermediate axioms with these general principles, is the mother of errors. Bacon said that logic is good only to correct errors and to achieve assent without reference to things, but not to find the truth. So, it is useless and even dangerous.[11]

2.2. The Neglect of Natural Philosophy as the Cause of the Sterility of Knowledge

Bacon said that the most important cause of the sterility of knowledge is the neglect of natural philosophy.[12] The neglect can be explained in three matters that are connected to each other: 1) man venerated the power of human mind too high, 2) man forgot nature as the foundation of knowledge, and 3) man did not seek for the right instrument to unite the human mind and nature.

Firstly, man venerated the power of human mind too high. Aristotle defined man as a rational animal.[13] Man used the mind to build knowledge without developing an adequate critique of the human mind itself, ignoring therefore the fact that the mind itself can be the source of its own errors. The mind can be blocked by illusions that impede man to know the truth as it is. Man has to purge the mind totally, before the mind can receive the rays of the truth.[14] Bacon called these illusions "idols".

Secondly, man abandoned the notion that nature should be the foundation of knowledge. Instead, man used opinions and arguments from a few people, especially from Aristotle, to construct knowledge. Human opinions are subjected

to continuous change. If man uses opinions as foundation of knowledge, the results are words, controversies, various schools of philosophy, and so on, without fruitful results. Knowledge that is based on opinions can change, but not grow. Knowledge that is based on nature grows as in mechanics though slowly.[15]

Thirdly, man did not search for the right instrument to unite the human mind and nature. One used syllogism from the classical logic that is not adequate for this purpose. Besides that, man used profitable experiments for purposes other than the advancement of knowledge (e.g. to get fame), and did not use illuminating experiments that can lead to true axioms. It is time to build the right instrument to aid the senses and mind in experimentations.

For Bacon, natural philosophy is the great mother of all sciences. If natural philosophy is uprooted from sciences, there would be no improvement in sciences. There would be more verbal disputations in the development of new dogmas. All of this brought no good fruits to improve the human condition.[16] Man has to build a pure natural philosophy.[17]

3. The Theory of Idols

There are tendencies of the human mind that hinder us in coming to know the truth. Bacon called them idols. They are like diseases of the human mind, and must be purged totally, before we can begin with the true logical process. The new logic cannot simply replace these bad tendencies of the human mind.[18] The impurity of our own mind is the source of all errors. "Nature itself does not lie"[19]. Purifying our mind prepares us to receive the eternal light of nature. Bacon identified four kinds of idols as follows.[20]

3.1 Idols of the tribe *(Idola Tribus)*

The idols of the tribe derive from human nature itself and affect everyone equally in every tribe and race. Bacon mentioned six manifestations. 1) Man tends to believe that there is more order and regularity in nature than what there actually is. 2) Man tends to abandon those examples which contradict the theory he holds as true, and tends to justify the examples that support his beliefs. 3) Man tends to expand to other subjects a theory that he received once so impressively. 4) Man tends to be unsatisfied with a good explanation, and therefore continues to search for other explanation *ad infinitum* outside of what man has already received. 5) The human understanding is subjected to the influence of the will and emotion. Man prefers to believe what he would like to be true, and tends to refuse something difficult to understand, because he has no patience for a careful investigation. 6) Man tends to make abstractions from something, although he would do better to focus more on the matter itself.

3.2 Idols of the Cave *(Idola Specus)*

The idols of the cave are illusions of the individual man. Because of the difference in education, social life, culture and so on, each man has a kind of individual appetite, which fragments and distorts the truth. There are at least three examples. 1) If man is interested in one subject, he tends to apply it to all other subjects. 2) There are some people who are interested only in the differences between things, while some others are only interested in their similarities. 3) There are some people who are interested only in investigating things in microscopic level, while others prefer to macroscopic one.

3.3 Idols of the Marketplace *(Idola Fori)*

The idols of the marketplace emerge from the interaction with other people by means of language that has systematic deficiencies. People think they control words and names, while we in fact still only debate about the meaning of words. There are two linguistic defects. 1) Language contains words that refer to things that do not exist, like fortune, prime mover, planetary orbits, element of fire and other words that come from idle theories. To overcome this problem, man has to reject the idle theories that have created these words. 2) Other defect comes from the words that have complex meanings, that are not well defined and that are abstracted simply from experiments, like humid, heavy, light, rare, dense and so on. These qualitative words contain different meanings in different circumstances.

