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Origins of the Modern Mind

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November 2021

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*This course is part of the superstar teacher series. The series is produced by the teaching company. This course is titled the **origins of the modern mind**. The lecturer for this course is Alan Charles Kors. Dr. Kors received his bachelor's degree summa cum laude [with the highest distinction] from Princeton University. He did post graduate work at Harvard, where he also earned his MA and his PhD. Since 1968 Dr. Kors taught history at the university of Pennsylvania, where he is professor of history.*

Lecture 1: Aristotle and authority¹

We're here to talk about one of the most extraordinary events in the history of European civilization, and certainly I think in the history of mankind, the intellectual revolution of the seventeenth century. For if our species, and in this case European culture, changes the way it thinks about thinking itself, changes the way it thinks about what is out there to be known, how one goes about knowing it, what it is to know something, from that sort of revolution a whole rethinking of our relationship to nature, to the world, to each other follows and it is that evolutionary thought I should like to talk about with you in the course of these lectures on the seventeenth century.

To begin to understand what the intellectual revolution of the seventeenth century is, we need to understand the system, against which, so many of the great minds of the seventeenth century place themselves in open revolt and that system was known as Aristotelian scholasticism. Aristotelian, because it was derived from the thought of the great philosopher Aristotle or at least Europeans believe that was so derived; and scholasticism because it was a system that had come to dominate the schools of Europe, the universities of Europe. We have a culture assent that very few human beings who could be spared from the ordeal of physical labor, from morning 'till night, in a subsistence society, so that some human minds might understand and be capable of teaching about the world.

One of the best introductions to any intellectual system is to ask within that system under what circumstances people find themselves convinced, what leads people to say "Yes, that's persuasive" or "No, that is unpersuasive", when do you say "Yes, that's right. I have to believe that, given the argument". In Europe, in the dawn of the seventeenth century, the same system of winning arguments and convincing other minds persisted that had been in place for the many prior centuries of European education. A system built around, what was known as the disputation in which, it took the place of examinations in SAT's combine in which people prove their mettle intellectually, by demonstrating the ability to win arguments about true things. The form of that disputation, above all, relied upon authority, the most convincing argument of all. It was a culture that believed, as most traditional societies believe, that certain things had stood the test of time. Innovation was a pejorative the citation of those works that had stood the test of time and people believed that these will work that had remained dominant in the tradition because century after century they had enlightened European minds and the most educated have always found them compelling. These texts that had stood the test of time, were deemed the equivalent of human practices. Upon which after experience, we have come to rely for our survival in this case, for our understanding. The leading authority was of course, religious; scripture, the

¹ Transcript by Zeinab Sohrabpour

teachings of the church fathers, the most celebrated doctors of the church, theology. In matters of natural knowledge, the leading authority with Aristotle. Anti-Aristotelians would frequently argue with a great deal of impatience that if Saint Paul or indeed, Jesus Christ themselves were alive, they could not be admitted to any faculty of theology or any university since they had failed to master the Aristotelian system. But Europeans often argued explicitly and most would have argued, implicitly that it was not coincidental that Aristotle had appeared before Christ. That God perhaps had sent Aristotle into the world to give us a means of understanding, the conceptual scheme, a way of thinking about the world consistent with the Christian revelation. Europe was also a culture that believed itself to be logical. Above all, and it inherited this from Aristotle and the Greeks, it believed that it had no right to contradict itself. The avoidance of contradiction as a guiding principle of the European mind in Aristotelian scholasticism. But if your premises are drawn from authorities, your astronomy from the ancient Greek colony, your natural history from Pliny, your natural philosophy from Aristotle, many of your deepest views from the scripture and the theologians; The trick in avoiding contradiction is to be consistent in seeing what follows from things known to be true, because of the authority of the source. So, the model of the use of reason that we see in the disputation is the syllogism. Given 'A' from authority and given 'B' from authority, 'C' follows. If we believe that all men are mortal, and we believe that Socrates is a man, we must believe (or declare ourselves lunatic) that Socrates is mortal. We are going to be consistent in our use of knowledge. But note, that the premises of the syllogism are all derived from authority. If we know something to be true, from authority and consistent with syllogistic reason working with those authorities, then there are to be evidence for it in the world itself: And the third part of the disputation, used for illustration and not for compelling argument, is the citation of experience. If we know from authority about the reality of witchcraft, if we know from authority and reason that certain phenomena can't be natural, they must be attributed to diabolical forces then we ought to find evidence for such witchcraft and Europeans, for example, could fight the trials of witches from a variety of court cases in which we had witnesses who testified people being transformed into toads, or poisoning wells with the spell found guilty by a jury of their peers. [Authority...] With reason, when it's going to use the authorities consistently and experience, one should be able to illustrate what is true. What kind of knowledge did Aristotelian scholastics wish within this system of authority, reason and illustration by experience? They wanted to know how and why things happened, what was out there, what had to be, given the world that we observe. And the heart of their attempt to understand that, was the Aristotelian system of cordiality of causal explanation what things contributed to the existence of something or any given act. There are 4 causes in the Aristotelian system and unless you can explain all 4 of these causes contributing to why something should be, you have an inadequate understanding of it, failed to achieve a deep grasp. These are the material cause (what is it out of which something is made), the formal cause (what form does that material take), the efficient cause (what is it that makes it) and the final cause in the sense of the end served (what purpose led to this Material being made into a specific form by an act).

Let's look at statues and souls to think about the Aristotelian system. If we ask what's involved in a bronze statue, the Aristotelian system gives us a great deal of deep knowledge

about it. It's made from bronze; Which means that it cannot conceivably be anything that bronze can't be. If we ask can a statue commit a voluntary act, we know it can't, because that's not a potential of bronze. If we ask, can this be immortal? We know it can't, because of what it is made of; bronze. An important element of your knowledge of what's involved in the statue, is precisely knowing all of the potentials and all of the limitation of the material from which it is made. Our human mind is made of a spiritual substance that is the material cause. Certain things are true about it that aren't true but anything made of bronze. But out of bronze, you could make a spear for the purposes of murder, you could make coins for the king, a statue to honor the king, you could make a religious statute give reverence to the gods. And out of the spiritual substance, out of Soul, one can make angels, things beneficent and good, human souls or one can make diabolical spirits, and demons. So, it is critical not only to understand what something is made of. But what set of potentials is actualized, is made real in a specific form. Aristotelian aesthetics is wonderful in this way if you look at a piece of bronze you say they're almost an infinity of possible things in it. What the sculptor does is take everything away that isn't Joan of arc, leaving you with one form out of all of the potentialities of the bronze.

You know so much when you know the formal cause, whether something is a murderous weapon for example or whether it's a religious statue that lets you give devotion to the gods. Let's go back to the case of souls. The formal cause of angelic intelligence is its goodness and its service to God, it's spirit. In that form of the demon or devil it's with malice, Wickedness, of a human soul it's the freedom to choose between good and evil, being a free and rational soul. You know a great deal when you know the formal cause of something. Now, [you could have a sculptor... excuse me.]

You can have bronze in a room, with the potential of the statue for all time, unless something brings that one form out of the potential of the bronze there is no statue, we need an efficient cause. And the efficient cause in this case is the hammer. The statute doesn't exist because of the sculptor alone. You need the form of a statue in the bronze but you need the hammer. The efficient cause of what a soul becomes is a God and efficient cause tells you a great deal about the value and nature of something. Is it made by God? Is it made by a Saint? Is it made by a wicked person? Is it made by a human being? Is it made by the wind? You know a great deal about the value of something when you know its efficient cause.

And very deeply, the Aristotelian mind believes that nothing at all happens without a purpose. A model very consistent with the Christian understanding of the world. The scope of all the bronze and the potential of the statue means nothing unless there's an end serves and the sculptor has a reason, a purpose to bring this one form out of all of those potentials and God does nothing without a purpose. So, to understand the end served by something also lets you appreciate it and value it and have deep knowledge about it. Was something made to honor the gods out of bronze or was it made to forge a weapon of crime out of bronze? That's a major difference between final causes. And in terms of investigating the things of which God is the efficient cause, it means that we can find God's intentions, his purpose, his will if we examine the final causes of things. That is deep knowledge. Concerning form, the Aristotelian mind distinguishes between 2 very different

kinds of forms. One, a form that makes something what it is, and two, a form that you can change but the thing remains what it is. For example, a human being has as its form to be a rational free soul. That human being can be tall or short, blonde or brunette, Dark skinned or white skinned. You can change those things a human being remains a human being but if you take away a free rational soul that human being is no longer a human, And the distinction is made between substantial forms, that make things what they are, (If you change them, you change what the entity itself is) and accidental forms, things that you can change. A triangle must have 3 angles the sum of which is 180 degrees but whether it's green or brown had nothing to do with it triangularity.

Concerning the final causes, it is in many ways the deepest knowledge because it lets us understand the purposes, God's designs of the world in which we find ourselves. Many of the examples of final cause can be drawn from Life sciences, natural history. We have eyes in order that we may see. That is the final cause. We have eyes because it was god's purpose to give us vision. Rain falls so that crops may be watered and life sustained. That's the important kind of knowledge to have. We have hands and thumbs that move like this so we might have dominion over the earth. Some of this you know from authority, some of it you know from deep study, the Aristotelian believe.

What is out there to be known according to this causal system? Critical to the Aristotelian mind is the understanding that the knowledge we have of the world is above all qualitative, the quality sustains. What the Aristotelian scholastics called the perfections; at the top of which is God, which gives us a measure. We know from authority the qualities of God; infinite wisdom, infinite love, infinite goodness, infinite power. These are the perfections. And everything that exists is either a diminished state of the perfections we know to be in God or a quality created by God, something fit only for the creatures that God himself does not possess. Let me give you an analogy so you can think in an Aristotelian manner. We use the word darkness as if it were a real thing but if you think about it, darkness is the absence of light. What's real in the world, is the positive quality, light. If we had a dimmer, we could diminish it, diminish it, diminish it... At some point you would say there's something new in the world; darkness. But what really exists is less light. Imagine the same with sound. Someone says:" Ah... There are 2 things in the world sound and quiet. But quiet is the absence of noise, the absence of Sound. We give it different names as we diminish it. For the Aristotelian, the world is filled with qualities in a lesser degree than the degree to which God possesses. And by understanding the qualities inherent in the materials and the forms and the purposes of things, we can gain the only kind of knowledge that truly matters; A contemplative appreciation of how things stand with relationship to God and to God's perfection. God is infinite power. They're lesser degrees of power in all the creatures and we can arrange them on a scale from God to the lowest creature. The same with the wisdom, the same with love, the same with the purposes served by things. Among other things what this let us know, is that the unchangeable, the immutable is higher, more important, more worthy of study and contemplation than anything that changes and is subject to alteration. God is immutable and unchanging but if you look at earth, you see a world, in which everything changes. Everything decays. Nothing remains the same. It tells you why the most trivial subject matter, that a great mind could study would be things of the earth. And the most important subject matter that a great mind could study would be

eternal things, unchangeable things, the things of heaven. The Aristotelian mind believes that if you look at the world above the moon, the celestial world, you see things that never change. They move perpetually, it is believed in perfect circles, unchanging, nothing altering them in all of our knowledge. If you look at earth you see things always in a state of change and flux and decay. Which is why the one area of natural inquiry, if you're not smart enough to do theology, if you're not smart enough to contemplate angels and souls, the most respectable form of natural inquiry, at least is astronomy; The world of the unchanging heavens. Which is why the break through natural philosophy of the seventeenth century, that will pose the most severe challenges to the Aristotelian system, first will come from astronomy. Theology is the queen of the sciences. Sciences mean anybody of certain knowledge. Theology is a science. The fact that science has now come to stand for what the seventeenth century would have termed natural philosophy, the study of the natural world by the natural mind, tells us about the triumph of natural philosophy. For theology was known in the medieval and in the seventeenth century as the queen of the sciences. Under God's design, all things strive to fulfill his purpose and to take their proper place according to their perfections. Meaning that we can understand reality is a series of ladders. Great chains of being, as the seventeenth century term them. A ladder of powers, a ladder of goodness, of freedom, of wisdom. In which all things may be appreciated by the extent to which they are close to and resemble or the extent to which they are removed from and don't resemble God himself. And within any given category of things, there exists another hierarchy.

So, for example, if we look at angels, we can arrange them on a ladder, according to the degree to which they correspond with God's perfection. The old story about scholastics arguing how many angels can dance on the head of a pin, which they never argued about, does stem from the fact that they did believe you could contemplate angels by degrees of perfection and of course the lowest was Lucifer who rebelled against God. The same with human beings. We have human beings who most resemble gods, saints of great goodness and piety and wisdom and the opposite, the extreme sinners. We have people who are wise. We have people who are closer to rocks than to a wisdom that resembles God and we can create in all spheres of knowledge, a contemplative hierarchy, so that we appreciate the place of things. Indeed, scholastics believed that there is a correspondence, parallel between the physical world and the world of perfections, that nature is physically arranged according to the chain of perfections. At the height of this chain of being, is the empyrean heaven, infinite, eternal, beyond the moving celestial orbs. The dwelling place of God and the souls of the blessed. Beneath that, is the created world. At the outer rim, there is the fixed stars in an orb, that circles around the earth and then the orb Saturn, Jupiter, Mars, the sun, Venus, mercury and the moon, the known planets. It is believed that these are so close to God and their motions so perfectly circular and unchanging, that they are governed by angelic intelligences that keep them on their perfectly circular orbit. If you start from the moon and count up, by the way, you reach 7 heavens, the source of that expression. Beyond that no one could imagine greater bliss. The world beneath the moon called the sub lunar world, is where we find ourselves and here everything is change and imperfection. Change and imperfection marked by the fact that everything here is composed of 4 elements, the Aristotelian believe. And none of them stay in harmony. They're always

fighting to separate out from each other and find their rightful place in the physical order of God's creation; Fire, air, water and earth, the rock group hasn't got that completely right! Everything is composed of these and they fight to separate out and find their appropriate place. Fire rises towards heaven and towards God. It can purge flesh. It can change the things of this earth and it rises. Air is below fire. Water below air and above earth and earth, because it is a base, corrupted element, as farthest removed from God, sharing the fewest of God's attributes, earth always sinks to the bottom. And beneath earth, at furthest removed from God; Hell.

The physical system itself not only tells you what you can study as valuable and what you should know about it, its relationship to God, it even points to the choices you need to make for your life. Nature demonstrates it. Part of you is flesh, and part of you is soul. Look at earth, dropped at flees from God, toward hell, toward the center of the universe. Your soul which aspires upwards, resembles in that way, fire which rises up toward God, toward heaven. So that the physical world itself teaches you. Do you want to move via the flesh toward hell in the center of the earth or like fire move up toward the celestial realms? What should one study, what is worth knowing? The whole system teaches that picture above all things, literally and metaphorically, there is God. Every potential for goodness actualized in his infinite form; Rational free, wise, loving, good, with no body, nothing that can be corrupted. Beneath God, the angels, pure intellect, without body or corruption. They are imperfect; Only God can be perfect. But they are the closest things in the creation to God. And now you will understand the meaning of the phrase: "man is but little lower than the angels." For beneath the angels, mankind, with a reasoning soul, capable at our best of goodness, of wisdom, possessed of extra ordinary power among the creatures of the sub-Lunar world, but with a corporeal body, a corruptible body that draws us away from God. In many ways we are the center of the drama of the creation. Beneath man is the world of animals. I suppose if you can't study God, if you can't study angels, if you can't study souls, if you can study heavenly spheres, then let minor intellect take a look now and then at animals with the whole value as to what a person should think about, possessed of a mind. They have, what the scholastics believe to be an animal soul that governs them in non-rational learning, in purposeful motions, they have senses. Beneath the animals, plants that have, the scholastics believe, vegetative souls that allows them to engage in purposeful growth and reproduction. Beneath vegetables, the thing without souls. Stones, earth, leaf, fire, water, air. No purposeful growth, no reproduction, no rational thought, no soul. What kind of a person, possessed of the capacity for real knowledge would study plants and plant growth, would study crops? Why should that concern an intellect of the highest order? Or animal life, cattle, livestock? The very structure of the world, the very scale of perfection tells you that that kind of knowledge is unworthy of a great mind. So that you can see that before we can reach the transformation into a world that indeed studies livestock, studies plant growth, studies the animals and the animal sides of the human life, the physical side of human life. One has to transform the very hierarchy of knowledge built into this system. What should a mind capable of study know? The answer speaks out from this whole unified system. And what was the deepest knowledge? The deepest knowledge was the knowledge of the system as a whole, and of its lessons, Knowledge of perfections and purposes, a contemplative classification of the world. This is the system that had emerged

officially triumphant. After all the intellectual wars of the renaissance and of the sixteenth century.

This is the system enshrined in the official curriculums of the secondary schools and the universities of western Europe and indeed enshrined there with official university codes. Enter any university of the western world in the seventeenth century and the regulations you will be given as a student, an undergraduate will tell you to abandon all authors, who depart from Aristotle, to hold to Aristotle as interpreted by the church to avoid all contentions to challenge the enshrined authorities of university thought of theology and of a whole system of organizing and valuing knowledge, which the seventeenth century believes has linked it to the greatest wisdom of the ages. One can now anticipate the excitement of the very title that Francis Bacon will give to his great challenge to Aristotelian thought. The prescribed textbooks that any student in secondary and higher education in the seventeenth century university is Aristotle's Organon, the system, the instrument of knowledge, of acquiring knowledge. Bacon will audaciously challenge his major work of philosophy, the new organon, the new instrument for acquiring knowledge. It is a frontal assault, upon all of the established traditions and authorities and norms of the educated world. The audience, to whom the critics of the Aristotelian scholasticism will appeal were ironically that audience was brought into being by the theological world itself.

In the sixteenth century, Europe is divided by the great trauma of the Protestant Reformation, and divided into two competing theological camps, each of whose main intellectual voices seek to convert, to win adherence from the other theological camps. In order to fend off, for example, Catholic criticism of Protestant theology or Protestant assault upon the foundations of Catholic theology, the major religions require rapid addition of educated minds, of teachers, of controversialists, of authors, of preachers, and each of the major theological positions begins the expansion of education that will alter the European world.

Secondary schools proliferate exponentially across the face of Europe throughout the sixteenth and then throughout the seventeenth centuries. Universities are expanding. New universities are created. In the medieval period, education was above all reserved for those devoted to careers in theology. One trained a few lawyers for the crown's purposes. One train the few doctors of medicine. Grudgingly, 'though they appear to have appropriated the title doctor, which just means learned; When you receive your degree in theology in the university, you were pronounced "doct", learned, you were called a doctor. The theologians and philosophers allowed the medical practitioners to give themselves a degree and they've gone and stolen the whole title out from under us! In the seventeenth century one would have said physician to doctors and reserve the word "Doctor" for people who are thinking about truly deep and important things from within this system sense of values.

