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Rise of Empiricism

Aristotle, Locke, Berkeley, Hume

Michael Sidiropoulos, MEng

The scientific method and discovery is probably quite a bit older than Aristotle but the great Greek philosopher provides the first known paradigm in history of what we now call the *scientific method*. According to the Encyclopedia Britannica, Aristotle was the first genuine scientist in history and every scientist is in his debt.

Born in 384 BC in Stagira, 55 miles east of the port city of Thessaloniki, Aristotle is the greatest polymath of all time. His writings span the widest spectrum of human knowledge imaginable. Biology, zoology, physics, geography, astronomy, metaphysics, logic, ethics, aesthetics, poetry, theater, music. Have we left anything out? Oh yes, linguistics, rhetoric, politics, government.

When Aristotle was a youth, his father Nicomachus died and Aristotle was raised by a guardian until the age of eighteen when he joined Plato's Academy in Athens. The Academy was a school of philosophy founded by Plato, where no doctrines were taught but problems were posed to be studied and solved by the students. The atmosphere at the Academy was unusually liberal by ancient standards. There was no clearly defined academic curriculum and no clear distinction between teachers and students. Can you think of any kids today who wouldn't want to be in a school like Plato's?

The words "academy" and "academic" that are so common in our everyday language have their roots in Plato's Academy, which was named after Academus, a legendary hero in Greek mythology. Plato's academy created the ideal learning environment where a creative mind like Aristotle's could flourish. Italian renaissance painter Raphael's wall painting titled *The School of Athens* is an excellent portrayal of the intellectually vigorous atmosphere at the Academy.

Aristotle's Greek name is *Aristotelis*. It is a composite name made up of two words, Aristos (best) and Telis (purpose). So, Aristotle means "best purpose". Quite appropriate for a man guided by such great purpose throughout his life! Aristotle stayed at Plato's Academy for about twenty years and became the Academy's intellectual powerhouse. On Plato's death, Aristotle left the Academy and moved back to the palace of King Philip of Macedonia, where Aristotle had spent part of his childhood when his father Nicomachus was personal physician to King Amyntas, Philip's father. Aristotle established himself as the head of the Royal Academy in Macedonia and became the tutor of Philip's 13-year old son Alexander, better known today as Alexander the Great. In this miraculous play of history, destiny brought together the greatest philosopher of all time with the boy who would turn out to be the most admired military genius in history.

One year after Alexander became King of Macedonia in 335 BC, Aristotle returned to Athens where he established his own school, the *Lyceum*. Following Alexander's death in 323 BC, anti-Macedonian sentiment in Athens forced Aristotle to flee to the island of Euboea, where he died of natural causes one year later. It is estimated that Aristotle wrote about 400 works of which only a small fraction has survived. We know of his work mostly from these surviving books and those of his disciples and later scholars.

Aristotelian philosophy has its roots in Plato's ideas, as expected, but Aristotle's development gradually took him on a philosophical path of his own. Plato and Aristotle are the two pillars of Western philosophy and no student of philosophy today can escape a detailed study of Platonic and Aristotelian ideas. Now, who is the greatest between the two? English philosopher and mathematician Alfred North Whitehead wrote the remarkable dictum that the safest general characterization of the European philosophical tradition is that it consists of a series of footnotes to Plato! On the other hand, Russian-American novelist and philosopher Ayn Rand accredited Aristotle as the greatest philosopher in history.

As philosophers of science we may be inclined to side with Rand, but we do not really need to take sides right now. Our discussion of the philosophy of science will naturally show a stronger affinity with Aristotelian logic than with Platonic ideas. And yet a basic discussion of Plato's idea of Forms is absolutely necessary. The most important metaphysical and quasi-epistemological idea in Plato is the Theory of Forms. It refers to the belief that the world that we see is not the real world but only an image. The forms are abstract representations of all the things that we see around us. The world of forms resides in our mind and is the cause of the apparent world, which constantly changes. The only fixed world is the world of forms in our mind.

Here is where we have our first objection: if Plato had said that the apparent world is not the effect but the cause of the forms, we might be in complete agreement with his idea. A possible interpretation of Plato's idea would be that the universe would cease to exist if the human race disappeared. It would certainly cease to exist in the human mind but no logical person really believes that the universe would physically disappear. Can our objection be proven? Probably not, it is just an intuitive guess!