3.4 Idols of the theatre *(Idola Theatri)*

The idols of the theatre come from various philosophical dogmas that people hold. All of these philosophies are like theater plays, in which various people play and create fictitious and erroneous worlds. Bacon found that there were three philosophies that lied at the source of the illusion, namely the sophistic, empirical and superstitious philosophy. 1) Bacon defined the Greek philosophers as being *sophistic*: Aristotle spoils natural philosophy with his dialectic; Leucippus and Democritus make theory of atoms; Parmenides makes a story about the earth and heaven; and Empedocles speaks about friendship and so on. 2) The *empiricists* created more deformed dogmas than sophists because they did not base themselves on common notions, but on limited experiments. From these premature experiments they then leaped to general principles. 3) Many people made from *superstitious* philosophy a natural philosophy on the basis of Genesis, the Book of Job, or other sacred Scriptures.

Here Bacon ended *pars destruens* and he began with *pars construens* for his project of great instauration.

4. The Instauration of Human Knowledge and Power

The true end of knowledge is for the use and benefit of life, and to improve it in charity.[21] Bacon's direction is works and not arguments. For this purpose he formulated a new conception of natural philosophy as *the inquiry of causes and the production of effects, speculative and operative* (De Augmentis III, 3). So, all true and fruitful natural philosophy has a double scale or ladder, ascendant and descendant, ascending from experiments to axioms, and descending from axioms to the invention of new experiments.[22]

Bacon planned the great instauration in six parts:[23] (1) The Divisions of the Sciences, (2) The New Organon, or Directions concerning the Interpretation of Nature, (3) The Phenomenon of the Universe, or a Natural and Experimental History for the foundation of Philosophy, (4) The Ladder of the Intellect, (5) The Forerunners, or Anticipation, of the New Philosophy, and (6) The New Philosophy, or Active Science. He constructed new assumptions as basis for his projects. I will try to formulate some of them.

4.1 Uniting the Human Mind and Nature with a New Instrument

Bacon saw that there were two competing ideas. On the one hand, Bacon identified two ways of thinking in science, namely rationalism and empiricism. [24] *The rationalists* believed only in the power of the human mind and used it to arrive at the truth and to build knowledge. Bacon said that the human mind is defective, because the idols prevent it from arriving at the truth. Bacon's criticism of the Greek philosophers is criticism of the unproportionate use of the human mind. As a result they produced only words, controversies and unproductive knowledge. *The empiricists* believe only in the senses and used their senses as the only tool in their experiments to arrive at the truth. Bacon rejected the sole use of senses because 1) senses are themselves defective and deceive, and 2) the subtlety of nature is greater than what can be perceived by the senses alone.

On the other hand, there was another way of thinking, namely skepticisms. *The skeptics* refuse both the mind and the senses, because there is nothing that can be known. Bacon rejected skepticism and said that we cannot know a lot of things if we use the prevailing scientific method. The human mind and senses are, of course, defective if they are left alone without a true aid. Bacon underlined the use of the human mind and senses and offered a true instrument to aid them.[25]

Bacon compared the empiricists to ants, because they simply accumulate and use. The rationalists are like spiders, because they spin webs from themselves. Bacon took the way of the bees, which is namely in between, in that bees take the materials from flowers in gardens or fields, but also have a capacity to convert and digest these materials. We cannot improve our knowledge if we use only our mental power without materials from nature, or if we use only nature without human mind.

Man has to search for knowledge from the light of nature, not from the darkness of antiquity.[26] So, we can only improve knowledge if we unite the human mind and nature with a true instrument. Bacon regarded it as a true and lawful marriage between the mind and nature.[27] The separation between the mind and nature lead only to the misery and poverty of human beings.

3.2 Human being as the Servant and Interpreter of Nature

Aristotle defined human being as a rational (*differentia specifica*) animal (*genus proximum*).[28] Human being was compared, grouped with and defined in contradistinction to other creatures that were lower than human being itself. Thus Aristotle defined human being as animal with a particular difference, namely rationality. As a result, human being is a part of nature. If nature is the *cosmos* with a certain natural order and knowledge should follow the order of nature, there could be no new things possible in nature.

Bacon introduced a new conception of human being. "Human being is the servant and interpreter of nature. He does and understands only as much as he has observed of the order of nature in work or by inference. He does not know and cannot do more. No strength exists that can interrupt or break the chain of causes. And nature is conquered only by obedience".[29]

For Bacon, we are not the children of nature, but superior creatures.[30] Bacon referred to the human condition before the Fall in Genesis.[31] At that time, man had power over nature, so that he could name every creature with their own names. After the Fall, nature was corrupted too. As a result, nature cannot be the model and man should not imitate it. Man has to conquer it in order to be able to use it and work with it for his ends. If nature reveals herself more through the manipulation by the human arts than in her own proper freedom,[32] man has to use a true instrument to take control over nature again.