This exponential growth in education in the sixteenth and seventeenth centuries creates a large group of educated Europeans, who are not committed to a vocation or a career in theology. It creates one of the most potentially subversive and explosive populations in European history. Educated, trained, secular minds familiar with the ways of reasoning and disputation, but not committed to applying that knowledge to the world of formal theology and religious training. The expansion of centralized monarchies and states in the

sixteenth and seventeenth centuries and advances in commerce and the need to maintain ever more complex military and fiscal establishments, also creates a demand for people who can read, who can write, who can compute, who can think logically. And so, from a second source in addition to the confrontations of the reformation, the growth of the secular state, larger and larger numbers of intellectual, educated minds did not committed to theology as the crowning discipline, are drawn into the world of education. Add one final variable to this, to get a sense for the potential that it is there in the seventeenth century.

As a growing number of practical and worldly minds pass through this system of education, largely designed for a contemplative and, above all, theological appreciation of God's order; And that is printing. Prior to the spread of printing in the sixteenth century, books were chained in central library and people consulted them, who themselves were well educated, usually who had access to the great monastic libraries, and if someone wanted a copy of a book it had to be copied by hand. Printing means that once you set the type, you can turn out hundreds, thousands, tens of thousands of copies of the same text. And there, waiting as the audience of that printer, with money in their pockets and questions on their minds, other than the theological are the product of an educational system who brought, a secular reading public into being, who gave it a thirst, a hunger for knowledge and who did not satisfy it, we shall seem, with the fruits of Aristotelian and scholastic education. One can scarcely overestimate the intensity, with which the books that we shall discuss in the course of these lectures, were read by the seventeenth century mind. They had no television, no photographs, no videotape, no film. Their window to a world outside of their own limited experience was the printed page. Travel was perilous and rarely undertaken. No one knew what things outside of one's small ken looked like. Books were a window on to a world beyond one's self.

The educational evolution of the sixteenth and seventeenth century, brought into being, a population that had a hunger to peer through that window to discover something about the world in which they found themselves. They were educated in an exquisite and complex system of contemplative knowledge. They were told, above all else, to ask about perfections, about the purposes of things. But many of them began to seek a wholly other agenda for the world of knowledge.

We shall begin our exploration of that agenda when we turn to Sir Francis Bacon. Himself a product of the new opportunities for education, his father had risen to be lord keeper of the seals of England. He entered Trinity College at Cambridge university at the age of 13, one had no time for extended adolescence in the subsistence economy of the early modern world. People entered the universities of the ages of 12 and 13 already masters of geometry, Latin. Bacon hungered for a practical knowledge as someone who was destined for worldly career in Elizabethan England, he was given the Aristotelian system and we shall see in our next lecture his response to that.

Thank you.

Lecture 2: What you're to Bacon and the call for a new science²

² Transcript by Amirhossein Ghadami

We turn now to the topic of Francis Bacon, and the call for a new science. As I said at the end of the first lecture, Bacon is a good example of the change occurring in higher education. He enters Trinity College Cambridge University at the age of 13. Brimming with worldly ambitions and concerns, destined for a high political career, he will in fact rise to the position of Lord Chancellor in England from which he will fall on the charge of bribery. On the other hand, or Lord Chancellor's in Britain in the 16th century, in 17th century, were guilty of bribery. But encountering despite these worldly ambitions, the traditional Aristotelian education that dominates the curriculum at Cambridge, I had hinted at the official status. Let me read you, in fact, from the charter of Trinity College, that was given to all incoming undergraduates, quote, all students and undergraduates, my students hate that distinction. All students and undergraduates should lay aside their various authors and only follow Aristotle, and those that defend him. So, they're in Protestant England the same dominance of Aristotelian scholasticism, the charter for bad clothes, all sterile and inane questions disagreeing from the ancient and true philosophy. One of Bacon's biographies his dear friend Rowley wrote that it was at Cambridge that Bacon, quote, first fell into the dislike of the philosophy of Aristotle, being a philosophy, only strong for disputations, and contentions, but Baron of the production of works to the benefit of mankind, and quote, and in that observation by Bacon's friend, indeed, is the heart and soul of Bacon's assault upon the traditional philosophy. In several works written between 1602 and 1608, Francis Bacon began his momentous assault upon the traditional philosophies. He condemned the European philosophical tradition, entirely on several grounds. It had mixed religion and natural philosophy, he wrote to the confusion of both, it has failed to understand the difference between a pious question asked from the perspective of the knowledge of faith, and a question about the natural order that must be answered by the patient acquisition of natural knowledge. It had confused our faith and our natural philosophy. Secondly, it had substituted a concern for words, in the place of a concern for things. This is one of the most obsessive and deep things in all of Francis Bacon his life's work, and its appeal. The argument that somehow the Western mind had become attached to words, to language, to the arguments of philosophy, rather than to the things of the created world by which it found itself surrounded, instead of learning from patient humble observation of God's actual creation. European thinkers in Bacon's early criticisms were portrayed as having devoted themselves to verbal to rhetorical skills, designed only to win personal things or dispute, to shine at the university to gain prizes and admiration.

But all from the manipulation of words, and never, from some linkage of the human mind, to the things of the world itself, at most for Bacon, looking at that part of the disputation that had to do with experience, the European philosophers had masqueraded a few perfectly commonplace observations, mostly untested, as if they were the fruits of genuine patient inquiry into the world. And where we needed desperately, a knowledge of nature that could alter the human condition for our betterment. By understanding and interacting more favorably with the things of the world. We have from our most educated students, only sophistry and debating techniques. In a metaphor among many for Bacon lows, metaphors, and a metaphor crucial to extort. They can call for a divorce, of theology and natural philosophy and a new marriage in natural philosophy of the human mind close with things themselves in a chaste, holy, and legal wedlock. And quote, instead of the unholy alliance, of minds and words, you in creations, we needed a marriage of minds and the actual things of God's creation. And that marriage should be we'll explore the metaphor chased, holy and legal. By chaste Bacon means without ornamentation, simple, without flights of fancy. Chase not only did not mean bearing, for bake, but a chaste marriage, without flights of fancy without ornamentation, without self-indulgence would be the only kind of marriage of mind and things from which there might issue. Offspring worthy of European philosophy and knowledge of God's actual created world. That marriage had to be holy, by which Bacon meant two things. One, that it must be undertaken with Christian utility, and Reverend so Bacon, what is involved in the Aristotelian

scholastic system is in one very real religious sense of blasphemy, something unholy. It is the imposition upon God, of a human skin for what the world somehow had to be. It is taking the fanciful product of the human mind, and imposing that upon God's work, a proper Christian Holy philosophy in Bacon's, you would assume that we begin not knowing that we begin in ignorance, and that we must patiently and without arrogance, learn from study of the creation, what God actually has wrought in the creation and not impose our philosophical schemes upon it. A second meaning of holy, and it's very critical to understanding Bacon's appeal in Protestant England, in the 17th century, and among other things, his appeal often in Calvinist and Puritan circles, as well is that philosophy must be holy in the sense of producing charitable works. Motivated by Christian knowledge, excuse me by Christian charity, and knowledge that can be used to alleviate human misery to increase human well-being to reduce the suffering of one's neighbors to enhance

The quality of the lived life of one's fellow creatures, the Aristotelian scholastic system. From Bacon's perspective, only one glory for its verbal practitioner and nothing followed from it. That reduced human suffering that increased the ease the well-being of the human condition. proper knowledge, then must be holy in the sense of humble, not imposing a system upon the creation, but learning from study of the creation, what God actually has done, and motivated by charity, giving us a kind of knowledge that we may use to reduce human suffering to enhance human well-being, and it must be legal, by which Bacon meant, according to rules, and proper method, philosophy he believed had been governed by human self-indulgence. We believe those things that we wanted to believe. We believe those things that our genius could assemble into some intricate, harmonious system so that we could admire our own handiwork. The antidote to that was a proper method to the acquisition of knowledge. Absent that, for baking, we will lose he compared method to a path he said there are runners who are very fast. But if you put them on the wall, their speed only takes them further away from where they want to be more quickly. You can take someone who is slow, if you put that person on the proper path, that person will arrive at the desired place. Method serves the function of that path, put genius in possession of a wrong method for learning of the world. And genius will fly ever more quickly to error and fancy. What the species needed was a method so that it could link its mind to the things of the world humbly and productive of works to reduce human suffering, and to enhance human well-being. So, they can your opinion thought had become enslaved to the systems of five or six Greeks who would lock themselves away in scholar cells, and earn fame by devising pompous systems of all-inclusive knowledge of the world. These systems of thought had no place he believed in Christianity; they were devoid of the fruits of charity. They had infected Europe's relationship to nature, and had cast the shadows of empty theories and systems between human kind, and the natural objects with which we live. But having made this criticism, Bacon found himself facing an awesome challenge. How does one convince thinkers to abandon a system of philosophy and accept a new method of philosophy, when they are very criteria for accepting or rejecting systems of philosophy, they are very standards by which to judge methods are based upon the very philosophy you would have them reject the very system of thought, in which they all had been raised? Aristotelian method and substance were taught in a work that all students pass through in the course of their education, the Organon and Bacon audaciously, wrote a new Organon, a new instrument of knowledge, and he addressed the problem you faced head on and dramatically close. I cannot be called upon to abide by the sentence of a tribunal, which is itself on trial, and, quote,

he would not seek to convince anyone within Aristotelian ways of reasoning to reject anything philosophical for it was precisely the Aristotelian enterprise that he was challenging. My disagreement, he wrote, quote, is upon first principles, and very notions, and even upon forms of demonstration, and quote, facing such an extraordinary challenge, begun appeal not to philosophy itself, but to the human consequences of thinking differently. They can essentially think that his readers should agree with him,

on one proposition about being human, and one proposition about being Christian. Concerning our being human, that we should put philosophy in the service of the human desire to be less helpless, less passive, in the face of nature. The end of knowledge, the goal of knowledge that they can propose was the expansion of human empire, over the phenomena, on which our suffering or our well-being dependent, if that was a goal of human knowledge, to be less helpless, to be less passive, to be able to alter our phase in terms of suffering, or well-being, if you granted him back Bacon, then odds are, he could show you that new kinds of knowledge and new methods of knowledge must be sought to achieve that goal. Setting Secondly, Bacon appeals to a Christian ethic, that human knowledge must be in the service of charity. That is Christians, we all he addresses his 17th century audience enjoined, above all, in our relationships with other human beings, to be governed by charity. We shall know things Bacon rights, by their fruits, and the fruits of knowledge must be charity, service and ministering to one's fellow creatures. As Bacon put it close, there is no sign more certain and more noble than that from fruits in religion, we are warned that faith must be shown by works, it is all together right to apply the same test to philosophy. If it be barren, let it be set at naught and quote, if it be barren, let it be set at naught zero, a wholly new beginning and absolute break with the past of European knowledge. That phrase philosophy needs some clarification. Philosophy is all human knowledge for the medieval and 17th century mind that is independent of theology. That is why people receive doctorates in philosophy, even if they study literature, or the biological sciences. We've inherited that the title Doctor and Latin diplomas from the medieval and 17th century university philosophy is all human knowledge other than that, which stems from theology. So, think van upon the drama of what Bacon is writing in the early 17th century, if it be barren, let it be set at naught let all prior claims of human knowledge or prior claims of method

all human learning be set to zero. Let us break absolutely with all authority and let us have a new beginning to the human attempt. To know, and to understand the things of nature. From this point on Bacon set for himself a monumental task which he could never complete, that he termed the Great Instauration. That is to say, the great new beginning. In his original design, it was to talk about how learning could be advanced, what the method of learning should be. And by application of that method, what we actually did and did not know, and how we might proceed to know more, he did finish its most essential part, the new Organon, the new method for acquiring useful knowledge. There are four great things to Bacon's work. First, the argument, that knowledge is human power, that knowledge is power. That knowledge of plants is not to contemplate them in light of their forms, their perfections their relationship to things divine, but to know things about plants that allow us to be spared the starvation of failed harvests that allow us to predict the circumstances of enhanced plant growth. Knowledge of rivers is not a contemplative appreciation of the Scholastic system of perfections and purposes, but understanding of Riven that allows one to harness their energies, to utilize their forces to predict their behaviors, to avoid floods, and ravages when you know something, you don't just have a contemplative appreciation. In Bacon's system of knowledge, when you know something, you are capable of altering your interrelationship with the thing known, you have increased your power over the human interaction with the objects of your knowledge, familiar with worldly commercial political England, they can enormously impressed by just how much has been accomplished outside of the university, away from the learned on the basis of unmeasured article unsystematic haphazard observation, what sailors have come to know about the seas, about navigation. What merchants have come to know about Weights and Measures. What one has come to know about mining and testing a saying the purity of currency, what one has come to know about artillery the means of warfare. For begun, all of these conquests have now have occurred. Apart from the world of the lowest learned, with no method, haphazardly, randomly by trial and error, hit or miss. Imagine Bacon appeals to his audience. If we sought that kind of knowledge, actually knowing what we were doing, systematically on the basis of a sound method. Though the philosophies pay failed

to pay attention to it, we've accomplished so much by chance in those areas where people understand that knowledge must be power. The invitation is how my human beings alter the very relationship of our species to nature, if the learned ever got serious

About studying the human world, now often, Bacon's model of knowledge is power. is cited as if it were a glorification of Human Empire for the sake of human Empire over nature. Two cautions must always be added to our understanding of Bacon here. One is insistence that the model be charity, never private gain, never private aggrandizement and to the power over nature only comes from being humble in the face of nature. In Bacon's celebrated aphorism, quote, nature can only be commanded by being obeyed, and, quote, if we impose our scheme on nature, were helpless in its presence. But if we learn from nature, what nature is, if we obey nature, in the formulation of our knowledge, then we are in a position to increase human Empire. The second great thing to Bacon's work is the separation of natural philosophy, what we would now call science, from theology. The mixture for bake, and it's a theme we shall hear much of in the course of the 17th century of natural philosophy, and Christian theology has nothing to do with the things of faith. Scripture did not enjoin upon us, a set of favored philosophers. Strictures is the proper intellectual methods. Canonical authors on the subject of astronomy or navigation or natural history, we must take and wrote, give, to face those good to face those things that are faiths. But then faith must give to natural reason, those things that are the province of natural reason. It is not the business of a student of the natural order to tell people how to go to heaven. What virtue is what charity is. But it is not the province of a theologian to tell us how plants grow, how rivers behave, how nature is organized as a natural system. The third great theme of Bacon's system is the method of induction. In logic, we distinguish between two categorically distinct uses of human reason. One, when we know a general principle to be true, as in geometry, the Deduction the drawing out from it of what follows given our knowledge of straight lines, we may deduce that parallel lines never intersect. The other method in the use of logic is induction in which we move from particular things known to general principles that are true about those particulars. This is the Bacon, the only method appropriate to the acquisition of new and useful knowledge, in theology, in the law, deduction indeed, should be the method. But if we are to learn from nature, we must do that inductively we must experience the particles of nature induced from our knowledge of the particulars generalizations that are true about those particular things. And then we must test them for the test must always be in nature. If I am correct, that this is generally true about all of these particulars, then the following should happen in the following set of circumstances.

So, there is the heart and soul of Bacon's method, we observe nature, its particulars, the actual behavior thing we induce from knowledge of those particulars, generalizations we test them in experiments designed to see if we have understood the behavior of things. When we have sets of generalizations, we then seek to make generalizations about our generalizations to induce yet more general knowledge. So, we know certain things about apple trees, about cherry trees about peach trees, and then we seek to know what we know about trees and combining that with other sets of generalizations, what we know about agriculture botany plant growth, this is the method of induction and at each step, we all have to let nature command us and the way to do that is by devising the experiment that would show if I am correct, certain things must follow and to test if they follow. We see here a very dramatic assault upon all authority, we shall assume nothing. We shall not draw our knowledge from texts from prior authors. We shall draw our knowledge from observation, induction and experiment upon nature. And we see here a very dramatic assault upon the authority of the syllogism for the value of the syllogism is only as high as the certainty of its premises. If A is true, if B is true, then C follows. **But exactly what we don't know is is a true, exactly what we don't know is is being true.** The syllogism makes us logically consistent, but it makes us logically consistent in our ignorance or in our era, and knowledge must proceed inductively from the study of nature. Finally, the fourth major theme of Bacon's system is that science, natural philosophy must

be a dynamic, cooperative and cumulative enterprise. One Mind will not master the creation. The natural order is not something that genius contemplates, and sounds all areas of. there will be no new Aristotle who understands it all. It is so very difficult to know, to eke out or knowledge to scratch, for real generalizations about the natural order. And we begin in such abysmal ignorance because of our having been enslaved to philosophical systems. We begin in such abysmal ignorance of the world where in and what's in it and how things work and how things proceed. That we must always proceed dynamically open to change, always revising, always testing, always letting new knowledge modify what we thought we knew, we must proceed cooperatively with different researchers working in a great variety of fields of inquiry. And we must be cumulative in our knowledge always moving to higher and higher orders of generalization. Now this notion of a cumulative science is a very dramatic intellectual and moral break. In the way of society, you can see itself for think of the model of Aristotelian scholasticism. There was, there were the great authorities. There were the Greeks, there was Aristotle. We are pygmies on the shoulders of giants, feeling only because they saw producing nothing greater than they looking back to a golden age of knowledge.

There was this one explosion that was Greece and Rome that preceded Christianity. Then came Christian theology, the sin This is of the two, and we have what we need. And we look back to the ages of genius. Bacon's model reverses that entire structure, and one can think of progress. The future will always know more than the past, we may always advance we may always proceed.

To do this, however, we had to overcome all of the weaknesses of the human mind for it was not accidental that we were so bogged down in error. They can offer the metaphor of three kinds of mind. There was the end that just piled up data just made piles of things, and saw nothing in it. There was the spider who Whoa, an exquisite and complex web, but of the stuff of its own being. The ends were just the collectors of facts would make no contribution to real knowledge, the spiders with a Greek philosopher as the Aristotelian scholastic who spun out these intricate systems that had no relationship to reality was just of their own imagination. Rather, he said, the natural philosopher must become like the honeybee, who takes from the things of nature, mixes it with the stuff of his own being inductive method, reason experiments, and produces something sweet and useful to human life. But why so many spiders? Why so many philosophies with these whole systems, because Bacon wrote, we worshipped fool's idols in the world of knowledge. First, there were what he called the idols of the tribe; all of the things inherent in human nature that led us into error. We flew the order, we try to see order where none existed, we were impatient. As a species, we wanted to know everything at once and make sense of it. We were not systematic; we were affected by sudden experience. One violent thunderstorm taught one more than 1000 days of patient observation of nature, because it made a deep impression. Our senses were deceptive and prone to error, which is why we needed experiment, we were affected by emotion and what we wanted to believe there were idols of the cave, he wrote, idols of the individual man, our own peculiar particular biases and predispositions, arising from differences of physiology, psychology, educational experience, hence the need for collective effort. There were idols of the marketplace, the stuff in which we engaged in the exchange the currency of philosophy, words, words distorted and misled us again and again, we had allowed our philosophies to develop around ambiguous equivocal words, the same word could mean 15 different things. We had ambiguous abstractions that preceded and controlled our observations and our pursuit of knowledge. Instead hears words should arise to be applied to rigorous, methodical observation in the sciences, a word should have a fixed meaning. Finally, there was what he called idols of the theater. Our received philosophical tradition and heritage, above all, Aristotle, for whom he reserved his most intense invective. But above all, the whole notion of authority. We should not be impressed that anything has stood the test of time, Bacon rose. If you think of things on a river, what is profound sinks and disappears. He did have a way with metaphors, what with light and insignificant was carried along the

rivers and oceans of time. We should not be impressed by what had reached us. Rather, Bacon offered a new vision to the learned world, that the proper use of the human mind could produce a new relationship between humankind and nature, in which mankind actively could seek for its betterment. He wrote a utopian work the new Atlantis in which human beings govern their relationship to nature, and to society on behalf of their real interest. And the instrument was knowledge, knowledge neither speculative nor magical, but knowledge methodically drawn by patient observation and experiment, producing verifiable and serviceable truths about the behavior of the things of this world.

