BERNARD LONERGAN AND THOMAS KUHN;
THE ADVANCE OF KNOWLEDGE

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Abstract: This is a critical analysis of the works of both Thomas Kuhn and Bernard Lonergan. I summarize the work of Kuhn and his notion of the paradigm. During this gradual growth of normal science, tension builds as anomalies arise. A crisis occurs which erupts into a revolutionary shift toward an incommensurately new realm of understanding. This perpetual cycle continues on, forgetting the past and grasping for what is yet undiscovered. However there are many pitfalls to this theory. Kuhn strategically sidestepped controversial scientific issues. I then compare Bernarnd Lonergan's work to Kuhn's by pointing out the corresponding aspects as well as the differences. Instead of an outside paradigmatic structure dictating the inner, investigative drive of a community of scientists, Lonergan's method is inside out. He describes an individual's personal, detached, disinterested, pure desire to know the truth. The joint work with others then leads to ever-higher viewpoints. My conclusion is that Lonergan does not fall into the same mistakes as Kuhn because he takes into account the larger context of the total human person ever seeking a more perfect and true knowledge.

Key words: Thomas Kuhn; paradigm; shift; incommensurate; scientific revolution; structure; higher viewpoint; transformation; advance; pure desire to know; general empirical method.

Thomas Kuhn's *The Structure of Scientific Revolutions* greatly influenced the common perception of scientific investigation and the collective advancement of knowledge. Kuhn's definition of the term 'paradigm' as the scientific community's common set of principles and universally recognized achievements is used in so many different contexts and has become such a familiar expression that the book can be considered revolutionary in its own right. His sociological theory depicting science periodically advancing by sudden, radical transformations of technical understandings, deeply held beliefs, and investigated world-views, labeled by Kuhn as a scientific revolution, has become the publically accepted understanding of the governing structure of the scientific enterprise. Looking back at the history of physics, as an example, and tracing its growth of scientific scholarship, the famous names of Aristotle, Galileo, Copernicus, Newton, and Einstein quickly emerge. According to Kuhn's theory, between these few individuals who instigated major, rare shifts of understanding, normal science, consisting of puzzle-solving and data gathering, proceeds along casually. When looking at the evolution of

most human disciplines, this basic sociological model makes sense and seems to accurately describe the developments. However, from its first publication in 1962, *The Structure of Scientific Revolutions* has been greatly critiqued by the scientists and philosophers of science who have dedicated their lives to these pursuits. Kuhn is criticized for isolating scientific investigation from all the other factors that go into major world changes as well as siphoning out an elite group of scientists who make all the true contributions while denigrating all other investigators. Ultimately, Kuhn is condemned for portraying the scientific path as a winding trail with no defined direction and no certain goal.

Bernard Lonergan, who first published *Insight; A Study of Human Understanding*, five years prior to Kuhn's world-shaking book, took great interest in Kuhn's ideas. He wrote extensive notes on the book, which are still in the Lonergan Archive, referred to Kuhn many times, especially in *A Third Collection*, and used Kuhn's notion of revolution in the context of theology. The question must be asked: Did Lonergan avoid the mistakes that Kuhn committed? Like Kuhn, Lonergan also investigated the advancement of knowledge. However, unlike Kuhn, Lonergan brought the knowing process down to the individual level of a critical mind going through the general empirical method. This process, if done completely and carefully, can only lead one to objective truth because of the verification process of judgment. Then, as many accurate judgments coalesce, Lonergan describes the great change that takes place as a higher-viewpoint. Several key aspects distinguish Lonergan's idea of this new understanding of the world from Kuhn's notion of a revolution.

This paper is a critical analysis of the works of both Thomas Kuhn and Bernard Lonergan. I summarize the work of Kuhn by highlighting the key features of his theory. He produces the context of the paradigm in which the progression of normal science can take place.