4.3 Theory of Matter

It is not enough to use only mathematical patterns to approach nature, because we analyze nature only at the periphery. The most important is to comprehend the behavior of nature in her fundamental substances and through this to learn how we can manipulate nature. Here Bacon laid down his thoughts on the theory of matter.

Like Aristotle, Bacon constructed his natural philosophy based on a certain theory of matter. In Aristotle, we cannot identify natural potentialities and tendencies in matter as something material. Bacon believed that natural potentialities and tendencies happened both at the microscopic level in a way that can be identified physically or from the interaction at the macroscopic level like squeezing, stretching, contraction, dilation, distension. For Bacon, but not for Aristotle, the causes of material processes are themselves material. There is no difference in kind between

the causes and their effects.[33] If all configurations turn out to be reducible to matter only, they are manipulable in and through matter.[34] The presupposition is very important to understand the Baconian forms.

The fundamental result is that we should use a method that can help us to find the natural potentialities and tendencies of matter from the general phenomena in nature, and use this method to create new phenomena aimed towards manipulating nature. With this, Bacon separated the autonomy of natural philosophy from theological concerns.[35]

4.4 Human Knowledge and Power

The cause of the sterility of traditional knowledge is that they searched only for profitable experiments, and not for illuminating experiments.[36] Illuminating experiments are experiments that can lead us to the discovery of true causes and axioms from every kind of experience. Once axioms have been rightly discovered and rightly formulated, they offer massive assistance to practice. For this purpose, Bacon formulated the end of his project of great instauration.

4.4.1 The End of Human Knowledge is to Find Forms

Bacon said that "the task and purpose of human science is to find for a given nature its Form, or true difference, or causative nature or the source of its emanation. The subordinate task and purpose of this is the discovery, in every generation and motion, of the *latent process* from the manifest efficient cause and the observable matter to the acquired form; and similarly, the discovery, in bodies at rest and not in motion, of the *latent schematism*".[37]

In this respect, Bacon is on the same line with the Aristotelian tradition that "to know truly is to know through causes". Bacon said that it is maybe useful to use the four Aristotelian causes, namely the material cause, the efficient cause, the formal cause, and the final cause.[38] Applied to a chair we can say that the material cause is wood, the efficient cause is the carpenter, the formal cause is the form of the chair (for example a folding chair), and the final cause is the motivation to make the chair (for example to be sold and to get money). Bacon said that the final cause is not useful for knowledge, and can even distort us, except in the case of human actions. The efficient and material cause is too superficial and has no meaning for knowledge. What remains is the formal cause.

To comprehend the meaning of forms, it is useful to analyze two Baconian terms, namely *schematismus latentis* and *processus latentis*.[39] *Firstly* we need to find the *schematismus latentis* or the combination of the simple natures of a thing. For example, the simple natures of gold are: "it is yellow, it is heavy with a certain weight, it is malleable or ductile to a certain degree, it is not volatile, and loses none of its quantity in fire, it melts with a certain fluidity, it is separated and dissolved in certain ways"

and so on. Whoever can unite these elements in a body, he can produce gold. We can use the same method in order to multiply other things. We can use the method only for things that have a constant, eternal and universal element in nature.

Secondly, we use a method not by finding simple natures, but by finding the *latent process* in concrete bodies as they are found in nature.[40] The latent process is not the actual measures, signs or stages of a process which are visible in bodies, but a wholly continuous process which for the most part escapes the senses. We need to analyze "what is lost and disappears, what remains and what accrues, what expands and what contracts, what is combined, what is separated, what is continuous, what is interrupted, what impels, what obstructs, what prevails, what submits and so on". Every natural action happens by means of the smallest particles, or at least by things too small to make an impression on the senses.

In other words, *schematismus latentis* is the structure of a thing, the essence of a natural phenomenon, and *processus latentis* is the law that governs the generation and production of a phenomenon. "Forms are the laws and limitations of pure act which organize and constitute a simple nature, like heat, light, or weight, in every kind of susceptible material and subject".[41] To comprehend form is to comprehend *the structure* of a natural phenomenon and *the law* that governs the process.[42] From this perception we can see that there are constant and dynamic elements in form and both elements are found in Baconian matter.

Form is always simple and fixed.[43] Form cannot be separated from matter. "It is always present when the nature is present; it is always absent when that nature is absent".[44] It is helpful to make a complete analysis and separation of a nature by the mind. The more the direction is toward simple nature, the more everything is transparent. "The procedure is from the multiple to the simple, from the incommensurable to the commensurable, from the random to the calculable, from the infinite and undefined to the definite and certain. Natural inquiry succeeds best when the physical ends in the mathematical".[45] As far as possible all things should be described in both natural bodies and natural powers,[46] namely numbered, weighed, measured and determined, because the plan is works and not speculations.[47] Bacon rejected, however, atomism, because an atom is an empty and unmoving matter.[48]

Whoever comprehends forms comprehends the unity of nature in its different materials, so that he can uncover things which have never been uncovered.[49] To comprehend forms is not an end itself, but a necessary condition to arrive at the next step.