Thank you

Lecture 3: Descartes vision of perfect knowledge³

We turn now to Rene Descartes and his vision of perfect knowledge. one of the most extraordinarily influential forces in the 17th century and indeed in the history of western thought. There is a certain sense in which when attempted to say that they can was correct, the human mind does thrive for order. The human mind does want a whole philosophical system. 17th century is a period of fundamental assault upon Aristotelian philosophy and by far the most successful of those challenges until the Newtonian revolution at the end of the 17th century, was the systematic or encompassing philosophy of Rene Descartes. There is a certain dream in the history of western philosophy. Plato summed it up well in his analogy of the cave, that as human beings we find ourselves the equivalent of prisoners trapped in a cave. Seeing only from within the confines of that cave. Real things pass to and for at the door of the cave and the shadows are reflected on the wall of that cave. The walls of individual human experience, think back to *Bacon's* use of the ideals of the cave. How each of us is trapped in individual human experience and we try to talk about what the world really is, we try to talk about what things truly are, on the bases of seeing these shadows that are cast against the walls of the cave of human experience. The dream of the philosopher Plato noted, would be to walk out of that cave and steer actual and know actual things as they truly were, not things just as they occur in our experience, not things as they came to us but things in and of themselves. The real components of the real world. Plato argued, the philosopher who walked out of that cave would be first blinded by the sun of that light. Descartes was someone who whom significant numbers of the deepest and most influential minds of the 17th century believed, managed to walk out of that cave. To overcome the limitations of things as they appear to us in human experience, to see the world as it truly was, to know what things really were in and of themselves and to let us know both the fruits of that and how to do it ourselves. One has to understand that at some level, the appeal of that image of the philosopher. Someone who can escape the limitations of appearance and stare directly with knowledge at what things truly are in and of themselves, to understand the truly remarkable appeal of Descartes, upon the 17th century. An appeal that occurs across the broadest, possible, spectrum that is to say there are mystical monks in catholic monasteries, who read Descartes with intensity, with passion. Whom become Cartesians as we call his followers, who became passionate and tense Cartesians and on the other side of that spectrum, there were catholic and protestant physicists, students of mechanics who become passionate Cartesians. Across the boundary of catholic and protestant from the extremes of mystical monasticism to the laboratories of

³ Transcript by Shehu Kunya

new mechanical sciences one finds in the 17th century Cartesians. He gave to Europe not simply a new method, not simply an invitation to challenge Aristotle but another hole, complete in the minds of his admirers' perfect philosophy. Perfect in the 17th century means whole, complete. And his appeal and his influence are truly almost incalculable, He is the continental alternative to Aristotle. There are many competing systems, but by large, the great challenge to Aristotelianism in the 17th century, until a new tidal current of English empirical philosophy born above all on the Newtonian achievement will sweep it away. The great challenge to Aristotelian dominance will be from the followers of Descartes, the Cartesians. He is an exceptionally difficult philosopher and he is in the context of the 17th century, an exceptionally, exciting philosopher. So let me see if I can overcome or at least clarify some of those difficulties and make clear why in terms of the 17th century, he generated the electricity of the philosophical intensity that in fact he did. One way to think about the appeal of Descartes is to see a convergence of crisis occurring, that to which Descartes responds in his philosophy. In history, often convergence is everything and a large number of simultaneous crises occurring in the world of European thought are responded to in dramatic ways by Cartesian philosophy. First, there is the crisis produced by the very fact of the protestant reformation in the world of European thought and philosophical debate. There always have been, so long as Europe was unified under the catholic church of final court of appeal. Philo sophists might argue, the church might tolerate within limits certain intense philosophical debates but there always was a way to provide closure to those debates. So, there was if you will a supreme court on such matters, the church herself. In the wake of the protestant reformation, obviously Catholics and Protestants debating with each other cannot appeal to the ultimate sorority of their own religion. Protestants can't say and convince Catholics but this is a correct protestant interpretation of scripture, whatever the Catholic Church says. Rome isn't to convince Protestants by saying but however you read scripture or however you argue certain phenomenon. Here is what the councils and papacy have rendered as a judgment guided by Holy Spirit. What the reformation makes very clear to a large number of European minds is that individual thinkers must have a criterion of truth. Independent of particular theological claims by which they can judge those theological claims and a lot of Europeans in the wake of the reformation are thinking about. what is a criterion of truth that transcends even religious debate that allows you to judge even religious debate? Related to this, for much uses made of it in protestants – catholic debate but independent of it as an intellectual phenomenon is the revival in the 16th century and the growing appeal in the 17th century of a school of Greek philosophy known as skepticism and the real meaning of skepticism is not as it comes to mean in ordinary language in the 20th century, doubts about religion. The real meaning of skepticism is the philosophical position that argues that human beings do not and may not know everything with certainty, that we are incapable of achieving certainty. In the wake of protestant-catholic debate in the 16th century, both sides make use of the revival of interest in Greek skeptical philosophy and one of the great publishing successes in the 16th century is a compendium by a Greek skeptic named Sextus Empiricus, of the main arguments of the schools of Greek skeptical philosophy and its uses to both Catholics and protestant apologists. An apology does not mean "apologist", someone who apologizes for a religion but someone who defends it, that's been an interesting change in meaning. An apologia is a defense, so an apology of faith is the defense of faith, not an

apology for the faith. Catholic and protestant apologists of the 16th and 17th century both found it useful to take skeptical philosophy and harness it to their arguments and causes. Protestants could say if the human mind cannot know anything with certainty that shows the need for a leap of faith for reliance upon scripture and the word of God. Catholic theologians could argue if the human mind cannot know anything with certainty, including whether its own interpretations of scripture are correct, that shows the need for the authority of church governed by the Holy spirit, infallible and both catholic and protestant apologists do much to spread the arguments of classical skeptical policy. Those arguments can be seen as assaults upon things known by the senses, stressing the fallibility of the senses, how deceptive they are, attacks upon human reason, arguing that it is very easy to show arbitrary assumptions and logical fallacy in almost any arguments or position. But most traumatically of all, classical skepticism seeks to demonstrate that we cannot advance beyond certainty by showing the problem of the criterion of truth. How do you know something is true, you know something is true because you have a criterion of truth, in order to know something is true, you have to have a standard, a criterion of truth? Okay, how do you know that your criterion of truth is true? You will have to have a criterion for criteria of truth. Well now you see the problem, how you know that your criterion for criteria of truth is true? You would have to have a criterion by which to determine whether a criterion for the criteria of truth is true and infinitum (forever). This is a very dramatic argument in classical skepticism and the Pandora's Box for all those religious apologists who introduced larger and larger numbers of minds to the arguments of classical skepticism, that we had no resting place, how can you know something with certainty if the claim of knowledge with certainty depends upon a criterion of truth? That you would have to demonstrate by prior criterion of truth about criteria and infinitum. So, they categorize in the midst of the crisis in knowledge and find courts of appeal in knowledge occasion by the reformation and in the midst of a certain crisis in philosophy occasioned by the revival of classical Greek skeptical philosophy and above all the argument that poses about how in the world without arbitrary may one arrive at a criterion of truth. A third thing we know to be the case of crisis in the midst of which Descartes philosophy will appeal to so many is that skeptical philosophy begins exerting a wonderful appeal upon the young, above all students in universities, dissatisfied with Aristotelianism, dissatisfied with the authority of their professors, mastering arguments of skeptical philosophy. They annoy their professors at the university beyond bearing with skeptical objections, challenges to sensory information raising the argument of criterion of truth and saying they will believe what they damn well want to believe since all human thought is arbitrary. And the Aristotelians are not the satisfaction of many doing the very good job of curving the appeal of such skepticism about human knowledge among the young. Fourth, at the same time adding to our convergences, there is a great revival in the appeal of mathematics. Subject to which we will return in our next lecture on the new cosmology but there is a great revival of interest in quantitative as opposed to qualitative knowledge about the world. You think about the Aristotelian system, the knowledge it gives you is qualitative, the qualities of things. The early 17th century is the inheritor of a great revolution in mathematical philosophy in the 16th century, much of it quite mystical. A faith that there will be mathematical order in the universe and a large number of minds is beginning to be drawn to quantitative, not merely qualitative thinking about nature and finally there is the challenge to Aristotle as I

indicated, there are so many among the newly educated in the early 17th century, throughout the 17th century who find the Aristotelian system inadequate, unsatisfying and are desperate for alternative models of the human mind, knowledge and the cosmos and Rene Descartes will appeal to all of these crises and all of these appetites. Descartes comes to fundamental philosophy, not via his university education which he despised. He found Aristotelian philosophy unsatisfying from the start but through his work in mathematics. He is the creator of analytic geometry and he was very struck, though he thought of mathematics initially as a trivial area of knowledge compare to issues of deep philosophy, he was very struck by the difference between how arbitrary everything seemed in philosophy taught in schools and how compelling a conclusion reached in analytic geometry and mathematics was. He began to wonder and to work on, a means of overcoming skeptical challenge in philosophy drawing not upon the experience of Aristotelian scholasticism but upon the power of that experience of a compelled conclusion in geometry, in algebra, in analytic geometry and he undertook both the discourse on method and what he turns meditations on first fundamental philosophy, in which he sought to see is the human mind could overcome skepticism and achieve certainty. He believed that one of the weaknesses of all the attempts to overcome philosophical skepticism had been that people had never given the skeptical argument full force, that they created a straw man. They showed us the skeptics of their strongest and overcame them. He was determined to make a better case for skepticism than any skeptic ever had and then to overcome it in such a way that people would understand the possibility of certainty, have a criterion of truth and with that criterion of truth we can construct their knowledge of reality, so he engages in hyperbolic doubt, pushing doubt to the absolute limit, he says I will believe nothing, unless I am absolutely compelled to do so. I will dismiss from my mind anything I ever thought true and doubt everything until I absolutely cannot possibly doubt. Well, what about being in this room, talking to people, touching in front of one, well they caught rights, what about dreams? Have you never had a dream in which you said I am not dreaming; these are real people in front of me? These are real objects, everyone has now distinguished between dreams and waking, further the senses of themselves absolutely deceptive something at a distance looks small, something close up looks large, the neighborhood house looks bigger than the sun, a twig looks straight in the air, bended in water, which is the true medium, and the senses are deceptive. Well, what about logic. Well but what about logic, have you made an error in computation. Suppose he writes and here he goes beyond the skeptics, suppose there were an infinitely powerful, infinitely wicked being, who used all of his power to deceive me, suppose there were an infinitely evil deceiver, would it be possible that between the first step of an argument and the second step of an argument, I could lose the train, I could lose the sequence, I could not remember accurately where I had the gun, of course that's possible or neither from the senses nor from the reasoning, can I find my grounds to certainty, I can doubt everything, I can doubt that you exist, that this room exist, that the world around me exist, that I exist, wait a minute, that the world around me exist, that I exist, wait a minute, I can doubt whether I exist? I can't, I absolutely can't because if I am right or if I am wrong, I exist to be right or wrong, knowing, doubting, right or wrong from the very fact of thinking, I cannot deny my own existence, it is impossible. I could give you any wild hypothesis to explain a way the reality of this room or the logic of mathematics, the evil deceiver but even if I am being deceived by an infinitely evil deceiver,

I exist to be deceived, I exist right, I exist wrong in fact as he put it in Latin cogito, ergo sum I think therefore I am, thinking makes it impossible to deny the reality of thought, the thinking being, now what is dramatic about proposition to Descartes is not that it gives us this one truth, I think therefore I am but it gives something indubitable, that not even under the evil deceiver hypothesis I can doubt, so if I figure out what is it that makes that proposition indubitable, what makes not susceptible to being put into doubt, I have a criterion of truth and Descartes' analysis the nature of the experience of the inability to doubt cogito ergo sum I think therefore I am as being composed of two parts. One, it is what he calls clear, that is to say self-evident, the moment the mind contemplates it is self-evident, I think therefore I am, there is no conceivable hypothesis under which it could be doubted its self-evident. Two, its distinct meaning it is not true, dependent upon any other truth. If I said A is true, B is true, C is true then D is also true that might be evident, clear but it's not distinct, its truth depends on ABC the truth of cogito, ergo sum I think therefore I am is both its self-evidence and its being distinct, independent nothing else need be true for it to be true. Now I have a criterion of truth, when I find ideas that are clear and distinct, I know that I may be certain about them. The task of any Christian philosophy is in its earliest stages, to prove the existence of God and the immortality of the soul, further more Descartes in order to put us in doubts about reason itself has hypothesized an infinitely evil deceiver and he recognizes this is an idea in his mind that violates another idea in his mind, contradicts it, the idea of God and so he asks, what do I know about this idea in my mind? I have established my own self existence, now I find drawn this to idea of God, Descartes argues that the idea of God clearly, indistinctly establishes the existence of God. One of his arguments that becomes most celebrated in the 17th century is one of the most influential, intriguing and for many people enraging philosophical arguments in the history of philosophy. Followed it if you can from with Descartes thought, we want clear and distinct truths. He argues as such, are certain things true or false about a being, whether that being exist or not, yes for example how many horns does a unicorn have? It has one whether or not a unicorn exists or not, a unicorn that's the nature of a unicorn. It has one horn. Does a unicorn exist? I don't know, but if it does it has one horn. How many sides does a chiliagon have? A thousand. How many angles? A thousand. Has anyone ever made a chiliagon? I don't know! But I know the sum of its angles, I know certain properties it must have to be a chiliagon. In short, I can say true things about certain entities, without knowing whether or not they exist. A triangle on the other side of mars has three angles, sum of which is 180 degrees, that's a triangle. Now what's God? God is an infinitely perfect being, a complete being all positive attributes to infinite degrees. So, let's do what we did with the unicorn. Does a unicorn have one horn? Yes. Does God have infinite love? Yes. God has infinite love whether or not God exists. Does God have infinite wisdom? Yep, perfect being has infinite wisdom. Does God have existence? Yes, God has existence, if he didn't have existence, I could imagine a being more perfect, a being with all those other attributes that did exist. Wait a minute, in the same way that a triangle must have three sides, in the same way that a unicorn must have one horn, in the same way that a chiliagon must a thousand sides, a perfect being must have existence and what is it to say that something absolutely, undeniably, indubitably must have existence. It exists. clearly and distinctly with the same force by which a triangle must have three sides, God must have necessary existence, and in fact a perfect being that doesn't exist is a self-contradiction. Self-

contradiction can't be, a perfect being must exist. Now we have not found the criterion of truth, we have used it to demonstrate something from Descartes perspective we thought we knew anyway but now we understand for the first time why we know it, that a perfect being, God exists. Well, I knew I had a mind and I have proved that I have a thinking being, thinking being must exist given the cogito ergo sum and I thought I had a body but I was able to put that in doubt with dreaming. Now I have my criterion. One, there is no evil deceiver, because a perfect being exists and a perfect being isn't infinitely evil, a perfect being is infinitely good. I have proven that by logic, by a clear and distinct idea. So, I need to examine what I knew by thought and what I knew by body and if I get a clear and distinct idealism, I know that clear and distinct rational thought knows reality. Clear and distinct ideas give me indubitable, absolutely necessarily true understanding of the world. The century was excited already by what Descartes has done, now what is it when I say I think, I can think correctly, incorrectly, well, badly. I can will in my mind, I can will good, I can will evil. In short, the clear and distinct idea I have that if you change that it will no longer be there, is that mind is thought. There exists a dimension reality that is thought. It can't be divided, there's half thought, it's not located in space, yeah, I will take this idea and move it. It's an immaterial dimension, I was certain of it before I even knew if I had a body but if bodies don't exist, I am a victim of the cruelest hoax because everything about my being convinces that there are bodies, there is no evil deceiver, so something is out there, I may have a wrong idea that something is out there, otherwise we are the victims of the greatest practical joke imaginable. If it's all in our imagination, let me analyze my clear and distinct idea of what's out there, what does Descartes do? He says we must find the aspect of our idea of matter that simply cannot be doubted, and it has nothing to do with the things we know through senses, think about it, I take a yellow piece of wax and I say what do I have in my hand? Well, it's yellow, smells of honey, certain hardness or softness, but now I move closer to the fire, the smell, the feel changes, the color changes. Something is out there, capable of being one or the other. Matter wasn't yellowness or softness; it was something capable of appearing in those ways. Now what must it be that contrast with thought? Descartes answers extension, dimension in lengths, widths and depth that is what is real, that is what exist, the material universe is an extended substance in lengths, width and depth, capable of appearing to us in different ways, depending upon things that happen to it and Descartes moves us into a dualistic philosophy in which there exist two distinct realms. One, a world of immateriality, of thought, of God, of soul, what makes things corruptible is that they change, divided they decay but souls, thought, mind doesn't occupy space, can't decay, can't be divided, is eternal but there is matter, it's the visible, its measurable, occupies space, its extension, in lengths, width and depth. What can you about a material universe defined as extension, length, width and depth? You can know dimensions, you can know motions, you can know the mechanisms of matter, touching and communicating, force to matter, but you can look at extension from any perspective from morning till night and you will know nothing about perfections and you will know nothing about purposes. Descartes invites us to divide our world into the immaterial, the spiritual, and the mental and matter to be measured, matter in motion, producing all effects to devise in effect a physics of material reality. Now Descartes argues that in and of itself matter is an earth, it just occupies space, if it's in motion, it's been put in motion by something immaterial, so we know that gods will set matter in to motion from which Descartes

deduces something dramatic, god being perfect, god being unchangeable, he will set matter into motion according to fixed in all tolerable laws, he will not change his mind which means that the whole of physical, of material reality is matter in motion to fixed mechanical laws. Mechanical because they are the quantifying of motion and we are invited to explore a spiritual world in thought and a physical world in measurement, and in mechanical physical science. The Cartesians insist upon purging all physical, material and natural philosophy of spiritual causality. They lead the assault on witchcraft beliefs, hell storms don't occur because of evil curses cast it, in the summer produce ice, it is a physical phenomenon to be studied mechanical. Well water gone bad, frequently blamed on witches, illness, crop failure, hell storm these are purely physical events and that dualism is the heart and soul of Cartesian philosophy. The implications are very dramatic, think now on the whole of the system. One, authority is of no value what so ever, the human mind is free by its own rational powers, its own rational forces to construct with the demand for certainty and the compelling demonstration, its vision of the world. Reason is strong, with it we can comprehend the whole of reality. Aristotle both as a systemic philosopher has got it wrong and in his physics of perfections and purposes has fail to grasp the actual reality of the physical, in which we find ourselves, which matter in motion, mechanistically. There will be metaphysical speculation about God, about souls and we can reach certainty about such things if we hold to reason and then they will be separate and apart from that, a quantitative physical science of measurement. There is also a set of problems in the Cartesian system that will hunt western philosophy from that moment on. So, you will that we talked about mind and body, matter and spirit as dualistically separating and yet we find them linked in human experience. We are the exception to that; we are the possessors of both will up and down body. How does mind know body? Mind now knows matter touching matter, how does matter receive communication from mind to move, to act? The mind-body problem given by Cartesian dualism will hunt western philosophy from that moment on. Two, the problem of miracle, in the Cartesian system all physical phenomenon is the product of matter moving matter according to fixed mechanical laws, Gods' perfection means that God does not change his will. But the Judeo-Christian tradition is built upon the notion of miracle of divine intervention in the natural world of propitiatory prayer in which he asks, for meteorological events or physical events to be alerted by the will of God. The Cartesian responses, well it's a miracle that's what we mean by miracle, it's beyond comprehension. Who knows? Perhaps God wound up two separate machines from the start, so that certain moments there will be a correspondence in time of physical and of spiritual phenomenon that when God set the world into physical motion, he knew that at a certain moment, a rare sure of a bitterly illness would occur at the same time that someone was saying a prayer, but why speculate on such things? The Cartesian said, what we mean by miracle is beyond human comprehension but this doesn't satisfy for what Descartes has given to so many of his readers, is a sense of the absolute comprehensibility of the world that we can think on spiritual things with the logic of metaphysical philosophy, reason apply to things beyond the physical dimension and that we can understand the laws of mechanics of matter and motion which when we understand them, we shall understand why all things are as they are in the physical world, for there is no purpose to be known, no perfections to be known but the mechanisms of a fixed and determined physical universe. The appeal however to so many is in the synthesis, phylogenies embrace mechanistic

physics from a Cartesian perspective saying it befits God as a perfect being that the universe should be matter and motion according to fixed mechanical laws. Physicists embrace speculative philosophy that the universe being disclosed by mechanical philosophy indeed is consistent with the idea of the perfect being who could not possibly not exist. The struggle is joined in the universities where Cartesian's struggle to achieve a voice in curriculum and textbooks, in courses silenced again and again, they find ways to offer what they take to be the deep philosophical vision of Rene Descartes. At last, so many in the 17th century believed someone has gotten outside the cave, understood what god was, what mind was, what matter was, why and how the world was what it was and with the use of reason, we touched the world as it really was. The appeal of Descartes will be as I said extraordinary.