During this gradual, steady growth of normal science, tension slowly builds as data are discovered that does not fit with the accepted models and theories. A crisis occurs which erupts into a revolutionary shift toward an incommensurately new realm of understanding. And, according to Kuhn's ideas, this perpetual cycle continues on, forgetting that which lies behind and grasping for what yet lies undiscovered. However, I next show how this theory falls short of accurately describing the advancement of scientific knowledge. For the uncritical, sociological reader, it gives the appearance of a very accurate depiction of the advancement of most disciplines. Nevertheless, I show how Kuhn strategically sidestepped many controversial scientific issues and avoided mentioning essential elements in the evolution of any particular science. That leads me into the work of Lonergan, which I compare to Kuhn's work by pointing out several features that correspond quite closely. Conversely, I explain how Lonergan has a different approach. Instead of an outside paradigmatic structure dictating the inner, investigative drive of a community of scientists, Lonergan takes an inside-out method. He describes an individual's personal, detached, disinterested, pure desire to know the truth about the world, which fuels each human being toward better understandings. He then shows the importance of the joint work with others that leads to ever-higher viewpoints. My conclusion is that Lonergan does not fall into the same mistakes as Kuhn because he is able to take into account the larger context of the total human person ever seeking a more perfect and true knowledge.

The Structure of *The Structure*

Thomas Kuhn describes a theory of the advancement of scientific knowledge in which data, conjectures, and procedures of scientific practice are accumulated and constantly revised over time. He relies on the history of the physical sciences throughout his book as a means of defining science and then explaining his schematic structure that creates the context for the

accumulation of data and the rise of new problems to solve. His aim is to show that natural scientists are misleading in their narrow-minded focus on the present questions and investigations. Instead, Kuhn develops a new concept of science that takes into account an historical perspective. He analyzes the major shifts of understanding that have taken place, by the few key people going back as far as the Ancient Greeks. Kuhn also evaluates the extended periods when science proceeded more slowly and an accepted cluster of well-known theories governed the scientific outlook.

Kuhn himself was trained as a physicist. It was through the natural sciences that Kuhn first felt he could confront the pressing problems of the world. However, after taking a history of science course as a graduate student of theoretical physics, Kuhn found, "that the exposure to out-of-date scientific theory and practice radically undermined some of (his) basic conceptions about the nature of science and the reasons for its special success."[1] These out-of-date theories and methods then became the basis of his formulation for a definition of science itself, which he states on page one of his book. "Science is the constellation of facts, theories, and methods collected in current texts (and) scientists are the men who, successfully or not, have striven to contribute one or another element to that particular constellation."[2] With this backward looking, historically-minded perspective, Kuhn analyzes several major moments in the history of science so as to come to an understanding of how science, in general, develops.

What makes Kuhn's perspective unique is that he is not trying to bring back out-of-date theories and perspectives to answer the questions of the present day. Rather, Kuhn analyzes the laws and discoveries in their own past context "to give maximum coherence to their contextual

[1] Thomas S. Kuhn, *The Structure of Scientific Revolutions*, Third Edition (Chicago: The University of Chicago Press, originally published in 1962, then 1996), vii.
[2] Ibid., 1.

opinions and closest fit to nature."[3] Then, within that historical context, Kuhn looks for those particular observations, important experiences, or arbitrary elements that caused the scientist working on the data at the time to think in a new way. This change then influenced the scientist to move the investigation in the direction in which it eventually proceeded. Digging deeper, Kuhn seeks to understand that which makes the scientist see the results of an experiment in one way and not another. What are the set of beliefs about the nature of the universe that the scientist held which immediately provoked the scientist to make a hypothesis about the data that made the most sense at the time? What is the ingrained thought process, happening within the scientist's mind, which leads to the decision that the world was functioning in the one way that the scientist conjectured? What commitments to past studies and previously accepted world-views did the scientist hold which impelled him to choose one set of data over another? Kuhn, who developed a deep interest in the psychology of perception, particularly gestalt theory, and was greatly influenced by his reading of Ludwig Fleck's book, *The Genesis and Development of a Scientific Fact*, wanted to break open the process scientists undertake when confronting a question. Kuhn was on a quest to come to know not scientific theory itself, but the method used by scientists to get to that theory. Though he began his investigation with a 'hard science' investigative approach, Kuhn was eventually drawn to probe the underlying influences that affected scientists through the history of science. These influences caused the scientists to have the perspectives that they did so as to form the understandings that are still at play in the scientific field.