4.4.2 The End of Human Power is to Create a New Reality

To comprehend forms is a means towards the transformation and creation of new nature for human purposes. Here Bacon formulated it as human power. "The task and purpose of human power is to generate and superinduce on a given body a

new nature or new natures. The subordinate purpose is to transform concrete bodies from one thing into another within the bounds of the *possible*".[50] "In nature nothing exists besides individual bodies, performing pure individual acts according to a fixed law."

If we can comprehend the form of a nature properly, we can comprehend the unity of that nature in the most fundamental way, so that we can create a new thing that has never existed before. Forms are both a necessary and a sufficient condition to create new effects. So, to comprehend forms brings us to "true thought and free operation".[51] Bacon used an analogy between alphabetical letters and words or sentences. The letters in themselves are not useful, but they are necessary in order to create new words or sentences[52]. By comprehending forms, we can re-write the book of nature. So, to comprehend forms means to penetrate into the most secret part of nature and to gain thus the power over nature.[53] As a result, knowledge becomes operative.

The Baconian form is different from the substantial form of the Aristotelian-Scholastic tradition.[54] In the Aristotelian-Scholastic tradition, substantial form gives existence to a body. Bacon formulated it differently. In the definition of *heat*, Bacon did not used the normal term for heat. Instead of using "calidum", Bacon used "calor". *Calidum* refers more to an object (heat) that can be perceived or detected by the senses, while *calor* refers more to the unity between particle and motion independent of the perception of senses. This is why Bacon did not mention that "heat (*calor*) generates motion or motion generates heat (*calor*), but that the essence of heat (*calor*) is motion itself and nothing else".[55] The substantial form of the Aristotelian-Scholastic tradition is more subjected to the senses and the order of its contents, while the Baconian form is a purely intellectual construct. The observer has not only to use his senses (it is not enough), but also has to build a certain analogy. So, the Baconian form has an ontological priority in its essence to the Aristotelian-Scholastic form.[56]

Furthermore the difference between the Aristotelian-Scholastic form and the Baconian form can also be conceived by raising two questions: 1) what is the world made of? and 2) what is the general process by which change occurs? In the Aristotelian-Scholastic tradition, the answer is 1) prime matter and substantial form, and 2) the replacement of one substantial form by another. Bacon said that in nature nothing exists besides individual bodies performing pure individual acts according to a fixed law. So, in the Baconian form, there are two elements: matter as a permanent element and motion as a dynamic element. So, the process towards change can already be indicated in the dynamic element of the form itself. A new creation of something that did not exist and had no prototype and the manipulation of nature are all possible on the basis of the dynamic element of the form itself. We can create a *novum* in a very different way to the Aristotelian-Scholastic tradition.[57] The Baconian shifting concept of matter and form itself is a scientific revolution.[58]

The direction of interpretation of nature is not linear, but up (to the axioms) and down (to the effects). *Firstly*, we formulate axioms based on our experiments. *Secondly*, we deduce from these axioms towards new experiments to create a new reality.[59] The capacity to interpret nature in the most fundamental way and to change a reality into a new one for the human purpose is the human power.

4.4.3 The Instauration of Human Dominion over Nature

Bacon used his biblical understanding from Genesis as the foundation of his argument, of how we can make the instauration. "By the Fall, man declined from the state of innocence and from his kingdom over the creatures. Both things can be repaired: the former by religion and faith, and the latter by the sciences".[60] By true knowledge, human being has to recover his dominion over nature. Before the Fall man had the capacity to name all other creatures with their own names and commanded them (Gen 2:19-20). True knowledge can be an instrument for the human being to reach the biblical promise of the dominion over the creation.

For hundred centuries human being has been crippled by a system of thought that impeded to reach the promised good. For Bacon, Aristotelianism was not effective, and will remain so. Bacon used the Bible to refute the Greeks. He saw them as a clear example of the sin of pride, the occasion of the fall, and thought they were therefore cursed with barrenness.