But our interpretation may be wrong. There are other interpretations which drive the appreciation of Platonic ideas much closer to modern epistemological concepts. In the discussion of American philosopher Charles Peirce in my article on *Pragmatism* we saw a striking resemblance of Peirce's theory of knowledge with Platonic ideas (check). That is quite remarkable considering that Peirce is considered an Aristotelian philosopher. In other words, there is a certain risk in interpreting Plato. He is not as dogmatic as we might think. His ideas are often propositions for discussion and they are not necessarily part of a systematic theory. Like his teacher Socrates, Plato promoted the discovery of truth through dialogue. If Plato were present with us today, he might be engaged in our objections and our discourse might lead both parties to unforeseen conclusions.

If we trace the evolution of Logic back in history, we will find its beginning in the works of Aristotle. Logic is the alphabet of philosophical formalism and is at the core of the scientific method. Aristotle was the first known thinker who investigated Logic in a methodical, scientific manner and in doing so he invented and formalized the rules of reasoning. Aristotle wrote six books that were collectively known as the *Organon*, which means “Instrument”. These books contain most of Aristotle’s work on Logic, although his *Metaphysics* also contain ideas and principles of Logic. One of Aristotle’s most important contributions to Logic is the *sylogism*, which is a logical argument that draws a conclusion from two or more propositions that are known to be true or postulated as being true. For example:

Major Premise: All mathematicians are intelligent.

Minor Premise: Johnny is a mathematician.

Conclusion: Therefore Johnny is intelligent.

We may restate the above as follows: The entire set A (mathematicians) is a subset of the entire set B (intelligent people). A particular person (Johnny) is a member of A. Therefore Johnny is also a member of the greater set B. As simple as this argument sounds, it is the basis of deductive reasoning, which means that the conclusion is of no greater generality than the premises. In other words, as the argument moves from the premises to the conclusion, generality becomes less and less. Deductive reasoning is top-down logic, as our argument moves from general to particular. In our example we have two universals (sets with many members), the set of mathematicians and the set of intelligent people. We also have one particular (Johnny), who is a single member and can belong to several universals. Aristotle noted that, in a sentence of a syllogism the universals can be either subject or predicate, while the particular can only be a subject. We will observe that the syllogism has two premises with two terms each. Two of the four terms are common to the premises. The conclusion is a categorical sentence having as terms the two terms that are not common in the premises.

Aristotle developed his deductive logical structure but he was equally interested in inductive logic, the bottom-up approach, where you discover isolated empirical facts through search and experiment and then develop a generalization or theory that explains all the facts. In his own scientific work his approach was primarily inductive. He was cutting up insects and fishes to look into their internal structure and wrote down his findings, which he categorized according to the main features of each species. This is an inductive approach.

Aristotle was the first major philosopher to argue convincingly for the role of chance in the natural world. First, there are causes that lead to events. There is a causal chain going back to the first cause. This is what we call in our modern language “cause and effect” relationships. But Aristotle did not subscribe to the simplistic idea that every event has a single cause. Within a chain of events there are accidents caused by chance. Aristotle was aware of the boldness of his idea. He noted that earlier scholars had no place for any randomness in their explanations of phenomena. It is quite astonishing that back in the

third century BC we have randomness as a driving force, a concept that had to wait until the nineteenth century, as we saw in our discussion of American philosopher Charles Sanders Peirce. A concept that is widely considered today as a major driving force in modern quantum mechanics. Aristotle's idea of the role of chance is the genesis of indeterminism and randomness in philosophy and science.

English philosopher Bertrand Russell, one of the founders of twentieth century analytic philosophy, has words of approval for certain aspects of Aristotelian philosophy, as well as disapproval for others. In one of his comments on Aristotle's deductive logic, Russell presents the phrase "the present King of France is bald" to show that such a phrase leads to difficulties. The problem for Russell is that France has no King at present, which, as far as we know, is correct! Russell believes that the phrase implies the existence of a King.

It is rather obvious that Russell is correct on the substance. When we say that "the present King of France is bald" we definitely convey our belief that France has a King. But here we have a bit of a conflict between structure and substance. The logical structure can be correct even if one or more of the premises are false. In fact, Aristotle wrote in his book *Categories* that an assertion whose subject does not exist must be false. It almost seems that Aristotle fully anticipated objections like Russell's!