Thank you.

Lecture 4: God's mathematical order, the new cosmology⁴

We shall talk in this fourth lecture on cosmology and God's mathematical order, in the 17th century. The Astronomy, which the Aristotelian's and scholastics had adopted as their canonical authority, was that of Claudius Ptolemy, a Greek astronomer of the second century AD .It was, in fact, quite reasonably useful astronomical tool. you could make not bad predictions about the course of planetary motions from it. But above all, for the Aristotelian scholastics, it was wonderfully consistent with the Scholastic worldview. It held that the earth was at the center of the universe, and that the moon, planets, the sun, and an orb of fixed stars, revolved around the Earth, in perfectly circular motion. And within certain limits, that indeed, is certainly the way things look.

Among the intellectual movement that arose to challenge Aristotelianism in the 17th century, was a revival of a line of thought that traced its lineage back to the mystical, ancient Greek philosopher Pythagoras. We call this thought Neo Pythagorean fall, where the scholastics view God's creation in terms of perfections, and purposes, quality shared in various degrees with God, and purposes, instilled in things by God. The Neo Pythagoreans view God's creation in terms of mathematics, and geometry. In their philosophical theology, the divine mind, God expressed itself; indeed, expressed its divinity in the order and in the harmonies, and the ratios of the created universe.

Indeed, the Pythagoreans and Neo Pythagoreans were fascinated simply by the harmonies of the plucked string. And the human ear's ability to perceive those harmonies, and the ability to state those harmonies mathematically. It's not a bad image of what it meant for Pythagoreans and Neo Pythagoreans, to contemplate mathematical order, and harmony and ratio. It put them in touch with the music of the universe, with the harmonies of the divine mind, manifested in the created Whoa.

Reality, emanating from the Divinity itself, was numerical and geometrical. In addition, the Pythagoreans saw the sun luminous and perfectly circular, As a most special thing in creation. The early Pythagoreans worshipped the sun. We know the later Neo

⁴ Transcript by Alireza Mamdouhi

Pythagoreans, new Pythagoreans, saw it as a virtual emblem of divinity, a seal of divinity, a representation of divinity, stamped upon the universe.

When the astronomer Copernicus in the 16th century, and initially with very little influence, revised the Ptolemaic system to make it, by the way, more circular and more harmonious his primary concerns. Otherwise, there was very little to choose between the Copernican and the Ptolemaic astronomy. Copernicus placed the sun at the center of the universe, and in his scientific work, turned that sun into the lamp, the mind, the Ruler of the universe, God visible, and he spoke of the center of the universe as the rightful place for that sun.

The most meticulous observer of the heavens for Copernicus, just looked at Ptolemies data then looked at the heavens themselves, the most meticulous observer of the heavens in the early 17th century, was the Danish astronomer Tycho Brae. Based upon his extraordinarily precise observations of the Heavens, He did not accept Copernicus's system. He did, in terms of the immediate solar system, put the planets in orbit around the sun, but then he put that sun, with the planets orbiting around it itself, in orbit around the Earth; which remained in the center of the universe. So, in Tycho Brahe system, there was the earth in the center, circled by a sun around which circled the planets, and then circled by the outer orb of the fixed stars.

The inheritor of Tycho Brahe data was, however, the extra ordinary figure Johannes Kepler, one of the truly astonishing figures in the history of European thought. He is a Neo Pythagorean mystic. He is a worshiper of numbers. He is a fortune teller. He is an extra ordinary mathematician. He is an astrologer, and he is an astronomer. The secret of Kepler's truly Herculean labor, by which he attempted to fit the data of Tycho Brahe observations of celestial motions to Copernicus's heliocentrism, meaning the sun at the center of the universe. The secret of Kepler's labor was his deep faith, long before his work allowed him to conclude. Often, despite everything that his data seem to be telling him, Kepler's absolute faith from the outset that with the sun at the rightful center of the universe, the quantitative and geometrical harmonies and ratios of God's creation would be disclosed.

If one imagines a Johannes Kepler working with the methods of modern science, and concluding after reasonable inductive research, his laws of planetary motion; One absolutely and categorically Miss reads Kepler and misses the absolute astonishment of his work. He wouldn't have asked the questions he asked. He certainly would not have persisted through failure after failure. He certainly would not have pushed on when for almost all of his intellectual life spent on the system of the universe. The data was telling him no, you will not reach the conclusion that you are seeking to reach. Without his commitment from the outset, his faith in the deepest sense that it won't be the sun at the center of the system, and that if you put the sun at the center of the system, the harmonies, the ratios, the numbers, the geometry, the workings of the divine mind in nature, now would be disclosed.

What Kepler did is almost unthinkable. Without either analytic geometry devised later in the century by Descartes; without the calculus, devised later in the century by Newton,

working simply with algebra; and with geometry, on multivariable problems of time, space, distance, and motion; Kepler went through a physical and mental ordeal of mathematical hard labor. mathematicians who go through Kepler's works, and in all, before the computational, is a deal of trying to solve the problems he sought to solve without analytic geometry, and without the calculus. Often, he would spend years upon a single problem. He spent six years on the orbit of Mars for example, only to fail again and again, but refused to give up. Tyco Brahe's data, and Copernicus's heliocentrism would fit in a way that disclosed an order of a mathematical and geometrical kind, and through a combination of inhuman perseverance, of astonishing chance several times. He makes computational errors that cancel each other out. In each of those cases, had he not made both errors, he wouldn't had to give up, he couldn't have pursued the line that he had pursued. The element of chance in Kepler's work is utterly remarkable. Eras that balanced each other's out. And through his profound belief that the universe would reflect God's mathematical harmony and order, God's quantitative wisdom; Kepler arrived in 1609, and his first two laws of planetary motion that for him brought order out of astronomy, and Copernicus's system.

His first law of planetary motion was a deep blow to him, and I'll talk about that in a moment. But the second law depended upon the first and thus, partly justified it. The first law was that the planets, including the earth, described elliptic, not circular orbits, around the Sun. He thought that notion, up until the last moment. He was absolutely convinced, as all the Neo Pythagoreans were, and indeed as the Scholastic's were, that the circle was the only perfect form in geometry and unvarying form in geometry. The only form appropriate to celestial motion. But it wouldn't fit circular orbits. He wrote to a friend about his first law, that the planets including the earth described, elliptic, not circular orbits around the Sun. And I shall translate very politely here, he wrote to a friend that the elliptical orbits were quote: "a cart full of dung, and crochet." And he was often in near despair, at having to reach that conclusion. But if one presumed the elliptical orbits, then the second law of planetary motion could be derived. That the line joining a planet to the sun, the radial vector sweeps out equal areas in equal times. This geometrical order was exquisite for Kepler. It was breathtaking, but it was an inadequate reward, He believed, for abandoning the circular orbits, which he and virtually all schools of philosophy saw as perfect forms. Kepler was convinced, that God would not have created elliptical orbits merely to produce the harmony. Exquisite though it was, of his second law of planetary motion. And so, Kepler returned to his ladies, for 10 more years, in a day and night ordeal of computational struggle to find a harmony in this universe of ellipses that would justify the first law of planetary motion. And in 1619, he found it in his third law of planetary motion, an astonishing discovery to him.

He truly stood back in awe at what he had disclosed that the square of the period of revolution of a planet is proportional to the cube of its average distance from the Sun. He had found the harmony of the world. The square of the period of the revolution of a planet is proportional to the cube of its average distance from the sun. Now, the ellipses made sense.

On the basis of them, God had manifested His wisdom, in a magnificent correlation of the squares of the periods of revolution, and the cubes of mean distances from the Sun. He

titled his work, the *Harmonice Mundi*, or the harmony of the world. The language of Neo Pythagorean science is not the language of modern science. Let me give to you the direct quotation of the text by which Kepler introduces his readers to the third law of planetary motion: "I saw the dawn 18 months ago, the bright day, three months ago, and several days ago, the brightest sun of a most wonderful vision. Now, nothing can restrain me, I let myself go in divine rage. I defy human beings with contempt in this. I have stolen the golden vessels of the Egyptians, to create from them, a sacred place for my God, far from the borders of Egypt. If you are angry with me, I shall bear it. The die is cast. I write for my contemporaries, or it does not matter for the future. Perhaps my book will not have readers for 100 years. But God Himself has waited 6000 years for someone to gaze upon His creation, with understanding." That is not the language of 20th century physics. God Himself has waited 6000 years for someone to grasp the harmony, the mathematical, the numerical, the geometrical order, that is the manifestation of the Divine Mind. The foundations of 17th century astronomy were mystical and philosophical indeed.

Kepler's correspondence and fellow mathematician and astronomer Galilei Galileo, also believed passionately in Copernicus's system, but Galileo, who though drove into mathematics through Neo Pythagoreans circles, was not himself a mystic. Galileo, in fact, could not accept Kepler's laws. They seemed far too speculative to him, much in the way that they can looked upon Harvey's or Gilbert's work. In fact, Kepler's three laws of planetary motion did not receive confirmation until the work of Isaac Newton much later in the century. If you ask Kepler, how do you know that your laws are true? The answer was the order. Look at the order. Look at the harmony. That was not enough for Galileo. And he saw no reason to accept the elliptical orbits or anything that follows from them in terms of Kepler's system. But what Galileo did share with Kepler was the deep belief that nature was to be understood quantitatively, not in terms of qualities or purposes.

Using the newly devised telescope which he perfected, Galileo looked with fresh eyes at things which were not supposed to be there in the Aristotelian system. Sunspots, craters on the moon that indicated by triangulation, the depth of imperfection on what was supposed to be a perfect crystalline sphere. The Aristotelian astronomers said to Galileo, we don't have to look through your telescope, we know what's there. If it looks different, the fault lies in the invention, in the optical illusions created by the tool. The Aristotelian astronomers said to Galileo, even if you triangulate, to demonstrate that those craters have depth, then what we know is that the craters occur underneath an invisible crystalline sphere that makes the moon a perfect circle. Galileo who was wonderful at this sort of stuff, we find, well, perhaps that invisible crystalline sphere is itself surrounded by an invisible sphere of mountains and craters. But looking at the celestial bodies with fresh eyes, and studying motions on Earth, convinced him that the universe would be quantitative, not qualitative, In terms of our real knowledge of it. Galileo attempted to triangulate distances and, in the heavens, and on earth, to mathematize our understanding of all motions.

In one of his major polemical works, the *Assayer*, Galileo wrote as follows To the Aristotelians of time, he said: "One, you don't know where to look for knowledge of nature. For knowledge of astronomy, you look in a book! but you don't find nature in a book, you find it in the world that is open to your gaze." And he added, and it is essential to

understanding the Neo Pythagorean moment and Galileo, “to read the book of nature, you have to know the language in which it is written.” And the language of nature, he wrote, “is number, and geometry, and ratio, without which you cannot understand a single word of it.”

For Galileo, everything that was not measurable in the natural world was not essential, was not what was really there. And he distinguished between what he called the primary qualities of things, what was really out there; and the secondary qualities, what we thought was there because of the way our senses interacted with what was really there.

The primary qualities were dimension, shape, magnitude. That's what was really out there. Things like sweetness, redness, beauty, they weren't in the object, they were in our experience of the object. Reality was quantifiable, reality was mathematical. And so, Galileo puts us in a universe, in which we need to distinguish between what is really there in the things of the world, magnitude, shape, dimension, the quantifiable; and the effect of those real things upon human senses, our experience of the world. Heat was not in a body, heat was in our reaction, our experience, of magnitude and motion. Beauty was not in an object. Beauty was what happened when a certain shape in a certain magnitude, in certain dimension struck our senses in certain ways. The real, in and of itself, was mathematical and geometrical. What was in the object was what was real and God's natural creation; dimension, shape, the measurable, all else was a problem of explaining the physiology of perception. All else was an effect of primary qualities, upon our senses. The world was not red, the world was dimension and dimension, and we experienced redness. Sugar was not of itself sweet. It was a set of physical measurable properties that affected the human sensorium a certain way. A statue was not of its own qualities beautiful. It was physical dimension that we experienced a certain way. Perfections then, the whole language of Aristotelian scholasticism; the Galileo perfections were human projections of our subjective experience upon a natural world, that in and of itself, was quantity in motion to be understood by mathematical law.

Once Galileo, in dispute with the Aristotelian, said: “they all believe that immutability is a perfection in things. I wish they all became frozen as perfect, immutable human beings; on moving, on writing, incapable of lectures, or the spread of ignorance.” I don't believe he wrote that they in fact, would accept that. If you ask a scholastic, why does a rock fall? The answer of a scholastic, is a rock falls to reach its proper level, In the great chain of being. Everything seeks out, its proper place on the ladder of perfection. And every object moves of its own particular nature. You have to explain the motion of every kind of thing that exists in terms of its own qualities, its place in the universe, its particular purposes, its final cause. If you ask Galileo, why a stone fall? He answers with a terrestrial physics of uniform law. A law not for falling rocks or cooling water or falling feathers, even though if you look at them in the face of air resistance that is for quite more slowly than wrong. But for Galileo, the universe is uniform. And he gives us his lore of falling bodies, stated mathematically, making the intuitive leap, that though we never observe anything in a vacuum, absent air resistance, absent friction; we know, and he could not perform the experiments, we know that there is a uniform rate at which a body fall. Indeed, we may calculate it. His modeled, in sense that the universe is to be measured, to be looked at.

Think of those two statements made to his opponent; you have to know where to look in the book of nature, not in the texts of human beings; and you have to know the language to read that book's mathematics. His system then, calls for empirical observation, what we are going to know from nature, we are going to know by studying nature, by observing nature. But it also calls- and this is not something he derives from the study of nature, but something he brings to the study of nature- it also calls for mathematical ordering of that knowledge. Empirical observation, and mathematical ordering, and in theory at least; experimental test. And what that will lead to, he promised, will be laws of motion; by which we are able to understand how and why the world is as it is, in this physical dimension and in its physical phenomena.

Motion is not a quality that everything has that expresses its essence, its substantial form, its perfection, its purpose. Like Descartes, Galileo strips the study of purpose away from physics, away from natural philosophy. Motion is nearly a mathematical expression of the relationship of bodies to time and physics.

The legacy of Galileo, and indeed of the mathematization of worldview in the 17th century, is dramatic indeed. First, again, of course, it is a direct argument against the entire Aristotelian scheme of seeking knowledge and perfection and purposes. In that way also, it is a direct assault upon the principle of authority. It says what we can do in the 17th century, and he like Bahen, with proper method, has cast aside all inherited alleged wisdom, and reconstruct a real knowledge of the universe in which we find ourselves. It is also an appeal to empiricism, that one will learn nature by studying nature. And Galileo was able to strike against the Aristotelians with reference to Aristotle himself; for Aristotle himself had said, that we have no ideas in the mind, except what enters via the senses. The Scholastic's believe that in theory that the believes that all the useful ideas had already entered someone's mind, and what kind of idea in the inherited authority and tradition of the West, what Galileo will write polemically to the Aristotelian is, if Aristotle were alive, he would look through my telescope. If Aristotle were alive, he would see that when we triangulate the lines reflected on a piece of paper from a telescope, we know with certainty, distances and angles. If Aristotle were alive Today, he would be an anti-Aristotelian.

A second legacy is this remarkable sense that God's wisdom is revealed in the mathematical order of nature. That there are two books in which we see the wisdom of God. There is scripture of revelations of things are knowable by reason; but there is the book of nature, which is a book of God that reflects divine wisdom, which leads Galileo into his nearly fatal belief that there can be no contradiction between those two books of God. He writes: "Scripture is a book that tells us how to go to heaven, not a book that tells us how the heavens go. If you want to know how to go to Heaven, you will never know it from the study of nature. It requires scripture, but if you want to know how the heavens go, you will never know it from scripture, you will have to look at the book of nature for that to was written by God." The problem is the book of Joshua, which states that God performed a miracle to the Israelites at a time of battle, when he made the sun stand still. Galileo, who will be charged with theological error and heresy for maintaining the Copernican system, will formally recant before a court of the Inquisition, and will spend the last significant part of his life in lonely house arrest, for having defended Copernicanism.

When Galileo confronts the problem posed by Joshua, he says that scripture was never intended as a textbook of science and natural philosophy. If God had chosen to teach physics, mathematics, the science of life, by scripture, he couldn't have done a better job? It's blasphemous to think Galileo believes that Scripture is intended as a scientific textbook. They didn't even know the planets we know through later observation in Scripture. What is the point of the story of Joshua? Is it to teach us a system of astronomy; or to let people know that God intervened in history miraculously, on behalf of the Israelites? That, Galileo wrote, is the purpose of the miracle described in Joshua and scripture. But look what a dangerous path is, is to go down.