Bacon formulated the true ends of knowledge as "not to seek it for amusement or for dispute, or to look down on others, or for profit or for fame or for power or any such inferior ends, but for the uses and benefits of life, and to improve and conduct it in charity".[61] In religion, faith is shown by works, and it is also true in philosophy. If philosophy is sterile, it is useless.[62] There are two commandments: to worship God and to love your neighbor. To love your neighbor means to do good things actively for the neighbor, and not to quarrel with their opinions in arguments and words. Knowledge is the effective way to fulfill the law of charity. These ends can be effectively achieved through the instauration of human knowledge and power over nature.[63] In other words, the instauration of human knowledge and power is nothing else than the instauration of human dominion over nature.[64]

4.4.4 The Method of Induction as the New Instrument *(Novum Organum)* of Knowledge

There is a need for a total reconstruction of the sciences, arts, and all human knowledge, raised upon the proper foundation. How could we achieve this goal? Bacon said that his method of induction is the instrument to achieve this goal. The method operates in two ways: to formulate axioms from experiments and to deduce these axioms that would lead to new experiments and results. Bacon did not intend to dethrone the prevailing philosophy,[65] but to offer a new instrument (*novum organum*,

the old one is the *Organon* from Aristotle) for new discoveries in sciences. With this instrument, Bacon united the human mind with nature. The purpose was to aid the senses and the mind in experiments. With this method, man collected particulars, made exclusions and rejections, and then moved ahead slowly to formulate axioms, until one reached the most general axiom at the end in an affirmative statement. From this point, man could deduce the axiom in the new experiments.[66] Bacon claimed that no one has ever used this method.[67]

4.5 Two Further Consequences

4.5.1 *Verum Factum*

In a certain way, one may argue that Bacon is on the same line with the Aristotelian-Scholastic tradition in maintaining that the epistemological guarantee of knowledge is knowledge by causes or *vere scire est per causas scire*.[68] But it is not enough for Bacon. From the beginning, Baconian direction is towards works, towards activities, and towards creating new realities, and not just towards a contemplative position. Bacon introduced a new criterion: *vere scire est (per causas) producere posse*.[69] Knowledge means not only the bare capacity to make, but also the capacity to understand a reliable procedure for making. I know x because I make or am able to make x, y, or z. To know something means to make or to be able to make something (*verum factum*).[70] The criterion of the credibility of knowledge becomes a praxiology. Knowledge becomes practical too, because it begins with particulars (towards axioms), and (from axioms) ends with new particulars.[71]

In *Valerius Terminus 12*, Bacon confirmed that "the discovery of new works and active directions not known before is the only trial to be accepted". The question is not only whether knowledge is profitable or not, but also whether it is true or not. "Not because you may always conclude that the axiom which discovereth new instances be true, but contrariwise you may safely conclude that if it discovers not any new instance it is in vain and untrue".[72] So, the criterion of the truthfulness of knowledge is no longer the antiquity, the authority, the common notions, the natural consent of the mind, the coherence of knowledge in itself, or the report of senses and so on. In this context, Bacon stated that truth is the daughter of time, and not of intelligence or authority, and it is the birth of time.[73] It means that through knowledge man can achieve more improvement than the antiquity could achieve. Truth and usefulness are the very same things.[74] So, *vita activa* has a priority to *vita contemplativa* and *negotium* to *otium*.

4.5.2 *The Public Character of Knowledge*

Bacon planned his project not as an argument or opinion but as a work for human progress and empowerment[75] and he claimed that his method can be applied to all knowledge: Logic, Ethics and Politics.[76] Knowledge brings moral mission for the goodness of human being. So, knowledge should have a public character,

so that every person may have access to it (It is different from the magicians who have only esoteric and elitist knowledge. They called themselves *illuminati*). Bacon claimed that people with normal intelligence can access and use knowledge that he introduced.[77]

The project of the great instauration should be handled by the highest political authority, namely the king, because it is the project for the development of all human beings, it needs huge financial support, the support from all the universities, the blessing from the church, and the support of other institutes.[78] It is not only a new chapter that has to be added into the book of knowledge, but the inauguration of a new way of life, the great instauration of man's dominion over the universe.

Furthermore, Bacon's claim that *knowledge is power* should be interpreted as a claim about power, about something practical and useful. It is a claim about the role of knowledge in political power, which man had never recognized the role of knowledge in power before. So, the political model should be not Plato, but Machiavelli.[79]

5. Conclusion

How can we make new discoveries based on our knowledge and what does the Baconian instauration (or renewal) mean? After rejecting the traditional knowledge because of its inability to lead to new discoveries, he warned us to liberate our mind from the illusions that can hinder us to arrive at the truth. Bacon constructed a new natural philosophy that united the human mind and nature and introduced a new instrument that would lead to new discoveries. Natural philosophy is defined as the inquiry of causes and the production of effects. The inquiry of causes is the purpose of human knowledge, and the production of effects is the purpose of the human power. Cause and effect are close to one another.