We must say that Russell's criticism on this issue does not address the distinction between form and substance and appears somewhat formalistic. It seems that Russell introduces false empirical input into a formalistic relation and then concludes that the relation is false. However, the value of a logical structure cannot be refuted by the possibility of misuse.

We saw in other articles how Aristotle's geocentric concept of the universe prevailed over the heliocentric concept of Aristarchus, taking seventeen centuries and the genius of Copernicus to restore the order in favor of the heliocentric model. Aristotle's intellectual stature and influence was such that many of his theories were accepted as doctrine without questioning and dominated scientific thought for many centuries. The great German philosopher Immanuel Kant thought that Aristotle had discovered everything there was to know about logic.

Kant was not very far from the truth. Aristotle invented from nothing the entire philosophical area of Logic. Aristotelian principles of Logic have stood the test of time and even now, in the twenty first century, modern courses on Logic at our universities are based on Aristotelian principles.

In this series of essays I have focused on the process of scientific inquiry and discovery with the intent of finding associations between logical structures and specific scientific discoveries. We will be learning as we go. Let us take a quick look at the logical structure that led to the discovery of the photon. First, we have Hertz's experiment in 1887 which showed that a spark jumped more readily between two charged spheres if light was shining on them. This photoelectric effect had not been seen before and was not expected

to occur based on known theory. So, the starting point in our logical structure is not related to some theory, it is a purely empirical fact discovered by experiment: a charged metal sphere close to another charged metal sphere creates a spark when light shines on it. Repeated experiments by others confirmed Hertz's findings. Then comes along Albert Einstein who develops the photon theory to explain the result.

So, here we have an inductive method. We have gone from the particular to the universal. From the isolated experimental finding to the theory that explains it. But the theory will not gain acceptance for simply explaining one empirical incident. It must be tested and found to explain other similar or related incidents. Here we start on a deductive course, as we walk the path from the universal to the particular. Experiments are performed, Einstein's theory explains new experimental findings and the theory is finally confirmed and widely accepted. We may risk a generalization and say that inductive reasoning is appropriate in the formulation of a theory while deductive reasoning is more appropriate in the testing and confirmation of the theory.

Albert Einstein said that no idea is conceived in our mind independent of our five senses. In our study of the evolution of the scientific process we will naturally follow the course of empiricism, the idea that the origin of new knowledge is not the mind but the senses. Simply put, it means that our mind must receive experiences through our senses before it gets to do its own work. The process of scientific inquiry and discovery is an empirical process.

John Locke, founder of modern empiricism

It is quite amazing that the next important empiricist after Aristotle would take almost twenty centuries to appear. His name was John Locke and he is regarded as one of the most influential thinkers of the Enlightenment. Locke was born in 1632 in Somerset near Bristol, England, to a strict middle class family of the Puritan faith. After completing his secondary education at the prestigious Westminster school in London, he was admitted at Oxford where he studied medicine and philosophy and became lecturer of Greek and Rhetoric. After his stay at Oxford, Locke became personal physician to the Earl of Shaftesbury, saving his life when a risky liver operation became necessary.

Shaftesbury's political involvement led him to his trial and acquittal for treason and Locke fled to Holland, fearing a similar fate due to his close association with the Earl. After a decade of self-imposed exile, Locke returned to England when political changes restored power to men who shared Locke's views. In the meantime he had started writing his two major works, *Two Treatises of Government* and *Essay on Human Understanding*, the former laying out principles that became the foundations of the American, British and French Constitutions. The Essay is Locke's greatest philosophical achievement and the work that set the foundation of modern empiricism.

The Essay is divided into four books, of which the first discusses innate ideas, the second traces the origin of ideas, the third deals with language and the fourth discusses the limits

of understanding. Locke attempts to determine the capability of the human mind and the nature of knowledge. He argues against philosophies of knowledge, like those of Plato and Descartes, which claim that the human mind is equipped with *a priori* innate ideas and principles that are properties of the mind and have not been delivered by experience. Locke is responsible for the term *tabula rasa*, which means that when we are born our mind is a blank slate, like a book with blank pages that are gradually filled as we go through life and our experiences are processed into ideas. Locke's writing is great philosophical reading, with clear and understandable language, balanced judgment, absence of doctrine and lack of presumption.