Scripture is written in the ordinary language of common understanding, at the time of the revelation so that people might know the deeper mysteries of God. Supposing scripture had said to the Israelites, Joshua commanded the earth to stand still, they would have said, then nothing happened! The Earth does stand still. And just as we speak of sunrise and sunset, even though we're Copernicans, he said; So, Scripture speaks of a sun that appears to move across the heavens. Because it is written for the common understanding of human beings; but look at the dynamic that sets up for Europe in the 17th century. That were scripture and natural philosophy, science, appear to contradict each other; We shall interpret Scripture in the light of scientific understanding. The dynamic flows in that direction. But for Galileo, it is unthinkable that the church or any Christian thinker, would dare to set in contradiction to each other, God, the author of nature, and God, the author of Scripture. And he invites European civilization into a bold adventure with Scripture, the after effects we still live with, that it shall be understood in the light of other natural understanding. And that the book of nature, as a divine source as real as the book of Revelation.

For Galileo, it is a category mistake to confuse them. He writes: "yes, theology is the queen of the sciences, not because it has the right to command the other sciences, but because it deals with the highest subject, God. But that theology is the queen of the sciences, doesn't mean that they have a bone set, you would be better off with a doctor of theology than a doctor of medicine. That theology is the queen of the sciences doesn't mean that to have your law case argued in the Kings courts, you would be better off with a doctor of theology than a Doctor of Law." The senses, intellect, reason, mathematical abilities, these are gifts from God to Galileo; utilizing the assumptions that God manifests itself clearly and mathematically in the order of nature, we may understand the book of nature that God has written. Truth cannot be suppressed, he will urge, on the basis of a theological claim. He writes to his critics: "You believe that to put an end to the Copernican thesis, all that you need to do is silence me. It is not enough, you would have to forbid mankind from opening their eyes, from looking at the heavens, and from using their minds.

In summary, what we see in the work of Kepler and Galileo, the mathematization of worldview, much of it mystically based and derived from Neo Pythagorean faith, in the mathematical harmony of the world; is a belief that one may marry empirical observation of the world with mathematical logic, and quantification of the forces of nature. It is the most dramatic moment of the world, I think, in the history of what will separate European from all other civilizations. Producing that uniquely quantitative science and the technology that

follows fund, that will for better or worse revolutionize the human relationship to nature. They thought that quantity was the start of reality; they invited a century to restructure its entire understanding of the world in which it found itself. Recall Kepler's sense of discovering what God actually had done, and how God had waited 6000 years for someone to understand it. That is a belief absolutely representative of the excitement of the seventeenth century mind. For the first time we know how to use our minds, and for the first time we shall write the proper book of human understanding and the human relationship for God's and the natural order.

Thank you.

Lecture 5: Locke's theory of knowledge⁵

There is, as many of you sent yesterday, attention that exists in the 17th century, between on the one hand, Bacon's call for an inductive empirical, new approach to knowledge and Descartes call for the application of reason and rational understanding. And when we turn now to John Locke's theory of knowledge, it's perhaps time to address that tension a bit more explicitly. The normal distinction that the textbooks make, between the two major strains of anti-Aristotelian thought in the 17th century, are between on the one hand rationalism the belief that reason alone, unaided by the deceptive Aaron senses, can give us knowledge of truth about the world in which we find ourselves rationalism, as it is term, and empiricism. The belief that reasons flies on its own to order to imaginary spider webs, constructions of reality, and in Bacon's phrase needs to be weighed down by the experience of the senses, and proceed inductively from the things of nature themselves. When the textbooks address this, they usually oppose, on the one hand, Rene Descartes, as the arch, typical rationalist, and John Locke as the archetypical empiricist. And though that distinction is in fact a very useful one, it is a distinction that can be overdrawn. And in talking about that, perhaps we can see some of the nuances as well as the broad brushstrokes of 17th century thought that first let's realize, to what extent, Rene Descartes is an empiricist as well as being a rationalist. Recall that once through reason, he determined that what is out there, what we sense is a material world, what is out there we know through mind to be extension, in length, width, and depth in motion, according to fixed mechanical laws, all of which he arrives at purely by reason. Right? It is his deduction from the immutability of God's will. That leaves a card to say, there will be fixed immutable laws of motion for God's setting matter into motion, doesn't change his will, doesn't change his mind. But one flock today, once a cart reaches that point in his philosophy, he must become an empiricist for reason cannot tell you what those laws of motion or reason can't tell you what the laws of mechanics are. And at that moment, Locke's rationalism, said it again Forgive me, Descartes rationalism leads him to insist that we become empirical open our eyes study the world of matter in motion, and Cartesian physicists and physiologists set about to dissect bodies to study the motion of muscles to study the central nervous system to engage in experiments with matter in motion to count two ways to measure.

On the other hand, they card rationalism takes him very far. For example, even in his physics, he posits without a single experiment, the law of inertia that matter in motion

⁵ Transcript by Reza Niknejad

remains in motion in a uniformly straight-line matter at rest, remains at rest unless acted upon by another fourth, he deduces that from the fixed will of God. He also deduces is a precondition for all physics. And it's a dramatic claim of reason over empirical observation that we know by reason that there can be no vacuum, that it is a self-contradiction to say that nothing occupies space. So, they card and all Cartesians reject as a logical absurdity, the concept of the vacuum. And they are convinced that all physics can be understood as fluid dynamics that in the same way that we don't see air, though it's matter there, that in what people think of as a vacuum, there must be a very rare matter, a very diffuse matter. And all Physics for Descartes, is matter touching matter, as in a great tub, in which you had ice and water and steam matter in different forms, but all the problem of fluid dynamics. For a true empiricist, to make such assumptions, there can be no vacuum. We know that by reason, the law of inertia must be prior to investigation are excessive claims of reason and logic over observation of the physical world. But it is important to understand the large domain given to empiricism in the Cartesian framework that bound by what reason knows at some point, we open our eyes We way we measure we explore the mechanical, physical universe. Likewise, one can overdraw the case for locks. empiricism, for Locke also is very much when he thinks on the issue of truth. A rationalist? JOHN Locke wants to distinguish categorically between two kinds of propositions the human mind can make about reality. One would be there are 45 people in this room, that's an empirical proposition, the only way to confirm it or disconfirm, it is the count. And there's always the chance you could be wrong, you could miss count, you could count someone twice, someone could be cleverly hiding, and you would miss the person. But lock notes, there's another kind of Proposition we made that 45 people in a room are more people than 40 people in a room that an empty room, and a room filled with people are not the same flock. These are propositions we may know with certainty that a circle is not a triangle, that three is more than two. And he believes with a car, that the mind knows the truth of those kinds of propositions. The relationship of ideas how a triangle compares to a square at a logical at a level of logical analysis. How three is more than two. At the level of logical analysis. Locke agrees with a car when he talks about certainty about truth, that those kinds of propositions the mind is compelled to see as true. As soon as its turn as soon as it turns its gaze at such propositions. He says their truth is a bright sunshine in the mind. We know them with intuitive certainty.

If someone said to you, I've just seen three people, and its fewer people than two people. You don't say let's go out and look, you say you're wrong. Three is more than two. And Locke calls that intuitive truth. And we only have certainty at the level of intuitive truth. But what is critical philosophy about that kind of truth is while it does tell us true or false things about the comparison of the ideas that we have. It does not tell us anything about the phenomena of the world, about the behavior of things in the world that we experience and the real division between Cartesian rationalism on the one hand, and locking empiricism on the other, can be seen in two great questions Above all, one, what is the goal of fundamental natural philosophy? For Descartes, as we've seen, that goal is that we should have true knowledge about the real qualities of the world, what things are in and of themselves. For Locke, the goal of fundamental natural philosophy in the final analysis, is knowledge of our experience of the world. A second great difference is the question of what

are these ideas we have in our mind? And where do they come from? What is the source of the way we think about the world and what follows from identifying that source correctly? For Descartes, we have innate ideas, we are born with ideas and our soul. God has imprinted upon the human mind, ideas of self, of matter of soul of God Himself. That is the source of our ideas. For John Locke, all ideas are derived from our experience of the world, in which we find ourselves. Thus, if a lot, the issue is where do we find certain rational truth, he sounds Cartesian, the criterion is intuitive certainty and issues of identity that something is either a or not a that if something is a circle, it cannot be a square, or ideas relationship, that three is greater than two. These are intuitively known as certain. But these rational, intuitively certain truths, do not give us knowledge of the world in which we find ourselves. that knowledge is known only by acquired ideas. We only know because all of our ideas arise from our experience, we only know phenomena, the appearance of things in human experience. For Locke, this is not a pessimistic retreat. In terms of the claims of philosophy. There is a sense of divine providence, and divine providential optimism that pervades John Locke's philosophy we have as our mental capacities, what God intended us to have to suit our needs. God adapted our mental powers, to being successfully human, in the natural world that we experience. And we can be successfully human, if we know how to make proper use of the mental faculties with which we have been endowed by God.

For John Locke, all of our ideas are acquired by experience. Now, in the course of the 18th century, people increasingly will define experience and present themselves as Lockeian as solely the experience of the senses. But John Locke himself argues that we have two sources of experience, to Windows if you will, through which ideas, experiences occur and ideas are formed in the mind. First are the experiences of sensation, our sense experiences, the things of the world strike our five senses, and those sensations are received in the mind and transformed into ideas of the things experience. But we have a second source of experience as well, that Locke labels reflection. And that is the experience we have of our minds dealing with the ideas of sensation, that is, without sensation, nothing would happen in the mind. But with sense impressions in the mind, we find ourselves having mental experiences, thinking, comparing, judging, we are aware of the behavior of our minds doing those things. And by reflection upon the operation of our mind, we have another source of ideas of experience, ideas, reflection, our ideas of what it is that our mind does. human thought, ideas, all knowledge for John Locke, can be traced only to these two sources sensation and reflection block in the manner of atoms forming into molecules, simple sensations or reflections combined in the mind, to form complex ideas. For example, having the idea of this street and that street, these buildings and those buildings, I can form the idea by combining them of the city or of Washington, DC. It's not that I have a direct perception of the city or of a particular city, but that the mind is capable of combining the units of its experience and giving a name to the larger entity thus far, in this case, the city. What this means in direct contrast to a car is that there are no innate ideas. Oh, all ideas are acquired by experience, from which follows one of the most dramatic possible claims in the history of theories of knowledge, that our knowledge is absolutely limited to our experience of the world, where there is not experience, that is not knowledge, or all human knowledge is acquired, is learned, and is ultimately dependent upon human experience. Now, if one thinks of the sorts of issues that so obsessed, the Aristotelian scholastics, and

they card when he thought about the essence of matter, and soul, and Galileo, when he tried to distinguish between primary qualities, what is really out there and secondary qualities? What do we experience of what is out there? If we think of those obsessive concerns of Western philosophy, what is substance? what's real out there? What is it out there that causes human experience, or that exists apart from human experience? John Locke makes a dramatic answer. And to the extent to the extent that it is accepted, the whole enterprise of Western philosophy is altered. Locke's answer is that if knowledge is bounded by experience, we have no knowledge of what underlies experience. We cannot know what is real, in a sense of prior to or underlying the phenomena of human experience. We have no non experiential, rational source of knowledge of Mind and Matter. Where they card, Galileo, the Scholastic would say, mind really is or Mazda really is. This, it's substantial form and scholasticism. The clear and distinct idea we have of it, and they call it primary qualities in Galileo. Locke says, we need to distinguish between the nominal essence of something, the name that we give a set of experiences, to distinguish it from another. And the real essence, what it is, apart from our experience, and understand that all we know is nominal essence, we cannot know the real essence of something. So, we look at the material world and we say, what I mean by a body, a material body is something extended in length, width, and depth. We don't know if that's what's real. We don't know if they were minds other than human minds, experiences other than human experiences. What In fact, it is, that we experience as a body, what we do is we say, I will take these features in my experience of the world, length, width and breadth, and say, it is that element of my experience of the phenomena to which I am referring, when I use the word body. Similarly, and in many ways, much more dramatically. For Locke, we do not know what mind is, for the same reasons. We can't experience what underlies the phenomena of mind, we only experience the phenomena of mind, the behavior of mind, and our knowledge, for better or worse, is limited to that. The Scholastic's want to say that mind is a specific, substantial form of rational, immaterial incorporeal soul, they call it wants to say that mind is fourth, spirit, immaterial, incorruptible, eternal. Locke wants to say, we don't know what mind is, we experience the phenomenon of mind. As you can imagine, there are those who want to charge him with great and piety here, but listen to how successfully he defends himself theological. Is critic critics say, then we have no proof of the immortality of the soul, the spirituality of mine, you're saying that for all we no matter could think that experiencing the behavior of mind we don't have to posit an immaterial incorporeal soul? And Locke replies, are you saying that God in His infinite omnipotence, could not, if he so wished, in doubt matter with the capacity for thought? Are you saying that God could not create thinking matter? And he charges, blasphemy in effect to his critics, who would charge it to him? Now, in fact, Locke leans toward a certain dualism. It's clear from his writings that he thinks it most likely that there are two different things about which we can't know anything, one material and one spiritual. But we cannot know what underlies experience. And we need to admit our ignorance in the 1730s popularizing lock for a French audience. In his philosophical letters from England, Voltaire, who will be the most influential author of the 18th century in Europe. Right fit until Locke, all philosophies had created novels romances, fantasies about the soul, that there were 100 theories of what the soul was, and that Locke has been the first to say, we don't know We can't know. But we can study how mind proceeds. For Locke and for Voltaire, this was proper humility. If

knowledge was bound by experience, then on a large number of what had been the major philosophical questions in the history of Western philosophy, the appropriate answer of an honest mind was, I do not know, I cannot know my knowledge is bound by human experience, which does not take me there. The problem then, is not to know what mind is, but how inexperienced mind behave, not to know what matter is, but to know inexperience, how the physical world behaves. Since such knowledge is not based upon logic, the comparison of three and two, for example, but upon experience, such knowledge is always open to correction. By further experience, we may not, given the limitations of human knowledge, arrive at certainty, because we never know what the next set of experiences will be. The first 1000 people you meet on an island might have red hair. If you're a betting person, bet that the 1000s and first will have red hair, it is highly probable, but there is no logical necessity. And indeed, if someone with brown hair comes along, you'll change your proposition. Most people on this island have red hair, someone raised in the tropics, hearing that someone had walked across a lake would find that absolutely inconceivable, impossible. But look how the person can't know that with certainty, the first time brought out of a tropical climate, and seeing ice, a frozen lake. The person from the tropics must add new experience, his knowledge of the world and change and understanding of the nature of the world in which we find ourselves. The mind philosophy is what he termed is a tabula rasa, a blank slate, on which nature imprints ideas, via sensations, and in which the mind becomes aware of its own operations on sensations via reflection. Some ideas as if almost by gravity attract each other, they associate. But the mind Above all, is active, and by abstraction, looking for common denominators and ideas from experience. And by combination, it forms complex ideas. Examining individual human beings, I abstract what they have in common, and derive my notion of humanity or human nature. Examining my experience of visual perception, I abstract the idea of color, traveling, reading and amassing my experience of the different peoples on a continent, I combine notions, and frame my idea of Europeans. And the propositions that I make about those ideas, those experiences, to the extent that they are not purely logical comparison, that they purport to describe how the world behave, can only be probable, never certain and depend for their degree of probability upon their relationship, to experience. One of the things that leads Europe to embrace Locke in epistemology your theory of knowledge of epistemology means a theory of knowledge. One of the things that leads Europe to embrace lock in epistemology with such fervor that for 100 years, almost all leading European thinkers will describe themselves in one way or another as Locke Ian's is the belief that locks model both builds upon bacon and the invitation to a new industry. Science and accounts for explains and gives us the model for the progress of the experimental sciences. Gilbert on magnetism Harvey on the circulation of blood Hagen's on the pendulum and centrifugal force, boil on the expansion of gases Galileo and eventually Newton. The culture believes that the lock in epistemology is in fact, an explanation of and the proper model for what is working in the experimental sciences, and that it is the heir to Bacon's invitation for a new science. As this model becomes the common property of European thinkers, what features of it are most important for the transformation of European culture? know that it is a model that demands always, and leads to a demand for analysis, for clarity, and for confirmation, in theory, any proposition however complex however abstract, it sounds, if it is an authentic proposition of knowledge can be analyzed can be broken down into its component ideas, those components

ideas can be analyzed and broken down to the experiences that someone has claimed to have, on the basis of which one purports to know something about the world. Any proposition then, may be analyzed ultimately into a claim about human experience, and then judged and evaluated on the basis of its relationship to actual experience, the world of learning the world of deep knowledge, the world of deep claims, of unraveling the secrets of the universe, and the reality in which we find ourselves now becomes by locking in analysis and experimental confirmation of lucid well a demystified world of knowledge and accessible world, the void of any irreducible obscurity. Take the most complex claim anyone makes. And you have the right to say, what are its simple parts from which it is built? What ideas inform it? And what experiences lead to those ideas and lead to the claims? And can we confirm them against further experience? It leads to an impulse very subversive. In a world of intellectual authority, it leads to an impulse to ask again and again, what gives you the right to make that claim? What is the source of your legit knowledge? How do you know that and it invites an intellectual culture to undertake the empirical confirmation or dis confirmation of all the propositions people would make about the world, by comparison to the claims of teachers, thinkers, philosophers, to the behavior of the things, the scribe? This becomes in many ways, the mission of the 18th century to analyze all prior claims of knowledge, and the bubble to do so on the basis of open communicable human experience. For Locke, and it is a sign of his work that he sees is very providential and reinforcing of the oh we ought to have at the universe God has given us but for others, it seems profoundly subversive and its implications. For Locke, we also learn our ethical ideas, by experience also. There are no inborn ethical principles, ideas of good and evil. And Locke seeks to analyze how we come to form ideas of good and evil. The analysis he makes is that we call good. Those things that cause or that we believe will cause, human well-being, and happiness. We call evil, what causes or what we believe will cause pain. For people who accept this model, when we realize that something will lead to human harm, towards the pain, the suffering, we attach the term good. acutely, we attach the term evil. And when we believe that something will lead to human well-being, ease of pain, harmony, prosperity, we attach the term good for law, what makes this model justifiable in a theological sense, is his belief that God has so arranged the world, that those things that are the real objective sources of human well-being, are those things which God himself has willed, as the good that if we truly pay close, empirical, rigorous attention to the real causes, of human well-being or human misery, we shall reach those ideas of good and evil, vice and virtue that God himself has will. Now if one holds to Locke's model of learned ethical ideas, and to a sense that justice God has given us faculties adapted to our needs, we don't have to know what a river really is, we have to know how it behaves. We don't have to know what crops really are at a level of metaphysics, we need to know how they grow, how they behave, the circumstances in which we interact with it. In that same way, for Locke, God has providentially adapted ethics, the ways in which human beings actually experience and Philippians for example, it is not accidental. It is not accidental. That the religions of the world in the true Judeo Christian orthodox culture, the true Christian religion, should speak of notions of eternal reward, eternal bliss, eternal happiness, or eternal pain, eternal suffering, eternal damnation. Because it is precisely by understanding the consequences for well-being or for misery, that we learn our ethical ideas, and know that if one thinks of that system, as governed by providential design, God's design, what an extra ordinarily

optimistic scenario it is, we seek happiness, we seek to avoid pain. But we make errors, we have false ideas, false propositions, about what would really make us happy, what would really make us miserable. But in the same way that if we attend empirically to nature, if we use our senses and mind properly, we can master medicine, we can mask the crop growth, we can deal with the physical events of the world. Similarly, if we use our minds properly, we can seek the true and real causes of human well-being or human misery and in doing such, reach appropriate ideas of good and evil, but without such a providential model, then Locke's analysis of the acquisition of ethical ideas can be subversive indeed. But it couldn't be read as saying, all we mean by the good is that which we believe will make us happy. All we mean by evil is that which we believe will cause us pain. For lack, it is an optimistic, providential fully religious mode of analyzing the acquisition of ideas of good and evil, but it plants a very subversive see about the meaning of ethical terms. How given lock sense that we learn all things from experience, is it possible to reach mysterious knowledge about God and religion? For Life, there is no problem here. So, God adapts all things to human senses. God has revealed to us and has shown us that something is from God in the New Testament, namely, the MIT the ministry of Christ was accompanied by the performance of miracles and the fulfillment of prophecy, people who had nothing to gain the apostles, everything to lose martyrdom and suffering, said, we saw him raised from the dead. We saw he himself be resurrected after three days of death; we saw him walk on the waters bring food down from the heavens. For Locke, this is God's empirical seal of evidence upon the New Testament. And at that point, knowing that the sources God, it makes good scientific sense. It is utterly reasonable to believe the content of Scripture and Locke and titled his major work of religious apologetics, the reasonableness of Christianity, the analogy is simple if you walked out one day, and the clouds formed themselves into a pattern of your house that said, john, you're wrong. I exist. God. You might think you were deluded, but you check in everyone has seen you check a famous sky writer up Nope. And there's no diffusion of the clouds. You now know, this is the real thing, would you or would you not pay close attention to anything urged upon you in the next message in those clouds? For Locke, God put his empirical stamp of evidence upon the New Testament, the fulfillment of prophecy, the accomplishment of miracles, attested to lock believers by credible witnesses, that teaches us that scripture is from God on good, scientific, empirical, reasonable grounds. And thus, it is sane and reasonable to believe the content of Scripture. For many, Locke had made the world of knowledge, the world, the philosophy, the world of science, the world of religion, clearer than they had ever been. And it is a model that exercises a very powerful attraction upon European civilization for the next 100 years.