The possibility to create new discoveries is already found in the dynamic conception of form and matter. To know the form of a nature is to know both the structure and the law that govern the process. To know the form is to know the structure of a nature in the most fundamental way and to know how to create a new nature. To know the form is to know nature in very different way, so that we have freedom to create new natures. A true method of inquiry should help our senses and mind to know the form and to create new discoveries. The step is from particulars to an axiom and from an axiom to new particulars. This method of inquiry allows us to transcend our natural deficiencies. The method of induction is the new instrument of knowledge.

He wanted to replace the traditional instrument (*Organon* from Aristotle) with new instrument (*Novum Organum*). With this new instrument, Bacon wanted to restore human knowledge and power to the condition before the Fall of man. At that time, man had a true knowledge over the universe, so that he could name

other creatures with their own names and commanded them. So, the instauration of human knowledge and power is nothing else than the instauration of human dominion over nature.

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Catatan akhir:

[1] Francis Bacon, *Neues Organon, Teilband I & II, Lateinisch-Deutsch*, Book I: 78-79. Successively, I will use the following method. For example, NO (Neues Organon) I: 19 refers to the first book of *Neues Organon* on Aphorism number 19. NO II: 5 refers to the second book of *Neues Organon* on Aphorism number 5. When there is no Roman number, it refers to the page of the first book. For example, NO 27 refers to the first book of *Neues Organon* on page 27.

[2] NO I: 72.

[3] "Philosophia contra et scientiae intellectuales, statuarum more, adorantur et celebrantur, sed non promoventur." NO 16.

[4] NO I: 71.

[5] S. Gaukroger, Francis Bacon and the Transformation of early-Modern Philosophy, 113.

[6] Farrington noted that, in *Student's Prayer*, Bacon criticized Plato as figments of the brain, Aristotle as shadows thrown by words, Scholasticism as adulterated religion, and the various Renaissance philosophies as stage-play. B. Farrington, *The Philosophy of Francis Bacon*, 19.

[7] Bacon criticized the other prevailing scientific fields as well. He wrote that he did not know whether the alchemists and magicians deserved to received laughter or tears. If *the alchemists* did not succeed in experiments, they felt that it was due to their own mistake. They accused themselves in thinking that they did not understand the authors properly. They studied the background and the tradition again and repeated the same experiment *ad infinitum*. In *natural magic*, they used idle and lazy conjectures; and they used superstitious arts for surprise but not for usefulness. *The chemists* achieved some results although the results came more from chance and incidental experiments than from a good theory. In *medicine*, Bacon cited Celcus who said that man first discovered medicine, and after that philosophized about the causes, but not otherwise, namely by discovering medicine because man used a certain philosophy or science. NO I: 73, 85. If the prevailing knowledge came from the Greeks, they are not only intellectually but also morally wrong. Bacon did not mention the error of each philosopher. All of them are judged by their products and progress. The discovery of products is the warranty of the truth of a philosophy.

[8] NO 43-45. "In logica enim vulgari opera vere universa circa Syllogismum consumitur." NO 42.

[9] NO I: 69.

[10] NO 47.

[11] NO I: 12-13.

[12] NO I: 78-80.

[13] G. Reale and D. Antiseri, Filosofia e Pedagogia dale Origini ad Oggi, vol. I, 151.

[14] Bacon cited Mat 18:3. "Assuredly, I say to you, unless you are converted and become as little children, you will by no means enter the kingdom of heaven." There is only one entrance to the kingdom of heaven, so there is only one entrance to the kingdom of knowledge. NO I: 68.

[15] NO I: 74.

[16] NO I: 78-79. There was no good natural philosophy that could bring the problem to light. Natural philosophy in the Aristotelian school was contaminated and corrupted by logic, in Plato's school by natural theology, and in Plato's second school by mathematics. Beside that, the Aristotelian thought corrupted Christian doctrines with metaphysics and science with logic, which were fertile in arguments

but barren as useful arts. The idealistic thought of Plato was a hindrance for science, because it moved man's attention away from observations. Natural philosophy faced strong adversaries from superstition and the blind zeal of religion. In *Summaries* and *Methodical Treatises*, the scholastic theologians reduced theology to order and formed a mixture between Aristotelian philosophy and religion. They mixed human things with divine ones, so that religion became an adulterated religion. The situation became worse because there was no separation between science and theology.

[17] NO I: 96. To illustrate the problem, Bacon show how the two different approaches would search for the truth. The first would be the traditional method with syllogism. Bacon called it *the anticipation of nature (anticipatio naturae)*. The second would be the new method from Bacon, namely the method of induction. He called it *the interpretation of nature (interpretatio naturae)* (NO I: 26). Both began with particulars. In *the anticipation,* axioms formed on the basis of arguments showed themselves to be useless for new discoveries, because the subtlety of nature is far greater than argumentations (NO I: 24). *Anticipation* is really good and strong enough to achieve agreement and consent, but not to make new discoveries. Popper said that the use of the translation „interpretation" could be misunderstood. In modern sense, „interpretation" means something very subjective and relativistic. "Interpretatio" may be better understood as "the reading, or better, the spelling out of the book of Nature." Galileo wrote "that great book which lies before our eyes-I mean the universe." K. R. Popper, *Conjectures and Refutations*, p. 13.