Looking at the history of science, there are extended periods of time when no major discoveries occurred. In fact, Kuhn found these stretches of time to be the norm, while the major discoveries and changes in theories are the exceptions. He gave the name 'normal science' to the scientific work in which a community of scientists are involved during these years. According to

[3] Ibid., 3.

Kuhn's historical and sociological analysis, the impression held by the community of scientists during these periods of normal science is that they know what the world is like. The groups of scientists are not trying to procure new sorts of phenomena or uncover contradictions to their firmly held theories. The data that "will not fit the box are often not seen at all. Nor do scientists normally aim to invent new theories, and they are often intolerant of those invented by others."[4] What Kuhn makes clear is that the scientists have an anticipated outcome in mind for their experiments and observations during these times of normal science. Research consists of fitting the events and phenomena observed in the world with the laws and equations that have been previously determined. It is a process of deciphering the significant facts within the research, matching those facts with the theories that are at hand, and articulating those theories. The scientists simply do not see the world and the data that they are working with in ways other than that by which their previously established laws, equations, and definitions dictate how they should be understood. They rely on the promise of success from past, though often still incomplete, examples. The idea is to extend the knowledge gained from those first instances into presently observed cases. This is not an easy task. It is what occupies the time of most scientists' careers. Kuhn knows first hand that scientists work at this normal science with great enthusiasm. They do this because "bringing a normal research problem to a conclusion is achieving the anticipated in a new way, and it requires the solution of all sorts of complex instrumental, conceptual, and mathematical puzzles. The man who succeeds proves himself an expert puzzle-solver, and the challenge of the puzzle is an important part of what usually drives him on."[5] The puzzle that must be solved is how the observed data fits within the agreed upon

[4] Ibid., 24.
[5] Ibid., 36.

understanding of the world. Each piece of evidence must fit into the box of defined laws providing the structure within which the scientists are working.

For science to function at all, it must have these previously determined and agreed upon set parameters. Kuhn gives the name 'paradigm' to this box of established theories and laws. Normal science, then, consists of the articulation and re-articulation of the paradigm through the collection of raw data. "So long as the tools a paradigm supplies continue to prove capable of solving the problems it defines, science moves fastest and penetrates most deeply through confident employment of those tools."[6] Normal science does proceed rapidly. The scientists are guided by a set of rules that are derived from the paradigm and give coherence to the research. Textbooks act as pedagogical vehicles by explaining clearly the operations and protocol steering the scientific community's research. When there is a general consensus among all scientists as to how the experiments should run, unanimity in their professional judgments, and wide agreement on the proper interpretation of observations, then of course progress is far easier to see. In the later editions of his book, Kuhn revised the term paradigm to "disciplinary matrix: disciplinary because it refers to the common possession of the practitioners of a particular discipline; matrix because it is composed of ordered elements of various sorts, each requiring further specification."[7] Normal science is the pursuit of making all the observations of the physical world fit into this neat, ordered package of well-defined, commonly understood, theoretically explained elements.

The danger that Kuhn points out with the paradigm is that scientists can lose their ingenuity. Even when anomalies and inconsistencies arise in the experimentation, scientists ingrained in the disciplinary matrix choose not to accept the novelty of their data. They may feel

[6] Ibid., 76.
[7] Ibid., 182

that they have made a mistake, or the scientists fudge the outcome so as to force the results to fit with the standard model. If the data do not fit into the paradigmatic box of accepted principles in a clean and orderly fashion, then there must be explanations that can compensate for the anomalies and yet still allow for theories to hold. Classic examples of this are the early observations of planetary motion. The geocentric, Ptolemaic model was the paradigm for over fourteen centuries. Even when Tycho Brahe acquired extremely accurate measurements of the five other known planets and mathematically calculated the length and time of the orbits, his thinking process still stayed within the boundaries of the Ptolemaic paradigm. Retrograde motion remained the accepted explanation for the movements of the planets visible from earth. Brahe did not have the creativity or courage to break with the accepted model or question the accuracy of the firmly rooted theories. The researchers, instead of being true scientists, according to Kuhn, become expert puzzle-solvers.