Thank you.

Lecture 6: The Newtonian Revolution⁶

We are now to the Newtonian Revolution. An event that is not only significant in the history of Western science but many ways even more deeply than an event Pro-family significant in the history of Western culture. Newton arises out of the growing attraction to a larger and larger number of bright young minds in the 17th century of the kinds of

⁶ Transcript by Musawer Andarabi

inquiries invited by the new philosophy. If you think back to the very first lecture, we talked about how the whole structure of reality is conceived in that philosophical system pointed people away from certain kinds of study as trivial and directed minds toward issues of abstract metaphysical philosophy or ideally of theology itself, but as a result of the cumulative effect of so many of the revolutionary currents in the world of education, learning and reading, that we've discussed this flaw by the mid-17th century. throughout Europe, one sees young men. there are no women educated at the universities. Young men are drawn to societies of mathematically and mechanistically oriented empirical natural philosophy. What we would now term science so great has been its triumph, but which in the 17th century remains natural philosophy. One of the striking features of the creation of these societies is how much of it occurs apart from the universities, though, the participants are often students graduates, occasionally professors at the universities, the universities are strictly and usually legally way to the Aristotelian scholastic method and where the universities provide no home for the new experimental sciences and the new mechanical physics. The new astronomy like-minded young men form, clubs, society, salons often attract patronage, aristocratic royal patronage and create a whole set of counter-institutions in the ways that some people argue rightly or wrongly. I leave it to your judgment. But in a way that some people would argue that in the 1980s and 90s, some of the best social science is being done at think tanks Rather than in departments of sociology or political science at the universities in the 17th century. From the perspective of what we now think of as the mechanical sciences and physics and astronomy, the truly exciting work is being done apart from the universities in societies and clubs devoted to the new philosophy. In England, from the 1640s on, there are meetings that tend to get more and more regular of students, tutors and professors at London, at Oxford and at Cambridge who were interested in non-Aristotelian natural philosophy. They tend to call it either experimental philosophy or simply the new philosophy. They are a generation excited both by Francis Bacon and but they refer to their societies as one devoted to quoting physical, mathematical, experimental reasoning and quote, with a very good I to the obtaining of patronage of subsidy for their efforts. by the progress of the mechanistic sciences. By 1660, the group is meeting weekly and defines itself as a society devoted to quoting. And you'll see how many of the themes we've addressed so far are caught up in the very name they give themselves, they choose as their president a member of the king's royal council. And in 1662 they are chartered by King Charles II as the Royal Society with approximately 130 members. Their motto translated into English means you accomplish nothing by word alone, that it is not. And one can think now again to Bacon's new organon and his criticism of prior philosophy, that it is not by verbal techniques, that one will advance human knowledge, but rather by experiments and this is central to the work of the Royal Society by reports of one's experiments, so that these may be open to the examination, the attempted confirmation or disconfirmation the criticism of others. In 1664, the Royal Society divides itself into committees that give us a wonderful flavor of what they took to be the important tasks of their group. First, there was the Mechanical committee dealing with all matter of subjects from physics, dynamics, mechanics, abstractly conceived to work being done on pumps, for example, or means of measurement. There is the Astronomical and optical committee interested in astronomy, interested in the development of machines to enhance and allow for observation and measurement and interested as well in the

physiology of perception and in questions of what is involved in perception and site. There is the anatomical committee, the Chemical Committee, the Agricultural Committee, an important committee on the history of trade, that, among other things quite essential to the island kingdom, dealt with issues of navigation and the broader issues of the increased efficiency of commerce. The 7th committee is Ideal for the 17th-century mind of course. I shall give you its full name. The committee quotes to record phenomena of nature, unrecorded or hitherto unobserved. A committee whose official purpose embody the sense that there was a world out there to be looked at for the first-time phenomena, the people obsessing on matters of pure theology and abstract metaphysics had never bothered to record to systematically observe. And finally, the 8th committee again, very important. A committee of correspondence that links this society to like-minded societies of people interested in the new sciences, in the new philosophy across the face of Europe, creating an international community of the new sciences and the new philosophy. Despite the increasing math atomization of so much of the mechanical sciences and bacon suspicion in the new organon of mathematicians of a rush to order, of imposing too much order upon the wall. It is a generation dramatically under the influence of bacon, His utopian works, the new Atlantis, which had, you'll recall the House of Solomon the equivalent of the Royal Society at the very Centre of its being. the new Atlantis had gone through 10 editions by 1670 and in the first publication of the transactions of the Royal Society by which they decided to communicate to the vast reading public, The fruits of their observations, reports, experiments, and research. The front's piece of the book showed us the King of England in the center, on one side the President of the Royal Society and on the other side, Sir Francis Bacon labelled the restorer of the arts. Arts means all applied human knowledge. Science was knowledge per se. The arts were the application of human knowledge. Hence our faculties of arts and sciences. The Royal Society, in publishing their transactions, finds an avid reading public and drawers for its articles on combinations of some of the deepest and learned and rigorous scientists on the one hand, and what became known as the virtuous on the other, a country gentleman farmer for example, who would send in an article a new recipe for mulberry wine. It accomplished many things. It drew such people into the orbit of the Royal Society, gave people good uses of mulberries and enormously expanded the audience for works that were of a much more serious nature as well. In that first publication of the transactions as the Royal Society, Europe met in many ways for the first time, a figure who would be of almost unimaginable influence in terms of the shaping of intellectual culture. Isaac Newton, later to be served Isaac Newton who published in that first volume of the transactions. His work on optics in which he had through the prism divided life into its primary colors. Isaac Newton was the son of a Lincolnshire Pharma. Born in 1642, the year of Galileo's death, there is good evidence that he was intended to become himself a gentleman farmer but in 1661 he enters Cambridge University. He's old for that 19 at the time, but there had been a civil war in England and many persons' education had been suspended. He enters Cambridge University and is quickly caught up in the world of higher learning, now Cambridge University in 1661 is dominated by the Aristotelians, but Newton enters Trinity College and it is the one college in Cambridge where the Cartesians are strong and influential. And Newton is a young student then is introduced to the cart to analytic geometry and higher mathematics. Although it will be Newton who will overturn the Cartesian physics of the universe without a vacuum. A

universe that's plenum that's filled with matter, so that all problems of physics of problems of in effect fluid dynamics. Though Newton will overturn eventually that Cartesian physics. His introduction to the new mechanical philosophy and above all to higher mathematics is at the hands of enthusiastic Cartesians. He is taught mathematics by Isaac Barrow who held the most distinguished chair in mathematics in Great Britain. In 1665 people have to evacuate Cambridge because of a visitation of the great plague And Newton goes to the countryside at walls Thorpe, to await during 18 months the passage of the plague. It is perhaps the single most extraordinary 18 months in the history of Western thought. While at walls Thorpe Newton is thinking about a problem that many people are thinking about across Europe. The problem of the motion of the moon. The great continental natural philosopher Huygens had demonstrated to European science in addition to his work on the pendulum, the problem of a swinging globe, you attach a globe to the end of a chain and swing it around your head and you let go. It does not continue travelling in a circle. It flies off in a straight line. Now almost all physics and astronomy in the 17th century, not just the Aristotelians, but Galileo's as well you will recall, depended upon the notion that the circle with a natural inertial motion that the circle was a natural motion. They caught on the other hand, purely as a matter of logic, had argued that all motion was a straight line that everything proceeded in a uniform straight line unless acted upon by another force. But when they cart thought about why the moon should be travelling in a circular orbit rather than in a straight line. He conceives of it as a problem of a whirlpool in a great tub of water for his universe is full. What is the swirl of the medium of rarefied matter on which the moon rests? That accounts for the motion we observe. Newton is predisposed by similarity with the Cartesians to think of motion as linear in its inertial sense, and he is very familiar with thinking about the problem of Huygens swinging pendulum, that when you let go of the chain flies off in a straight line, and he is trying to think what would be before that could be operating centripetal upon a moon. That of its inertial motion would be proceeding in a straight line, but is drawn as if by some invisible chain toward the center into the motion we observe there is every reason to believe an apple did fall as he sat outside thinking about the problem, and Newton put to himself the case at what point does the force operating upon the apple by which it fools and obedience to Galileo's law of falling bodies? At what point? And in what manner might that diminish if you drop it from a hill, it drops if you drop it from the highest mountain, it drops, presumably, then one could hypothesis, if you drop it from much higher than the highest mountain it will drop, suppose that one projected that force outwards indefinitely, and sought to conceptualize as the equivalent of that chain that would be holding the moon in orbit, rather than causing it to fly off in a straight, rather than allowing it by its inertial motion to fly off in a straight line. And he arrived at a calculation that some other people had come very close to arriving at thinking about what would be the force exerted by such a chain if one treated the moon in effect as a swinging globe problem, held by a string. And Newton arrived at a calculation that the pull of the earth diminished according to the square of the distance from the center of the earth. In effect, that was the law of gravity, but not having his books with him in the wall store. He did not have the precise figures for the circumference of the earth calculated by miles to a degree. And his calculation was slightly off as he wrote. He quotes, pretty nearly end quote, proved his calculation. He had discovered the law of gravity, but his proof, slightly off, he set it aside and mentioned it to no one. In that same 18 months,

Newton had found it enormously difficult to work with multi variables of space motion and time nearly with the cards, analytic geometry alone. So, he developed a means of calculating differential and integral calculus. In the same 18 months. Thinking about the problem of motion, he developed the three laws of thermodynamics, the three laws of motion that lie at the heart of modern physics interested in the question. How do Galileo's abstract mass and force behave? Newton developed three laws of motion. On the law of inertia matter in motion, mass in motion proceeds in straight linear motion unless acted upon by another force. The matter at rest remains at rest unless acted upon by another force. He defined that forces the ratio velocity equals times, time, times acceleration, and articulated his 3rd law of thermodynamics, that for every action there is an equal and opposite reaction. Still, during those 18 months he developed whole new ways to think about the nature of numerical series, and through the prism discovered the composition of light, and lay the foundation for the modern science of optics. In short, in the 18 months that followed his receipt of B. A. At the age of 23 to 24, Newton had formulated the law of gravity, formulated the essential laws of motion mechanics. Thermodynamics that would govern Western physics created the calculus, laid the foundation of modern optics with his experimental discovery of the composition of life, and was typical of Newton, who often forgot to East. He communicated not a word of this to anyone from the 1660s to the 1680s, he was England's most celebrated mathematician, but no one knew of his work on gravity and the laws of motion. When in the late 1660s, he finally showed Isaac Barrow the work he had done on mathematics, and in particular, calculus. Isaac Barrow did something that never happened before, and I guarantee you never will happen after. He immediately resigned his chair in favor of his student Newton. But there he is from the 1660s to the 1680s, with no one knowing about his work on gravity or the laws of motion. In 1684 there was a meeting In a London coffeehouse of three Great Scientific Minds. Edmund Haley, the great astronomer, whose comments so disappointed us all. So, Christopher wren, the great architect and Robert Hooke, astronomer, mathematician, and the first great theoretician of the mechanical laws of the elasticity of mass, discussed the problem Of the Moon and Hagan's work on the swinging globe and the pendulum. Newton had seen the connection 20 years before Hook proposed the inverse square law as a model of what the force might be. Ren thought about it and waghered that it could not be proven. Haley and Hook put their mind to it, and cannot prove it, and cannot use it to account for any of the data of the observed celestial world. They think their problem might be with mathematics and Haley is sent to Cambridge to get the views and help of the celebrated mathematician, Isaac Newton. He asks Newton what would be the curve produced in a satellite if there were a force that diminished as the square of the distance between two bodies and Newton immediately answers, and the lips. The elliptical orbits of all heavenly bodies, end of the moon, exactly as Kepler had maintained. Hailey looks at him and wonder, we're told how you know that I had worked it out, Newton says, but it didn't quite fit according to one of Newton's relatives, Haley said. Where did you work it out? And Newton begins looking through his desk, draws unsuccessfully, as one celebrated historian of science had noted all of European mechanical science was looking for a law of gravity. Isaac Newton had lost it. Finally, Newton can communicate his work to Haley and say, Haley sees at once that with the geography of the earth, corrected the whole solar system and Kepler's planetary laws all fall into place and that Newton has demonstrated it mathematically consistent with all

observed data. At Haley's urging an expense, Newton works on his discovery, integrates it into his general laws of motion, thereby linking all celestial and all terrestrial physics, and publishes it in Latin, in 1687 Volume one. The Philadelphia naturalist. Principia Mathematica, wonderful 18th-century title, the Mathematical Principles, 17th-century title of Natural Philosophy, or as it is known simply the Principia. It took him 18 months to write and it changed the culture and the cultures way of understanding the world in which it found itself. It was, as many said, a mathematical demonstration of the Copernican hypothesis as proposed by Kepler in the three planetary laws of motion, which now for the first time, had their experimental proof. It explained all of the then known phenomena of celestial motions pretty well, through the supposition of a force of gravitation That decreased according to the squares of the distances between the two bodies. it made the universe seem ordered, lucid comprehensible. It made the human mind seem capable of understanding the very architecture and design of God in the creation. It is important to understand how the culture perceived the Newtonian accomplishment. The English catholic poet, alexander Pope penned Newton's appetite. Nature and nature's laws lay head in the night. God said, Let Newton be, and all was light. Nature and nature's laws lay head in the night. God said, Let Newton be! And all was light. The great astronomer Lagrange, 100 years later was asked by napoleon, would there ever be another new to understand how the early modern European world took the Newtonian accomplishment. Here is what Lagrange replied to napoleon, he said, there can only be one Newton, because there was only one universe to discover. Writing in the 1730s, attempting to explain Newton to a French audience will pair. Put it this way, he said, they can put us on the road to truth. Newton took us to the end of that journey. The astronomer Haley, in a poetic introduction to the Principia, concluded his verse on Newton's accomplishment with the line nearer the Gods. No mortal May I approach, those senses all was light. The human mind had discovered the actual universe. We had unified celestial and terrestrial physics had reached the end of a dramatic journey that a human inquirer had come as close by natural means in this mortal sphere as anyone could to touching the mind the plan of God. These are as much a part of the Newtonian revolution as any specific achievement in mathematics, in physics or astronomy posit linear inertia as a force operating on mass wherever it is in the universe. Posit gravity according to Newton's formulation, and one understood the composition of the heavens in a matter in a manner consistent with one's ability to understand and predict the motion of things on earth. If you could understand Newton substantively, they depended upon the writers of prefaces are they depended upon popularizes, but those popularize and those prefaces increasingly made it clear with this model, the heavens and earth fell into place, there was mass, there was a measurable force, there was space and time and distance, and with the mathematics correct. One understood the world at which we had given ignorance till now, and from that system, one could predict with accuracy the planetarium celestial motions. The tide's whose behavior now followed from the law of gravity itself, Kepler's ellipses the behavior of comments. Nature and nature's laws lay hidden Night, God said, Let Newton be, and all was light. The Cartesians Red Newt and said, wait a minute. This is no explanation at all. This is mysticism. We don't see the mechanism. This is as speculative as the mysterious forces were given to things that can't be seen in Aristotelian scholasticism. Let's try to understand how the Cartesian has responded to the Newton system. Because if we understand that, we will also be able to

understand a very important direction in which European science will move in the wake of the Newtonian accomplishment. If one wanted to make fun of Aristotelian scholastic learning. In the 17th century, one made fun above all of their giving everything a secret reason for moving that couldn't be observed. These were called Occult forces, forces that couldn't be seen in the scholastic language itself. A stone falls to reach its proper place in the universe. Fire rises to reach its proper place in the universe. It had a hidden force by which it moves, in Moliere's play *Le malade imaginaire* Louis the medical doctor, despite himself, we get a critical view of an Aristotelian scholastic oral examination. For someone seeking his doctorate in medicine, the examiners asked him, why does opium put one to sleep? And he answers as a good Aristotelian because of its dormitive power. And the doctors go duct learned. For the Cartesians, what kind of explanation is that why opium put one to sleep because of its normative power? Let's see what happens in the nervous system. Let's see what happens physiologically. Let's study the mechanisms of the effect of opening. This is how they hear Newton. Why do the planets and moons hold their orbits because of their power of attraction? Beg your pardon, because of their power of attraction. Have you seen it? No? What is it? A force that operates like normative power for the Cartesians? It was no explanation at all. Imagine a universe filled like a bathtub with water and swirling motions and eddies and whirlpools, and you could understand why things moved. A billiard ball strikes another billiard ball. It communicates its motion. One understands such a thing. One looks for the mechanism by which forces communicated, but what the Newtonian is giving us action across, avoid action at a distance, A billiard ball moving another billiard ball without ever touching, and with allegedly nothing in between, through which light could travel. For the Cartesian it was mysticism. It was Aristotelian occult forces all over again, action at a distance. Powers of attraction. Show us the mechanisms now. The Newtonians are initially sensitive to this. They want to know what gravity is. They try to see could it be magnetism, but that doesn't work. And finally, they make a virtue out of a necessity, in a man of very consistent and the two, you can see the merging right here very consistent with the low key in the model that we are limited to explaining phenomena not what underlie phenomenon, The Newtonian reply? What we have demonstrated is that such a force exists, what we have demonstrated is the quantity of that force on the basis that you would predict exactly what you observed. Based on that. You can predict the behavior of comets and tides. We know that such a force exists. We know the quantity of such a force. Why such a force should exist. In what way such a force can operate in the universe with action at a distance. We do not know. And we will not favor hypotheses known single hypothesis. Newton will state, I do not think I do not make up hypotheses where we lack the data, where we lack the experience. We do not posit hypothetical explanations. We admit our ignorance. God is free. Newton will be right and his defenders will be right unlike the carts God who must operate the universe according to the principles of fluid dynamics. God is free to have created as he chose. God is omnipotent. We see what he has done. We see the exquisite nature of the design. We see the laws of nature. We state them quantitatively. We see through nature to nature's laws and their author God, and we will not in science, attempt to posit metaphysical and hypothetical explanations of why the world should be as it is, or how it could be, that the world is as it is. We will state what we know and we will await data before going further. No cultural conclusion that if one could see through nature to nature's laws and their author God, this

meant both, that Nature was knowable and that the pursuit of natural knowledge was also the pursuit of the wisdom, the design, the handiwork of God. Science was piety. Let no one think that he was sacrificing his soul or higher faculties in the study of nature or rocks or rivers or emotions. Nature reflected the exquisite design of God and all Science was piety, but the greatest legacy of all from Newton was the sense of order and clarity, and all was like. The Newtonian achievement gave Europe great confidence in the method which had brought about this achievement. One could argue all one wanted in the abstract. Should one be experimental? Should one be inductive? Here was the proof of what one received by this method. God did not intend us for ignorance. We now had a method by which to use our minds and know his world, and for many, this was a model to be extended to the whole of knowledge.