[18] Gaukroger noted that Bacon proceeded in a different way from the late Scholastic philosophers. They believed that there is a common remedy to overcome the weakness of the mind. For example, Raphael Aversa in *Logika* said that logic remedies the natural weakness of the mind. Descartes said in *Meditationes* that we can treat those things which are uncertain as if they were false, in order that we might identify something indubitable. Descartes generalized all roots of mistakes without making classifications. S. Gaukroger, *Francis Bacon and the Transformation of early-Modern Philosophy*, 120-122.

[19] This purification is a condition for science. It is almost a ritual that the scientist has to undergo before he is ready to embark on any scientific study. It is analogous to the mystic's purification to prepare for the vision of God. K. R. Popper, *The Logic of Scientific Discovery*, 279.

[20] NO I: 39-66.

[21] NO 33.

[22] "Doctrina de Natura: inquisitionem Causarum et productionem Effectuum, speculativam et operativam". "Omnis solida et fructuosa Naturalis Philosophia deplicem adhibeat scalam, eamque diversam, Ascensoriam et Descensoriam, ab Experientia ad Axiomata, et ab Axiomatibus ad nova Inventa". De Augmentis Scientiarum III, 3 in Francis Bacon, vol I, Edited by J. Spedding et al, 547.

[23] NO 37. Of these six parts of the plan, Bacon could only finish the first part in totality. He finished the most of the second and third parts. *Novum Organum* belongs to the second part. This book is far from complete because he wrote it in a hurry. He said that the reason for this was not one of ambition, but "if in the human way of things, anything should happen to him, there would still be extant an outline and plan of the thing which he had conceived in his mind" NO 7.

[24] NO I: 95.

[25] NO I: 37.

[26] B. Farrington, The Philosophy of Francis Bacon, 48.

[27] NO 31, 51.

[28] G. Reale, Filosofia e Pedagogia dale Origini ad Oggi, 1 & 2, vol I, 151.

[29] "Homo enim naturae minister et interpres tantum facit et intelligit, quantum de naturae ordine, opera vel mente, observaverit: nec amplius scit, aut potest. Neque enim ullae vires causarum catenam solvere aut perfringere possint, neque natura aliter quam parendo vincitur". NO 64, I: 1.

[30] B. Farrington, The Philosophy of Francis Bacon , 28.

[31] NO 33, II: 52.

[32] NO 57.

[33] B. Farrington, The Philosophy of Francis Bacon, 94.

[34] A. Perez-Ramos, Francis Bacon's Idea of Science, 97.

[35] B. Farrington, The Philosophy of Francis Bacon, 95.

[36] Bacon referred to the method of God who on the first day created only light and dedicated the whole day only to it. God created other materials in the following days. NO 23-25, I: 70, 83, 99, and 121.

[37] "Datae autem naturae Formam, sive differentiam veram, sive naturam naturantem, sive fontem emanationis invenire, opus et intentio est humanae Scientiae." The subordinate task and purpose of this is: "inventio in omni generatione et motu latentis processus, continuati ab Efficiente manifesto et material manifesta usque ad Formam inditam; et inventio similiter latentis schematismi corporum quiescentium et non in motu." NO II: 1.

[38] NO II: 2.

[39] NO II: 5-7.

[40] NO II: 5.

[41] NO II: 18.

[42] G. Reale, Filosofia e Pedagogia dale Origini ad Oggi, 1 & 2, vol. II, 218.

[43] F. H. Anderson, *Francis Bacon*, 304.

[44] NO II: 4.

[45] NO II: 8.

[46] Bacon mentioned natural powers as dense, rare, hot, cold, solid, liquid, heavy, light and so on. NO 57.

[47] "Illud insuper praecipimus, ut omnia in naturalibus tam corporibus quam virtutibus (quantum fiere potest) numerate, appensa, dimensa, determinate proponantur. Opera enim meditamur, non speculationes." Parasceve ad Historiam Naturalem et Experimentalem, VII, in J. Spedding et al., Francis Bacon, vol. I , 400.

[48] "Neque propterea res deducetur ad Atomum, qui praesupponit Vacuum et materiam non fluxam, sed ad particulas versa, quales inveniuntur." NO II: 8.

[49] NO II: 3.