One of Locke's basic ideas is that the way we acquire any knowledge is sufficient proof that the knowledge is not innate. Locke refutes the argument that common ideas are innate by suggesting that they are not shared by infants, children and idiots and are, therefore, not common. No ideas are naturally imprinted on the mind and there are actually no principles or ideas that are accepted by every human being. Locke proposes that the most basic units of knowledge are simple ideas that are acquired exclusively from experience and combine in three different ways to form more complex ideas: comparison, combination, abstraction. Our mind forms ideas about the world only through impressions that enter it through our five senses. The mind has the ability to remember past impressions and compare new and old impressions, to make judgments, to refine by abstraction complex ideas into simpler ideas and to enlarge a simple idea into a complex one by repetitive impressions or by discovery of new impressions.

In Plato's philosophy, all objects, including humans, animals, mountains, trees, are mere shadows of forms that pre-exist in our mind. The tree is a particular object but its tree-like qualities are aspects of the ideal form. In Locke, the tree-like qualities are the result of an abstraction. Once we have observed more than one tree, we begin to distinguish their common features from their particular characteristics and by abstraction the common characteristics become the form of the tree. The difference with Plato evidently is that in Plato the form pre-exists in the mind and is the reality of the world, whereas in Locke it is the opposite. The particular object is the reality, while the form is a mental abstraction developed from experience.

In the third book of his Essay, Locke points out different types of language abuse which obscure the communication of ideas. One of the most common abuses is the use of different definitions of words by different people, leading to misunderstanding and superficial disagreement. Locke pays particular attention to the need for communicative language with the use of clear definitions common to all.

In the fourth book, Locke discusses problems of knowledge but also gets into ontological issues that we normally refer to as *metaphysics*. Does the world exist outside of our minds? To many of us this is quite a naïve question and yet it has occupied many a great philosopher through history. We know that the universe has existed for billions and billions of years before humans came into existence and there is plenty of evidence that the world continues to exist as our minds die when we die. We also know that our beloved philosophers are not the type of folks who are easily impressed with simple

ideas! In all fairness to Locke, he seems rather contemptuous of metaphysics than embracing it.

We know that Bertrand Russell has a word to say about everyone and everything. Sometimes we agree and sometimes not but we always find his thoughts interesting. His review of Locke's philosophy is quite sympathetic on some issues. Perhaps not surprisingly so, as Russell is also one of the great philosophers along the same line of empiricism drawn by Aristotle and Locke. We will come to Russell's own philosophical contributions at some other time but for now we will enjoy and be enlightened by his commentary. We have many philosophers in the twentieth century but few present a twentieth century view on classical philosophy as eloquently as Russell does. He writes:

One of the great historic controversies in philosophy is the controversy between the two schools called respectively "empiricists" and "rationalists". The empiricists, who are best represented by the British philosophers, Locke, Berkeley, and Hume, maintained that all our knowledge is derived from experience; the rationalists, who are represented by the Continental philosophers of the seventeenth century, especially Descartes and Leibniz, maintained that, in addition to what we know by experience, there are certain "innate ideas" and "innate principles", which we know independently of experience. It has now become possible to decide with some confidence as to the truth or falsehood of these opposing schools. It must be admitted, for the reasons already stated, that logical principles are known to us, and cannot be themselves proved by experience, since all proof presupposes them. In this, therefore, which was the most important point of the controversy, the rationalists were in the right. On the other hand, even that part of our knowledge which is logically independent of experience (in the sense that experience cannot prove it) is yet elicited and caused by experience. It is on occasion of particular experiences that we become aware of the general laws which their connexions exemplify. It would certainly be absurd to suppose that there are innate principles in the sense that babies are born with a knowledge of everything which men know and which cannot be deduced from what is experienced. For this reason, the word "innate" would not now be employed to describe our knowledge of logical principles. The phrase "a priori" is less objectionable, and is more usual in modern writers. Thus, while admitting that all knowledge is elicited and caused by experience, we shall nevertheless hold that some knowledge is "a priori", in the sense that the experience which makes us think of it does not suffice to prove it, but merely so directs our attention that we see its truth without requiring any proof from experience. There is another point of great importance, in which the empiricists were in the right as against the rationalists. Nothing can be known to exist except by the help of experience.