Thank you.

Lecture 7: Pascal and Bayle⁷

For all of the growing attraction of the new philosophy in the late 17th century, there are deep skeptical strains in the 17th century that persist. Skeptical in the philosophical sense, in which we talked about it in our discussion of Descartes and the revival of classical skepticism of Sextus Empiricus, that is to say skeptical about the claims of human, and natural, and philosophical knowledge. The word *Skepticism* has undergone such an evolution of meaning since the early modern period – indeed since the classical period. We tend to use the term now to refer to people who have doubts about religion, but skepticism in its philosophical meaning, and very much in its 17th century meaning, is again skepticism about the claims of natural, of human, of philosophical knowledge. And indeed, the most common fusion of skepticism with any other strain of thought is skepticism as a philosophy underlying what we term *Fideism*, from the root FIDE (faith), which is the dominant form of 17th century skepticism. The position that human knowledge cannot attain significant certainty and that to understand and to know anything of authentic significance we must depend upon the supernatural lights of faith and grace. So again, the dominant form of philosophical skepticism in the 17th century is one directed not against religious faith, but one in the service of religious faith, arguing that given the human incapacity to know anything significant with certainty, we depend upon the lights of faith and grace.

The two most influential and deeply reflective models of such fideism in the 17th century, one Catholic and one Protestant, are Blaise Pascal and Pierre Bayle. Pascal remains a celebrated author to the 20th century. Pierre Bayle has entered a certain obscurity and is largely unknown today, but he was, in fact, an author of exceptional renown in the late 17th century and throughout the 18th centuries. In fact, people who have inventoried private libraries from the first half of the 18th

⁷ Transcript by Mahla Memari

century on the continent – in which at the time of death a report was made on all of your worldly possessions for purposes of your state, and very usefully to intellectual historians, all books held in private libraries, private collections, were inventoried – the most widely owned book after Scripture in all of these continental libraries is Pierre Bayle’s historical and critical dictionary. So, he is an author not well known today, but an author of quite remarkable significance for the late 17th and to the 18th century.

Let us talk first about Blaise Pascal. One of the things that adds to the great impact of Pascal’s own fideism is the fact that he came to it from a brilliant precocious scientific career. As a teenager he had done remarkable work on conic sections in mathematics. As an adult, his work on cycloid curves and calculation is work of today primary mathematical importance. To aid his father in computation – his father worked in a tax collection office for the government of France – he devised a method of binary computation and calculation that many people believe is the first model of a computer and the conceptualization of calculation via a computer in the history of the West which, true or false, has earned him his greatest renown today, namely a computer language Pascal named after him. He moved in scientific circles in France and did exceptionally important work in barometrics where among other things, he performed experiments that to the satisfaction of some, proved against Descartes the reality of the vacuum, he made improvements in the barometer that required the exceptional scientific calculations that allowed for quite strikingly greater precision in the measurement of air pressure, he did foundational work in fluid dynamics, in pneumatics, and made major contributions to the mathematical calculus of probability – work that earned him great fame in a century in which almost everyone wealthy gambled, and in which the calculation of probability was not merely an issue of scientific importance. But at the height of this astonishing career and at the frontiers of 17th century mathematics, barometrics, dynamics, and mechanics, Pascal gives it all up in a state of despair over his relationship to God, saying to himself and writing to others that he knows himself to be without grace. He comes to the conclusion that the rebirth and the forgiveness and the peace offered through Christ in the New Testament is not something to be attained merely by attendance at Church, by participation in Communion, but that he must feel within the mysterious act of God’s grace and salvation through Christ and a belief that this would mean, among other things, the end to his feelings of worthlessness, of guilt, of doubt about his moral qualities and his relationship to God. He has what he calls *his night of fire* after which on the whole he abandons his scientific and mathematical career.

His night of fire occurs when he is sitting in an armchair reading a passage from Scripture on the crucifixion of Christ and, as he will record it, he becomes aware that it is he, the sinner Pascal, who should be there suffering for his sins and for his

worthlessness, and that God himself incarnate in Jesus Christ has taken his place to suffer, mysteriously and without deserving, for the forgiveness of human sins and he writes on a piece of parchment that it is not the God of the philosophers whom the Christian must seek, but the God of Abraham, Isaac, and Jacob, Christ on the cross, sole source of real understanding and salvation. The God of the philosophers, *he believes*, there's little relationship to that Christian understanding of God. His main work of religious apologetics, his thoughts on religion – in French simply his *Pensées* – is a work that he himself never completes. His disciples and friends take his notes, edit them as best they can, and publish them in the arrangement that they think is consistent with Pascal's apologetic tone. He dies in his thirties, but the *Pensées*, his thoughts on religion, will electrify a generation. And in this century of growing confidence and philosophy and natural understanding of God and seeing God in nature it is important if we are to understand the 17th century, to understand as well its deep, Christian fideistic side as well.

Pascal's apologetics begin with an appeal to the reader, honestly to situate himself or herself with relationship to the world in order to assess: What is it one should seek to know? What kind of knowledge should one seek to have? To what should one in fact devote one's life? And he asks his readers to look closely at the human condition in passages that I think for Pascal represent the misery of human beings without God. For all of our pretensions to order, to civilization, to knowledge, to final understanding, what are our lives really about? *Pascal asks*. They are about the endless search for diversion, what we ask above all else but we fail to analyze what should follow from this. What we ask above all else is not to be left alone anywhere with only our own awareness of our own self as our companion, and our lives are nothing but a search for diversion. The human condition, *Pascal writes*, is a condition of unhappiness, people seeking to divert themselves from that unhappiness in an endless array of activities that never satisfy. It is also a condition, *Pascal writes*, marked by two phenomena that really are quite extraordinary if one thinks about them. Hate and self-hate, both absolutely remarkable phenomena. We are filled with jealousy, contempt, and anger toward our fellow creatures, mysterious enough, but yet more mysterious, we are filled with anger, loathing, and hatred to ourselves and thus, we seek a life of absolute diversion, whether it be knowledge and science, or gambling or career or worldliness in order to avoid the deepest question that we most fear to ask: Who am I and what is my fate?

We study the universe, the stars, we study bodies and motion, we study air and water, but surely, there is one thing we need to study first: Ourselves. We need to know ourselves as creatures. What could be conceivably more important knowledge than that? And if we are able to end our quest for diversion and avoidance of thinking upon the real nature of human life, *Pascal writes*, if we observe ourselves

closely and honestly, what we discover is that we are the most astonishing mass of contradictions. Contradictions that seem without possible explanation. Look at us, *Pascal writes*, what an extraordinary mixture of on the one hand genius, and on the other hand, ignorance. We can measure the distances of the stars, we can reduce natural motions to mathematical harmony and law; and we are creatures of the most inconceivable superstition, self-delusion. We are capable of on the one hand, an extraordinary science that seems to allow us to understand almost everything on which our wellbeing might seem to depend, except that we cannot achieve morality. We cannot make ourselves good, we cannot find moral purpose for the knowledge we have. We are beings of almost unlimited energy, but energy without purpose. And we combine not just as species, but in any given individual's life the most remarkable contradictory poles of subtlety and grossness; the ability to appreciate at one moment the finest music, the finest art, and then to be drawn to the grossest imaginable forms of bestial entertainment or behavior. We are creatures of extraordinary self-assertion and egotism on the one hand, and racked by fear and guilt on the other. We are creatures of exquisite reason; we have devised systems of mathematics, of logic, of calculation. There are monuments to the genius of reason and yet we are victims of the most arbitrary custom, such that given the arrangements of human lives we say: "This person lives on one side of the river, he is my fellow countryman and friend, this person lives on the other side of the river, he is my enemy and it is my duty to kill him." Creatures capable of high mathematics and creatures for whom a river divides between friend and mortal enemy.

Now, what have the philosophers said, *Pascal asks*, to explain that? So, there is knowledge that we need, surely, it is some understanding of ourselves. The problem is that philosophy assumes an abstract human intellectual power when all human thought, all human reason, is embodied in creatures of these contradictions. And the result is not intellectual strength, *Pascal argues*, the result is that we are creatures of intellectual weakness. We have reason without sincerity and have achieved the astonishing ability knowingly to deceive ourselves when we find it in our interest. We are moved by false appearances again and again. Our much-wanted intellectual life occurs, in fact, always under the influence of passions and prejudices. We live under the empire of imagination which rules us with infinitely more power than the empire of reason. Further, all of our knowledge is relative to the kind of mind we possess. We make arguments that talk past each other. Some of us have intuitive minds, presented with a great number of particulars; we see generalizations and argue from those. Others of us have geometrical minds, we deduce from a few principles things that seem self-evident to us, and we don't even understand that the things we find convincing or compelling, we find convincing or compelling not because at our intellectual best they satisfy some pure detached

model of appropriate use of mind, but because they appeal to the predilections, the predispositions of our own ways of thinking.

Further Pascal will argue skeptically, even a moment's reflection suffices to convince us that we find ourselves between two extremes neither of which we can comprehend. We are unable to grasp the infinitely large. The mind loses itself with all thinking about infinity and we are unable to grasp the infinitesimally small. The mind loses itself thinking about the infinite divisibility of things into the infinitesimally small and yet, we must try to place ourselves somewhere between two poles neither of which we are capable of understanding. Aware of this, the search for natural and scientific knowledge should pale in significance. In contrast to our desire to have the deepest answers for some knowledge of the mystery of ourselves, of the infinite, of the eternal of God, but we avoid these considerations out of such fear but it is foolish to do, *Pascal says so*, and I'll prove to you it's foolish, *he writes*, but this will not be a proof of God for the human mind does not reach God by reason, the human mind does not know God by philosophical proofs, but I'll prove to you it is the most important knowledge that you should have and, *he writes*, addressing – a man well versed in probability, theory – a nation of gamblers, I will prove it to you on the model of a wager. Why should you want there to be a God in whom you believe? Calculate the terms of the bet, *Pascal writes*. And remember this is not a proof of God; it's an incitement to make the reader want to believe. There has been much confusion about Pascal over this.

The argument of the wager: Supposing that you bet that there is a God and you are right, you stand to gain everything. Supposing you bet that there is a God and you are wrong, there isn't, you lose nothing. So, there is one side of the wager; the possibility of infinite gain and no loss. Now imagine that you bet that there is no God and you are right, you gain nothing. Imagine that you bet that there is no God and you are wrong, you lose everything.

Who wouldn't understand, *Pascal writes*, the necessity of that wager? On the one side the possibility of infinite gain and no loss, on the other the possibility of infinite loss and no gain. It is not a proof, *he writes*, it is an incitement to a proof and it cannot be a proof because there is nothing philosophical that gets one to God because it is not through abstract contemplation of the God of the philosophers; it is through the grace of God incarnate as Christ, *Pascal will write*, that mankind alone can know God.

The God of the philosophers answers nothing. You say there must be an author of the order we see in nature, of the mathematical relationships, but what are we left with? We're still left with the evil and depravity and contradictions of human nature. Those remain incomprehensible. So, the philosophical knowledge of God has brought us nothing. Further, it is not knowledge of God that changes human – or

any being's – lives; it is love of God. And between knowledge of God and love of God, *Pascal writes*, there is infinite distance. Lucifer knew that God existed, but he didn't love him. Judas knew that God existed, but he didn't love him. Mere intellectual recognition of God is not enough. Love of God in one's heart alone is knowledge that answers the dilemmas of our condition.

He will write: *How I hate the theology of Descartes. His God winds up the universe and then steps away from it. He will write: Others look up at the skies and see astronomical systems and claim to know of God, I look up at the heavens and see immensities and voids that fill me with dread and terror.*

In reply to these dilemmas, *Pascal writes*, there is only the Christian revelation. It has its reasons, *he argues*, fulfillment of prophecy, the testimony of the miracles, the power of grace observable in people's lives, the consequences of conversion, but one should not believe by its reasons. One believes, *he will write*, via the heart. If one is touched by grace for the heart has its reasons that reason cannot comprehend. No one can think his or her way to grace. One experiences grace mysteriously and is touched by it, but then, *Pascal writes*, with such belief everything falls into place. Understanding that we were created in the image of God, that we fell through Adam into a stage of depravity and that those two natures exist explains the mystery of our contradictions and unhappiness, our greatness and depravity, our reason and superstition. For Pascal, *as he writes*, it is like looking at a trick picture. You look at the world from one direction, it looks a certain way. As you look at a picture for a certain direction it looks a certain way and then someone says: *Look at it from this angle*; and suddenly you see something else that's there. That, *Pascal writes*, is what happens in the wake of grace and Christian belief. Suddenly the contradictions of the world are comprehensible. Suddenly one experiences an inner peace that philosophy cannot give about the goal of life, and understands that the main function of reason is not to explain the world, the main function of reason is to humble reason, show us what we do not understand, and lead us to the search for faith. But recall, Pascal writes this in an age about to be swept away by the Newtonian demonstration of just what reason could accomplish in the world.

In the case of Pascal, his piety was – and is – obvious to all. The case of Pierre Bayle is a much more remarkable and interesting case and wonderfully illustrative of the tensions and potential paradoxes of a Christian age embracing reason, natural philosophy – the new philosophy – simultaneously.

Pierre Bayle is a Calvinistic writer exiled from France – which expelled the Protestants – and living in Rotterdam, who believes that the attempt to make all things rational has extreme dangers for religious belief; and he undertakes among his goals to humble reason by showing the great dangers that reason poses to

religious belief. Against the attempt to make all belief rational Bayle wishes to demonstrate the insufficiency of reason and the need for faith by showing the incompatibility of reason and faith. To show that incompatibility, not to make rational people disbelieve religion, but to make religious people understand that they must not rely upon reason. But here is the great paradox of Pierre Bayle's life, writing as we know from the most pious of reasons in the midst of an intensely religious Calvinist community in Rotterdam: Within one generation, Bayle will be read in Europe as a great anti-religious author, as the father of Enlightenment criticisms of Christianity and the Jubilee Christian tradition, as the great scoffer and mocker who sought to show that rationality and deep religion were incompatible in order to disgrace religious belief. It is one of the remarkable paradoxes of the early modern period – the faith of Pierre Bayle – but comprehensible if you think that he is writing for the very generation that is embracing Locke's *The Reasonableness of Christianity*, that he is writing for the very generation that is thinking: *God said let Newton be and all was light*.

For example, Pierre Bayle is deeply convinced – in good orthodox Calvinist fashion – that salvation, justification, sanctification are mysteries of God's grace beyond human understanding. He is appalled by what he takes to be the increasing tendency of very self-confident, and – in Bayle's sense – arrogant theologians to pass judgment on *this person is saved, that person is damned*.

Calvinist theologians believed in pre-destination, that God mysteriously had elected certain souls to be saved, and that the evidence of their salvation was not necessarily evident in the details of their lives. Catholic theologians counterattack, arguing: *By that logic the worst sinner could be saved, this murderer could be saved, this adulterer could be saved! Look at what you are doing in Protestant theology*.

Many Calvinistic apologists back off and begin to talk about: *No, there will be evidence in the lives of people, showing that they are among God's elect*. For Bayle, this is a very dangerous abandonment of true religion, so he writes an article on King David – take it from his orthodox meaning but think how it can be read later – he says: What do we know about King David from Scripture? He was a murderer, he was a thief, he was an adulterer, he was a liar, and he was beloved and favored of God. He sent a husband to a certain death because he lost it after the wife. He committed adultery. He organized, as Scripture tells us, a band of robbers who killed witnesses so there would be no one to report on his crime, and he was beloved and favored by God. For Bayle, the things of Christianity are beyond natural human comprehension. The mystery of grace and salvation and justification and sanctification are beyond human understanding. But in an age demanding reasonable belief, think of how Bayle's article can be read; and within one generation, Enlightenment Anti-Christian deists will be virtually copying Bayle's

article on David to show the incompatibility of the Jubilee Christian Scripture with any rational or reasonable understanding of God.

Or Bayle will write extensively and it will involve him in most of his polemics on the problem of evil. He is appalled by the efforts of evermore rationalizing and naturalizing Christian theologians; to say we can justify to human natural understanding the evil of the world. And Bayle will write in articles that electrifies contemporaries that the problem of evil not only is insoluble by human reason, but that by neither logic nor evidence could anyone overcome an objector who doubted the goodness of God or to name what everyone agreed had been the vilest heresy – the Manichaeian heresy – that said: *There was not one good God who governed the world, but two gods, one infinitely evil, one infinitely good who warred with each other.* How could the Christian through natural philosophy overcome? Look at it as a problem of logic: Either God could have prevented evil but chose not to, in which case he is not infinitely good; or God wished there not to be evil but could not prevent it, in which case he is not infinitely powerful.

No natural rational argument can overcome that skeptical objection, *Bayle writes*, and if one looks at the evidence of the world, suffering, war, disease, famine, flood, would anyone say: *Oh! The only inference I can draw from this is this must be the work of an infinitely perfect being?* Bayle argues: *No, it is the last inference you would make.* The Christian doesn't come to a belief in the goodness of God through the power of reason or through the power of natural evidence. The Christian comes to that most central element of Christian belief only through faith. And if one attempts to do it by reason and by natural evidence, one is lost and overcome by the objectors.