The main theme of *The Structure of Scientific Revolutions* is that paradigms can and do change. When the anomalies become too great, and the researchers have severe difficulty keeping their known puzzle-solving techniques inline with the acceptable and coherent data of the set paradigm, a crisis builds up pressure that must somehow be released. "Paradigms are not corrigible by normal science at all. Instead, as we have already seen, normal science ultimately leads only to anomalies and to crises. And these are terminated, not by deliberation and interpretation, but a relatively sudden unstructured event like the gestalt switch."[8] The rigidity of the paradigm can no longer hold as more and more inconsistent data are collected that stubbornly refuses to fit with what has been established previously. Kuhn describes the transformation of the world that takes place within the scientists' viewpoints. The scientific community is no longer able to function within the past disciplinary matrix. A whole new model and system of

[8] Ibid., 122.

theories must be established which satisfactory accounts for all of the inconsistencies brought against the last paradigm. "The decision to reject one paradigm is always simultaneously with the decision to accept another, and the judgment leading to that decision involves the comparison of both paradigms with nature and with each other."[9] Kuhn feels that the resulting new paradigmatic structure must be revolutionarily different. Though the physical world continues to exist as it always has, the scientific community who experiences this abrupt shift, see a different world. The newly devised equations and theories are incommensurate with the previous models. A new language of speaking about the research develops that simply would not have made sense before. The past textbooks preserving the paradigm of old must now be discarded and new ones written. A new, neater, simpler, more suitable theory takes over from the primitive one. Kuhn calls this major, abrupt change of paradigms a scientific revolution.

The scientific community that goes through this revolution is Kuhn's main group of interest. In Bernard Lonergan's reading of Kuhn's theory, he made the comment that "the scientific community is of fundamental importance. It is a sociological concept of science, locating the science not in books or periodicals, not in the mind of this or that man, but in the group of men at the cutting edge of a developing science and gradually moving from the tension and opposition of disagreement to the unison of a consensus."[10] As Kuhn looked back through the history of science, he found that a new paradigm could not be forced onto a community, much like the people in Plato's cave could not be forced to see the light of truth. The crisis within the community and the tension that exists from unsolvable problems cause the scientific community to be in need of a new paradigm. Then, the right person comes along who is able to capture the community's attention. This person must have a proposal that resolves the tension

[9] Ibid., 77.
[10] Bernard Lonergan, "The Analogy of Revolution," (in the Lonergan Archives, A2041), 2.

and calms the crisis that arose from the previous paradigm. The individuals who were able to do this throughout history made the crucial discoveries at the right time. They were the elite few who were courageous enough to think of the world in ways never conceived of by anyone else. They thought 'outside the box' of the paradigm and took a risk by making a hypothesis that did not fit with any previously established theories. A revolution takes a great scientist to make an act of judgment that impels the rest of the scientific community to reject the past disciplinary matrices. "For the sciences, like other professional enterprises, do need their heroes and do preserve their names. Fortunately, instead of forgetting these heroes, scientists have been able to forget or revise their works."[11] Kuhn often times found these revolutionaries to be quite young or new to the field so as not to be overly ingrained with or committed to the standard paradigm. Werner Heisenberg is a classic example of one who at the age of twenty-four published his famous paper on the quantum mechanical notion of uncertainty, contradicting even the great physics genius, Einstein. Kuhn's analysis uncovered the similarities that existed between the revolutions caused by individuals like Galileo, Copernicus, Newton, Lavoisier, Einstein, and Heisenberg. He found that "Scientists often speak of the 'Scales falling from their eyes' or of the 'lighting flash' that 'inundates' a previously obscure puzzle, enabling its components to be seen in a new way that for the first time permits its solution."[12] Kuhn sometimes found that the revolutionary illumination came to the person in sleep or moments of relaxation. When the right mind was struggling to solve a previously unsolvable problem, it was all of a sudden transformed to link together components of a new and unique paradigm. From these moments of insight, a new paradigm took shape within the scientific community.

[11] Kuhn (1962), 139.
[12] Ibid., 122.