Russell makes two statements that appear contradictory. First he states that "It must be admitted, for the reasons already stated, that logical principles are known to us, and cannot be themselves proved by experience, since all proof presupposes them." A few lines later, Russell says "Nothing can be known to exist except by the help of experience." Is Russell engaged in a circular and fallacious argument? Are logical

principles among those innate or *a priori* ideas that are already imprinted in our mind as we are born? Does the infant have reasoning ability as a result of the possession of logical principles? Do these logical principles remain fixed as the child grows up or are they expanded in depth and scope through experience? These are some of the questions raised by Russell's statements.

Locke's influence on his contemporaries and on later philosophers was enormous. We have already mentioned the influence of his political theories on the shaping of the American, British and French Constitutions. His philosophy of knowledge influenced Hume, Berkeley and Kant, among others, and became the theoretical foundation for modern empiricism and pragmatism.

Empiricism with a poetic streak

George Berkeley is a major philosopher even though his basic premise poses quite a challenge to our intuition and common sense. Berkeley held the view that material objects do not exist unless they are perceived. It almost sounds nonsensical. How can something be perceived unless it exists? However, Berkeley's argumentation is so ingenious, it almost seems irrefutable. Berkeley is always grouped together with British empiricists Locke and Hume. The reason is simple: perception (or sensation) is the source of all reality.

Berkeley was born in 1685 near Kilkenny, Ireland. He completed his secondary education at Kilkenny College and entered Trinity College in Dublin, graduating in 1704. He remained at Trinity until 1724 as a tutor and Greek lecturer and this is where he wrote his major philosophical works. In 1710 Berkeley published his masterpiece *Principles of Human Knowledge*, a work that is still regarded as the best argued expression of metaphysical idealism. Three years later he published the *Three Dialogues Between Hylas and Philonous*, where he makes a deliberate effort to defend the ideas developed in the *Principles*. Berkeley earned a doctorate in divinity in 1721 and was appointed Bishop in Dublin in 1734.

There is a poetic streak in Berkeley. Let us read an excerpt from his opening of the first dialogue in his *Three Dialogues*:

Can there be a pleasanter time of the day, or a more delightful season of the year? That purple sky, those wild but sweet notes of birds, the fragrant bloom upon the trees and flowers, the gentle influence of the rising sun, these and a thousand nameless beauties of nature inspire the soul with secret transports; its faculties too being at this time fresh and lively, are fit for those meditations, which the solitude of a garden and tranquillity of the morning naturally dispose us to. But I am afraid I interrupt your thoughts: for you seemed very intent on something.

Do you think that Byron and Goethe might be envious of George Berkeley, the poet? The dialogue is between Hylas and Philonous. In Greek, Hylas means "matter". Philonous

means “friend of reason”. Philonous is supposed to be an impersonation of Berkeley himself. Hylas is believed to be an impersonation of John Locke, Berkeley’s philosophical opponent.

In this same dialogue, Philonous argues that matter is only known to us by its qualities as we sense them and it is impossible to imagine matter without these qualities. In the absence of the qualities that we sense, matter loses its essential nature. Berkeley does not suggest that the material world ceases to exist if it is not perceived by humans. He believes that the material world is always perceived by God. We cannot therefore adopt the view that Berkeley rejects the independent existence of the natural world.

Berkeley’s arguments seem irrefutable but only because they have a quasi-axiomatic arbitrariness. Let us consider two hypothetical statements: the claims “God exists” and “God does not exist” are both irrefutable. It is not possible to devise a logical argument to disprove either. At the same time, they cannot both be true, unless the two claims are made from two different axiomatic reference frames having different definitions of “God” and “exists”. Therefore, we may say that irrefutability is not sufficient for truth and we cannot consider Berkeley’s conclusions as truths solely based on their irrefutability.

In a brief essay titled “Objectivity, Reality and Truth” I have argued that there are two realities: First, there is an absolute universal reality that is independent of human existence. Second, there is a human perspective reality, as humans are unable to transcend their human perspective in order to achieve awareness of the absolute universal reality. Any human knowledge of a reality will necessarily carry the human perspective. By definition, that is not a knowledge of universal reality. Humans can achieve only a human perspective reality. The “thing to be known” has characteristics that are independent of human existence and are part of universal reality.