It is time, *Bayle writes*, for Christianity to detach itself from a notion that the mysteries of Christian faith and the natural philosophical enterprise of logic and natural evidence are part of the same world of belief. And the more Bayle is opposed by outraged theologians, the more he attempts to criticize the very foundations of his culture's intellectual inheritance; showing that when Christianity mixes itself up with natural philosophy, it ends again and again in superstitions, in untenable theories, or in threats to the essence of its own most deeply held pennants rather, *Bayle argues*. Let us be humble, let us be tolerant, let us think about the natural world in the most rigorous natural ways, but let our religious beliefs be a matter of quiet faith and conscience.

But what evidenced for the coming tidal change occurring in early modern European culture; that Bayle with each passing year is read as an irreligious thinker by each new group of readers. Because given the growing commitment of a Christian European culture to rational and evidential belief, to reasonable belief, to inductive belief, the claim that natural philosophy and Christian mystery, the

reasonable and rational belief and Christianity are incompatible; can only be taken as an assault upon Christianity.

Bayle's David was a Calvinist case on the mystery of grace and sanctification. Two generations later, almost word for word plagiarized Voltaire's article on David will be taken as grounds for mocking the Old and New Testaments. Fideism persists. The appeal of Pascal is deep and indeed, for a generation, the appeal of Bayle as a religious thinker is deep; but Fideism is occurring on a wave of the naturalization of worldview and the increasing rational commitment of the culture. Think again on Pope's epitaph of Newton: *Nature and nature's laws lay hid in night. God said let Newton be, and all was light.* A culture that believed that was moving rapidly away from a belief that the world would be clearer if reason's light were diminished or we stripped it.

Thank you.

Lecture 8: The triumph of the moderns⁸

Of 1680-1715. To conclude our lectures, with a discussion of the legacy of the intellectual revolution of the 17th century, the generation of 16 at the 1715, the heirs of the intellectual revolution we have studied is one of the most intellectually momentous transformative regenerations. In the history of Western thought. It's not clear that it would have been obvious at the time, that the forces of the new philosophy, the challenges to authority, the new sciences, were going to triumph in the manner in which they did in the West in the 18th century. But in retrospect, we see the very dramatic impact of the cultural and intellectual transformation of the West in the 17th century, in this critical transitional generation. They have their own institutions everywhere. Academies of Science, of secular studies, academies for the dissemination of the new knowledge, not simply now in the capitals of Europe, but in provincial centers, as well. They have their cell phones, in almost all the major cities of Europe, where young men and increasingly young men and women are drawn to the new philosophy, me to discuss to share ideas to share communications with like-minded groups elsewhere. They have their coffee houses, as well, particular places in London and Paris and Edinburgh, where people go to discuss the latest ideas, the new theories, the new philosophy, the new scientific achievements, and very dramatically, they have their journals. There is a proliferation of new journals for people interested in precisely that world of learning occurring outside of the universities, which will be one over the last of all, the universities. There are journals for people who want that new learning that is occurring outside the university that contain long articles on topics as new knowledge, reviews, of books published in all the corners of Europe, literary

⁸ Transcript by Hadi Amini Pouya

correspondence reporting from London, from Edinburgh, from Berlin from Paris, it is an extra ordinary generation, in terms of the excitement that feels about a new world to be thought about to be known to be explored by new methods of mind. There is an interesting way to think about the transformation of the interests of the reading public, in this generation from 1680 to 1715. If we quantified some of its interests, for example, the percentage of journals devoted to articles on theology articles on abstract metaphysics, we see from 1680 to 1715, and the publisher who were interested in making money, they knew what this new educated reading public wanted. We see with each passing unit of time, fewer and fewer titles and reviews of works in theology. In abstract metaphysics, if we look to work devoted to the new sciences, the new philosophy, secular studies, we see a rising bar graph with each passage of time and that phenomenon will continue throughout the 18th century.

Stop a moment. And think about how far Europe has come in transforming what is, after all, the most fundamental element of a civilization in its relationship with nature, and the natural order, the way it thinks about the world, the way it thinks about thinking. Remember where we began this course? What makes you say yes, that's right. No, that's wrong. What makes something persuasive, or not persuasive? What do you think is out there to be known? And how do you think you go about knowing it, why the things happen? These are the most fundamental elements of being human in terms of our relationship to the world in which we find ourselves. So, let's pause a moment. And look at the distance travelled in this remarkable century. By again, that small number of miners who were culture still struggling to eke out survival from the difficult Earth, on the basis of its new knowledge, it would transform its productive relationship to nature. But let's look at how those few minds who in the culture singled out and spared from morning to evening labor so that some human beings might understand the reality in which we found ourselves might teach the reality in which we found ourselves how far the civilization had come in its transformation. We began with the model of the disputation in which, above all else, one persuaded and one arguments by citation of or authority. Aristotle said so was a compelling argument. Plenty said so Ptolemy said so. In anatomy, Galen said, so the ancient authorities cited were compelling demonstrations. Why? Because the culture sense of its relationship to knowledge to the wall, was that it was the air, the beneficiary, the recipient of that which had stood the test of time, that which had gotten us here, we've survived, we've made it here we were still alive, the knowledge worked, or theory. What a transformation by the end of the 17th century, or authority has virtually disappeared as a model of compelling belief, the citation of ancient texts for purposes of demonstration, what influence would that have on a generation touched by Galileo and Bacon, by de caught in mathematics and in physics, by the Newtonian revolution and achievement? Well, what a change in a culture sense of its relationship to reality, to

move to move from a model of the presumptive or thorty of the past, the presumptive or authority of inherited tradition, to precisely the opposite conclusion, that after long centuries of error and darkness, the human species in 17th century Europe for this is how the culture thought of itself had cast away blind obedience to a model of authority and had discovered a method for using the mind that allowed us to discover the actual world and set of natural relationships in which we found ourselves. What was next in the disputation, it was syllogistic reason given a formal authority, given B formal authority, C followed the European mind and made its compact with

It would avoid contradiction. But its model for that use of reason as the 17th century dawn. And so far as the university world is concerned, the universities are not always in the forefront of the transformation of a culture or the teaching of wisdom. So far as the universities were concerned in the late 17th century, the model of authority and syllogism still held. But the West had made a compact with reason in which given A given B C followed and one would avoid contradiction. The whole model of syllogistic reason has been swept away because the culture has come to believe what is the value of consistency if the premises are unexamined? What is the value of consistency if the premises are arbitrary and it has shifted instead above all else, to a model of inductive logic, in which we make generalizations from our observation of the particulates and test those in rationally devised another use of reason rationally devised experiments? If I am correct, it would follow under these circumstances that X would occur. Let me test that. So, reason induces generalizations and devises what would be the logical experimental tests that would determine the truth or falsity of the induced generalization. The other model of reason that rises from the status in the Aristotelian scholastic will have a minor technical skill useful to people who deal maybe with currency and trade is mathematical logic. To deal with the data of the new sciences in a mechanized model encouraged and required a revolution in mathematical logic, that is truly quite breathtaking. The development of analytic geometry, the development of calculus, whole new systems of mathematical logic of mathematical notation. So, we have moved from a system of knowledge based upon or authority and the syllogism to a model of knowledge based upon the presumptive falsity of authority. The presumptive weakness of inherited or authority, the belief in a new model of inductive and experimental reasoning about nature and a model of mathematical logic and rigor. The assault upon the principle of authority further, is not something that one can restrain nearly to the realm of the philosophical, the scientific, the intellectual, there is a much broader cultural attitudinal issue involved. As the 17th century dawns, it is assumed that the way things have been done is the way they should be done. That one doesn't question the past. There is a presumptive rightness to what is inherited in challenging the model of authority at an intellectual level. Europe is dealing not only in the particular but in the general

that authority as a model in general, the past is presumptively right in general need not be accepted as the safe and the rightful human relationship to history to the present and to the possibilities of the future.

If one could question you inherited physical or authority in physics and astronomy? Why couldn't one question inherited political theory? Why couldn't one question the authority of bathrooms have divine right monarchy, doctrines of hereditary aristocracy to take away from inherited or authorities presumptive rights is to open a very general revolutionary perspective, the right to question the sense and we shall see it in the 18th century so dramatically, that one need not accept a static world or pattern oneself upon the model of the past. That one may think in terms of progress, of altering the condition of things of challenging the manner and the justifications of the world in which one finds oneself. There are such dramatic intellectual currents associated with this generation of 1680 to 1715. Its growing commitment to empiricism, that human knowledge must be derived from our experience of the world. That there must be reality checks upon our theorizing upon what they can describe as the spider's webs of the theorists that are so intricate, so harmonious, so beautiful, but spurned solely out of our own stuff in its own mind the generation of 1680 to 1715 believe it was making a compact with nature, a compact with the reality principle with the world out there, it would learn from it, it would derive theories and knowledge tentatively, from the study of how things actually behave, what the real phenomena of the World War, one would not accept, theorizing however elegant however satisfied that could not be confirmed by the actual data of the world. Secondly, the belief in quantitative rather than qualitative knowledge about reality. The century moves us into an understanding of nature based not upon perfections and purposes, but measurable forces and leads to the extraordinary revolutions in physics, chemistry, and astronomy, in technology in engineering, that utterly transform human life upon this planet. Life in the 17th century, is not that different from life 2000 or 3000 years before a few better ploughs. Some improvements in the efficiency of gears and mechanisms, a compass but the conditions of our species life are still ones of eking out in the 17th century subsistence, of minimal increase in the ability to apply force to the things of nature, human force to the things of nature. The 17th century quantifies our view of nature puts us in a universe of measurable forces. As a result of which these lights shine, planes fly overhead, you push a button and exert more force than 50,000 human beings could have exerted at any time between Rome and the 17th century.

They alter the thinkers of the 17th century, the species relationship with the natural world beyond, I suspect, the wildest dreams of a bacon when he saw what might be possible in the expansion of human Empire. Third, there is in this generation, a settling in of the naturalization of world view. It is the growing consensus in 17th century mind that we feel now in this century of extraordinary

progress in natural knowledge. That thing that we attributed to the supernatural to the direct will of God can be understood and explained via the forces of nature

The phenomena attributed to God's punishment or reward, to spells and curses and enchantments to witchcraft or the prayer, to angelic intelligences to vegetative or animals' souls can be understood in terms of the forces of nature itself for a deeply theological and religious century, which the 17th century is, what this naturalization of worldview involves, is increasingly the location of God's providence. In natural laws themselves. You're moving from a view in which nature is random chaotic, from which we are rescued by divine intervention, in which nature is the location of sin and disorder, in which God intervenes to achieve his will, to a view in which nature is seen as the very product of Divine Will and intention, the noise of nature or the product of the Lord giver of nature. It is a virtual shift in what one is tempted to call a religious aesthetic. The advantage of being a lecturer is if you're tempted to call something you can call it something, a shift in the very aesthetic of religion and theology. Imagine, if you will, people who lived in a village in which there was a broken-down clock. And every hour on the hour, someone ran into the village square. Move the hand around so that it showed the correct time. dragged down to St. George on some rails, lifted up a hammer, a sword struck and drag in the right number of times went back and people went, Oh, what a miracle. What an extraordinary figure. Look, look how, how is shown the time.

But now imagine a village in possession of a clock. So exquisitely wrought, so exquisitely crafted. The mechanism so perfectly adapts that on its own, from the design, the brilliance, the wisdom, the handiwork of that clockmaker. It keeps telling the right time.

And someone tells you, you think that's something we have someone who runs in and fixes hours, once an hour, talk about power, no, you would say what's more awesome. What's more subject for reverence would be the clock maker who is mechanism embodied his intentions, his will from the star, and it is back shift in religious aesthetic and depreciation that is occurring in the 18th century. In the wake of this revolutionary generation, they don't want to hear very much about miracle and intervention. The growing consensus is miracles happened back then to establish Christ and the church. But the wonderment of God is the operation of natural law, by which in astonishing order unquantifiable forces, the universe Fit for Life proceeds, one can think of this as a distinction between general and particularly Providence. In the case of God's in the model of particular Providence, God wills particular events. Calvin put it this way, not a blade of grass grows, not a

leaf falls from the tree, except by an express particular will of God. That's particular Providence. Things that happen via a particular volition, by God. If you believe holy, in particular Providence, someone slips off a cliff on a rainy night and you say, why? Why did this happen? What purpose is being served. But if you locate your reverence for the divine, and the theological culture in general province, one a shift in the world that you experience, you judge God, not by particular events, but by the generality of law. The one demand is that we have the law of gravity that keeps the solar system static, it makes life possible. That's the gift from God. And another gift from God is it's always there. It's predictable. You can base your life upon it, you can calculate now it does mean that if someone is walking along a slippery Cliff in the middle of a storm, he or she could fall to death. But don't ask God, why that happens. The only better shoes for walking slippery, high places, put fences up. The fourth is God has built into the universe ought to be utilized toward the end of human betterment. What this does pose and it will be a genuine crisis. The Judeo-Christian belief in the 18th century, is what are we to make of miracle, if one comes to admire is the universe that operates according to general laws? What attitudes are we to have, to those claims of divine intervention and Miracle on which so much of the Judeo-Christian tradition is based. It is by no means coincidental, to say the least, that in the wake of this intellectual Revolution, the 18th century should witness the first great challenge in the intellectual world to Judeo Christian teaching in the Enlightenment, and they aesthetic and often atheistic assaults upon traditional beliefs. No. So that if one looks at nature, not as abandoned by God, not as that from which we must flee, to know or encounter God. But as the very locus, the very sight of God's love and wisdom and power made manifest in the world, then we value nature, then the natural becomes a good guide. The natural becomes the place where God love, where God's wisdom where God's power touches us.

If nature is a reflection of Divine Will and power, then natural law, embody the choices the will of God. This means also, that one must revalue human nature in a consequence of very high drama for European civilization. It was commonplace in the history of the Middle Ages, and traditional early modern thought, to look at human beings and say, they seek pleasure they flee pain, they seek wellbeing, they flee suffering, a mechanism of human nature in most sermons. It could be cited as the very evidence of our sin of our ego this of our unwillingness to bear the causes and pains and sufferings of the world. But if you absolutely revalue nature, if you see the mechanisms of nature as the embodiment of God's will, what happens to that mechanism in European thought, if we and other living creatures seek happiness, and flee suffering, then nature itself by its mechanisms and laws, teaches us that God intends us for happiness. Indeed, it's obvious nature speaks it, it's obvious. We are intended for happiness by God Himself. It's a revolutionary criterion listened to; we hold these truths to be self-evident. Jefferson wrote, that all men are created equal and that they are endowed by their creator with certain

inalienable rights among this life, liberty, and the pursuit of happiness. And it is to that end the governments are established among human beings. Christian readers in 18th century America didn't say how empires, Calvinist, and Methodist, and Baptist and Presbyterian readers of the day, as Jefferson didn't read that passage, and say how on Christian, for it was self-evident to them too, for the whole culture moved on this title, current of the revaluation of nature, that produces such a revolutionary transformation in the expectations of human life and possibility, and linked to the idea of progress, and the assault upon the principle of authority. Virtue virtually full ordains that the 18th century will be a revolutionary century for its really conceptualization of nature. And the relationship of God and human beings to nature gives you the most extraordinarily revolutionary criterion, that we have the right to examine all things and judge them, according to whether or not they serve human wellbeing or human misery in this world. What a revolutionary criterion in the same manner, in which the century be queen to this generation, a new method for assessing claims of knowledge, claims of science, claims of convincing arguments, it also the queen to this generation and the century that would follow it. I believe that from nature, from God Himself through nature,

We were taught with the same clarity that we knew gravity to a pain in the solar system, that human beings were intended by God, the happiness on this earth, because it was the natural mechanism of their being. And natural mechanisms, as one saw in Galileo, in Huygens, in Boyle in Harvey Incapsula in Gilbert in Newton natural mechanisms with the architecture of God Himself. So, we have the assault on arbitrary authority, no longer the presumptive authority of the past. And we have in the social, the political, the moral domain, and analogy to what had occurred in knowledge, that with a new method, we may reexamine everything we have a right to that the world ways must be justified according to the new methods of knowledge and judgement, and with a new moral criterion. We may reevaluate every everything And, in both cases, the world of knowledge in the world of social, political, economic, more examination. A religious culture believes that God Himself through the structure of nature and mind has will the new knowledge and the new secular moral criterion. No wonder the 18th century will be so dramatic. What could be more influential than a conceptual revolution, which forces a change in the way one thinks about or responds to everything? Let me stress what I alluded to before that one experiences and lives in a different world is one re conceptualize is it. Think of crop failure, or a hail storm in summer, as a mark of divine punishment, and you walk through that event, with one set of experiences, think of it as a natural phenomenon, obeying the general laws of nature, and you experience it as a wholly different event. Model things along particular Providence, I'm ill, why has God chosen to make me ill? And one experiences it as a particular kind of phenomenon. Think of it as an instance of general Providence, that I and all things are the product of nature. And when experiences it as an absolutely different

phenomenon. In both England, and in France at the end of the 18th century, there are two extraordinary literary debates in England known as the Battle of the books in France, known as the ancients versus the moderns, in which the civilization debates with the university professors eloquently lined up on behalf of the past on the whole, whether or not there is greater wisdom, and knowledge, now or in antiquity. While many hold that there is not necessarily an aesthetic progress, perhaps the poetry of Houma is unequalled as a literary form. Knowledge and science are seen now as cumulative, and progressive. And on the basis of that the culture clearly comes to believe. Knowledge may be the foundation of a human progress in the very way that we organize our lives, in relationship to nature, and in relationship to each other. The more we know about the real causes of things, the more we may change the world, according to the heart legitimate desire for human happiness.

There is the dramatic legacy of the 17th century across Europe, the learned impose often upon a frightened populace, an end to practices and beliefs, they now gain, superstitious, unjustified by modern knowledge. The most dramatic instance of this is seen in witchcraft persecution. The height of witchcraft, persecution is not the 13th or 14th centuries, the height of witchcraft persecution in Europe by far is the first half of the 17th century. Far more witches burned in that 50 years stretch than in any other 50 years stretch of European history. But by the end of the 17th century, the educated no longer believe that that is why crops fail. That is why cattle die. That is why people change personalities. And they impose upon a population that still would think in terms of curses and charms and witches. a ban on that persecution and an invitation to consider the world from the perspective of natural phenomena. They mechanize the worldview of the 18th century with their criterion of the right to happiness, they give us a utilitarian moral value, that the end of human activity is the reduction of pain and the increase of human wellbeing. With the assault upon authority, they insist upon the rights of free inquiry, free examination, the white of free minds, to check challenged question, to ask a new wave to demand justification for beliefs. They seek to remove theology from what they consider to be areas not properly, it's near, or at the very least, they desire a theology consistent with and evolving with increases in natural knowledge. Both of these are revolutionary phenomenon that will alter Europe's relationship to religion, all the Europe's relationship to Scripture. And further, intensely, the secularization of the West. In so many of these things, then we stand clearly at the birth of modern consciousness, scientific, secular, inquiring, seeking a principle of authority, apart from mere tradition, and repetition of the past, but tempted by skepticism and leaps of faith at time critical and equally confused by the range of choices it has created for itself. For better or for worse, we are the heirs of that 17th century mind living at once in its light, and living simultaneously in its shadows. It's been a great privilege to have talked with you about the 17th century. And I'm

very grateful for the attentiveness, the thoughtfulness of the questions and this entire experience.

Thank you so much.