After this tidal wave of a revolution, scientific investigation continues once again, but now with a whole new outlook on the world. In order for the new paradigm to be accepted by the community it "must promise to preserve a relatively large part of the concrete problem-solving ability that has accrued to science through its predecessors."[13] Normal science then resumes in the wake of the revolution, but now with a radically different mentality. The puzzle-solving research mops up all the components that were shaken up by the revolution and attempts to fit the observations and data into the new structure of theories. With the advancement, Kuhn finds that the discipline of science becomes increasingly more specialized. "Revolution narrows the scope of the community's professional concerns, increases the extent of its specialization, and attenuates its communication with other groups, both scientific and lay. Though science surely grows in depth, it may not grow in breadth as well."[14] The wake of a successful paradigm shift should make the scientific enterprise more efficient. New and stronger arguments based on the best-known observations should be the backing to the scientific theories. And, as Kuhn says, "until the scientist has learned to see nature in a different way, the new fact is not quite a scientific fact at all."[15]

Kuhn's closing comment about this theory of the advancement of knowledge is that it is very much like biological evolution. As the course of scientific investigation goes through this perpetual cycle of normal science, to crisis, to revolution, to a new level of normal science, Kuhn makes the argument that there is no ideal goal for its progression. Science is constantly advancing and developing a greater understanding of the intricacies of existence, but Kuhn, presents his theory as an alternative to the notion that there should be progression toward a desired goal. This is not to say that he believes scientific progress to be a process that is not self-

[13] Ibid., 169.
[14] Ibid., 170.
[15] Ibid., 53.

correcting or ever seeking an "increasingly detailed and refined understanding of nature."[16] Rather, Kuhn's point is that the human mind will never come to a point of having a perfect and true understanding of the way the universe works. Rather than hoping for this ultimate goal or constantly seeking that which we wish to attain but never will, Kuhn stresses the importance of appreciating where science has come from and what science has accomplished at the present time. The accumulation of factual knowledge of the world which science has already done is enormous. Many paradigms have come and gone. Old schools of thought have given rise to new ones only for those to fade out of existence for the next generations. Structures of paradigms are built up by the investigators and puzzle-solvers who solidify them with many theories and observations. An enlightened individual demolishes these structures by means of a revolutionary breakthrough. The scientist spurs the creation of a new set of structures that fulfill the needs of the new insights. Kuhn simply wants the scientific community to be in the process *of* advancement rather than ever trying to work *toward* some particular level of understanding.

Weaknesses Within *The Structure*

As detailed and well developed as Thomas Kuhn's theory of paradigms, normal science, and revolutions is, does it account for the way that science progresses in reality? Without a doubt, Kuhn's theory made a big impression in the realms of philosophy, science, sociology, anthropology, history, and the philosophy of science. It is acclaimed as the best-known academic book of the second half of the twentieth century. Over a million copies of the book have been sold and it has been translated into twenty languages.[17] Despite its immense popularity, it has also caused a great deal of controversy within the communities of natural scientists and philosophers alike. Does it give an accurate description of the emergence of

[16] Ibid., 170.
[17] Steve Fuller, *Thomas Kuhn; A Philosophical History for our Times* (Chicago, University of Chicago Press, 2000), 1.

scientific advancement, or has it led the masses of students and new-paradigm-seekers astray? After giving a detailed account of Kuhn's *Structure*, I now discuss its weaknesses and pitfalls. Steve Fuller, a professor of sociology at the University of Warwick, Imre Lakatos, a philosopher of mathematics and science, and others, have written extended critiques of Kuhn, which I refer to here. Kuhn is criticized for disregarding the importance of the past theories and historical developments that have lead science to its present, well-established level of understanding. He is accused of being an elitist, focusing only on a few world-renowned scientists and forgetting about the thousands of contributors who have had a hand in the advancement of science. His view of science appears to be extremely narrow-minded as he fails to mention the many other influences that affect the way in which scientists push their research. Finally, and most dangerously, Kuhn's notion of the uncritical investigations of a science having no ultimate, teleological goal has serious consequences if it is truly the case. His view of how the individual researcher should be doing his or her experiments without having a bigger picture is never explained. These weaknesses must be acknowledged and investigated.