[50] "Super datum corpus novam naturam sive novas naturas generare et superinducere, opus et intention est humanae Potentiae." The subordinate purpose is: "transformation corporum concretorum de alio in aliud, intra terminus Possibilis." NO II: 1.

[51] NO II: 3.

[52] "Sed ita prorsus se habeant illa ad res et opera quemadmodum literae alphabeti se habeant ad orationem et verba; quae licet per se inutiles eaedem tamen omnis sermonis elementa sunt." NO 56.

[53] G. Reale, Filosofia e Pedagogia dale Origini ad Oggi, 1 & 2, vol. II, 217.

[54] A. Perez-Ramos, Francis Bacon's Idea of Science, 95.

[55] „Non quod calor generet motum, aut quod motus generet calorem; sed quod ipsissimus Calor, sive quid ipsum Caloris, sit Motus et nihil aliud." NO II:20.

[56] A. Perez-Ramos, Francis Bacon's Idea of Science, 96.

[57] Nicholas Cusa 1401-1464 said that man is *alter deus* who participates in the process of creation by God with mathematical knowledge.

[58] A. Perez-Ramos, Francis Bacon's Idea of Science, 97.

[59] Bacon gave three examples of discovery: printing, gun powder, and the compass. The force, power and consequences of discoveries are not recognized by the ancients. NO I:129.

[60] NO II: 52.

[61] NO 33.

[62] NO I: 73.

[63] Compare to J. Martin, Francis Bacon, the State, and the Reform of Natural Philosophy, 141.

[64] Compare to NO 41, 77, I: 117.

[65] NO 75.

[66] In the second part of *Novum Organum,* Bacon gave an example of the method of induction and took *heat* as an object of experiment. His steps are as follows. *The first* is to establish a table of presence (*tabula*

praesentiae). *The second* is to establish a table of absence (*tabula declinationis sive absentiae in proximo*). *The third* is to establish a table of degrees or comparison (*tavola graduum*). After that, the true induction can be applied. The road to the true induction is the rejection or exclusion of the contradictive elements from the three tables. The human being should proceed in a negative way and should make his affirmation only at the end. Only God himself or the angels have direct knowledge of forms by affirmation. On *latent process* and *latent schematismus*, Bacon reminded us that what we search for is forms, namely those laws and limitations of pure act which organize and constitute a simple nature. From the three tables, we should make exclusions or rejections of nature that do not belong to the form of heat. It is very important to confirm that "every contradictory instance destroys a conjecture about a form". Therefore there could be no contradictory instance. After clearing all ambiguities, Bacon described four *examples of differences* in order to define motion as the form of heat. The method proceeds toward a preliminary hypothesis of heat. *"Heat (*calor*) is an expansive motion which is checked and struggling through the particles. While expanding in all directions, it has some tendency to rise. It is not completely sluggish, but excited and with some force"*. From this, we can put it in a different way: *"If in any natural body you can arouse a motion to dilate or expand, and if you can check that motion and turn it back on itself, so that the dilation does not proceed equally but partly succeeds and is partly checked, you will certainly generate heat* (calidum)*"*. NO II: 20. It can be applied in every condition with no exception. After that, Bacon mentioned 9 other aids to the intellect and senses: *prerogative instances, supports for induction, the refinement of induction, investigation to the nature of the subject, natures which are privileged, limits of investigation, deduction to practice, preparations for investigation,* and *ascending and descending scale of axioms*.

[67] NO I: 19.

[68] A. Perez-Ramos, Francis Bacon's Idea of Science, 118.

[69] A. Perez-Ramos, Francis Bacon's Idea of Science, 149.

[70] In Descartes, the goal of knowledge is more to understand the machine of the world. *Opus* is not hermeneutically significant in Cartesian natural inquiry. A. Perez-Ramos, *Francis Bacon's Idea of Science*, 152.

[71] NO I: 24.

[72] Valerius Terminus, 12, in J. Spedding et al., Francis Bacon vol III, 242.

[73] NO 9, I: 78, 84, and 122.

[74] NO I: 64.

[75] NO 35.

[76] NO I: 127.

[77] NO I: 117, 130.

[78] It was already in 1592 and 1594 that Bacon proposed a project to the Queen Elisabeth: a research Library, a botanical garden and zoo, a museum, not primarily of natural objects but of inventions, and lastly a laboratory. Such was the program of the would-be Minister for Science and Technology. B. Farrington, *The Philosophy of Francis Bacon*, 15.

[79] S. Gaukroger, *Francis Bacon and the Transformation of early-Modern Philosophy*, p. 17. Later, J. Habermas wrote a critique to technique and knowledge as ideology in *Technik und Wissenschaft als Ideologie*, Frankfurt a.M.: Suhrkamp, 1968.

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