Humans perceive certain characteristics of the object that are shaped by their sensory abilities and the processing abilities of the mind. These characteristics may be the same or different from the object’s universal characteristics and it is not possible for humans to know the difference. Any meaningful discussion of reality must be limited to the human perspective reality, which is the portion of universal reality that the human mind can know and this portion may be qualitatively different from the ontological reality. There is a difference between what one knows and what is to be known. We have, therefore, two types of reality: universal reality and human perspective reality.

The above view is very similar if not identical with Berkeley’s basic premise. In Berkeley, only God is aware of what we call universal reality, while the human mind perceives the human perspective reality, which does not exist without the workings of the mind. At first glance, Berkeley’s views appear non-intuitive. But a careful reading reveals a coherent and systematic philosophy of mind and matter. Berkeley’s idealistic empiricism may not have a wide following today but the reading of Berkeley is pure philosophical delight and is as popular as ever among contemporary philosophers.

Hume and the problem of induction

Scottish philosopher David Hume is widely regarded as the greatest among empiricist philosophers and was strongly influenced by John Locke who preceded him by almost a century. Hume was born in 1711 near Edinburgh into a family of moderate means and entered the University of Edinburgh at the unusually young age of 12. He was not interested in anything except philosophy, literature and general learning. At the age of 28 he completed his first major work, *A Treatise of Human Nature*, which turned out to be his intellectual masterpiece and one of the most important books in all philosophy. Hume published the Treatise in three volumes anonymously but the work, which advocated a system of morality based on utility, or usefulness, rather than God's word, failed to arouse public interest and debate. When he recovered from his failures, Hume reworked the Treatise into smaller volumes, believing that style rather than content was the reason for the book's failure. This time Hume was more successful in attracting public interest and was established as an important proponent of a new utilitarian morality. It was not all positive, however, as he was twice denied academic posts in Scotland due to his alleged immorality and atheism.

Hume went to France as assistant to England's ambassador and published *The History of England*, a major work of over one million words that took fifteen years to complete. The book traced events from the invasion of Julius Caesar in 55 BC to the Revolution of 1688. This time Hume achieved tremendous success and fame, with the book running into six editions. In 1748 Hume wrote *An Enquiry Concerning Human Understanding*, which was a shortened and more readable version of the first volume of the Treatise. This is an excellent introduction into Hume's theory of knowledge and a student of philosophy who wants to read Hume's original works will be well served to start with this book.

Hume has much to say about definitions. Conventional definitions consist of replacing a term with its synonyms, which merely replicates the initial ambiguity and does not reveal the true cognitive content of the term. Hume begins with the term and asks what idea is associated with it. Without such an idea the term has no cognitive content, regardless of the term's popularity, common use and prominence in philosophy, theology or politics. If the term has an associated idea, Hume uses a microscopic method to analyze it, just like a scientist who uses a microscope to analyze matter. Hume looks at breaking down a complex idea to successively simpler ideas and finally to the simplest indivisible idea possible, with the view of associating it with the sensation that produced it. If the process fails, the idea is void of cognitive content. If it succeeds, it will provide a true definition of the term in question. Hume uses this method to show that many of the central concepts of metaphysics lack clearly defined content. Needless to say that Hume does not have much use for metaphysical theories attempting to prove the existence of God, divine creation, the soul and other similar ideas. We have no reason to believe that any of these ideas are true as we cannot receive a direct impression of them.

The problem of induction is at the heart of Hume's philosophy of knowledge. Hume writes that induction concerns how things behave when they go "beyond the present

testimony of the senses and the records of our memory”. In other words, induction is drawing conclusions from the observed to the unobserved. Hume notes that all such inferences rely on the premise that the future will resemble the past.

There are two dimensions to this problem. First, the uniformity of the observation. Hume argues that it is conceivable that nature might stop being regular and the notion of uniformity cannot be justified. The second dimension of the problem is even more troubling. The principle of uniformity can be proved only by induction. So, induction is invoked to prove uniformity and then uniformity is used to confirm the validity of induction. This is obviously circular reasoning, as it invokes in the proof the very idea that we must prove. Hume solves this problem by arguing that inductive inferences are usually made by natural instinct rather than pure reasoning.