In chapter one, Kuhn described his life-changing conversion from a hard-scientist exploring theoretical physics to an historical philosopher of science who wanted to probe the minds of scientists and the development of scientific ideas. He embarked, at the beginning of the book, on the quest to uncover the ways in which new, radically different scientific theories developed from the ones currently held by the scientific community. The only way he knew how to do this was to look back at the past and completed investigations and old theories. However, the main premise to Kuhn's theory of scientific development is that each new revolutionary paradigm only comes about through the complete deconstructing of the past matrix of ideas and the rebuilding of a radically new theory. The present paradigm is so drastically different from

the previous ones that the same language cannot even be used to talk about them. The past paradigm is incommensurate with the present. A new way of seeing the world has come about, a new dimension taken shape, and a leap in understanding has occurred. Therefore, the past theories become irrelevant and obsolete. This notion is like the famous phrase from St. Paul's first letter to the Corinthians, "When I was a child, I talked like a child, I thought like a child, I reasoned like a child. When I became a man, I put childish ways behind me…" although Kuhn applies it to the entire realm of science. Can a discipline like science forget about its past? Does Kuhn's theory of the constant progression of radically new paradigms leave the door open for repeating past mistakes in the unknown future? Kuhn's theory gives the impression that insights and established facts are not so much accumulated over time, but the scientific slate of knowledge is wiped completely clean with each new revolution. Karl Popper made clear this point in saying, "It would thus be simply false to say that the transition from Newton's theory of gravity to Einstein's is an irrational leap, and that the two are not rationally comparable… thus in science, as distinct from theology, a critical comparison of competing theories is always possible."[18] Past theories are an essential part of the progress of science despite Kuhn's notions.

Another question that must be raised against Kuhn's theory is his view of the scientists themselves. He repeatedly names and gives great praise to Galileo, Copernicus, Newton, Lavoisier, and Einstein. These were the men whose great genius to think in new ways and daring courage to question what had never been questioned before, sparked the greatest scientific revolutions ever conceived. However, the countless scientists working before, between, and subsequent to these men are given very little credit. According to Kuhn, the majority of the scientists will spend their whole lives working away in the realm of normal science. Kuhn calls

[18] Imre Lakatos & Alan Musgrave, eds., *Criticism and the Growth of Knowledge* (New York: Cambridge University Press: 1970), 57.

these scientists 'puzzle-solvers' who work away at phenomena already well explained by existing paradigms, or phenomena whose nature is indicated by existing paradigms but whose details can be understood only through further theory articulation. Fuller likens this attitude to a "new kind of Orwellian history." Thus, the classic line from *Animal Farm*, "All animals are equal, but some animals are more equal than others," could easily be changed for Kuhn's theory to read, "All scientists are equal, but some scientists are more equal than others." Can Kuhn account for scientists like Aristotle, Tycho Brahe, or Johannes Kepler, whose observations and work were extremely influential on Newton but whose theories were ultimately proven to be wrong? Newton himself made famous the quote that he was "standing on the shoulders of giants," possibly indicating how he relied so heavily on many great scientists before him in order to establish his revolutionary theories and equations. Kuhn's theory is too elitist. His history is critiqued as a classic example of whiggishness, focusing only on the relevant issues and people who have contributed to the problems still important in the present day rather than those which, in the past context, were seen as crucial but have lost importance over time. There are many people who have contributed to each new step in the advancement of science and who cannot be merely brushed aside as Kuhn's theory seems to do.

A third critique of Kuhn's theory is that he takes into consideration only a very idealistic and, at the same time, extremely small component of the many factors that in reality affect research and development in the scientific field. For example, Copernicus is one of the first scientists mentioned by Kuhn whose radical ideas transformed the way people perceived the structure of the known universe. Copernicus was the first to announce publicly the revolutionary model of the heliocentric arrangement of the solar system. This is a radically different paradigm and incommensurate with the geocentric models which, up till that point, had dominated the

belief system of the authorities of the time and the general public. However, volumes have been written about the trials Copernicus had to endure for making a statement clearly against Holy Scripture. The role of the Catholic Church's hierarchy and other public authorities greatly influenced what Copernicus did and what information he released. The other contemporary researchers that Copernicus had known, and who both helped and hindered the spread of his ideas, also affected how this revolutionary idea emerged. The equipment Copernicus had to work with at the time and the funding that he had access to all must be taken into account. After his discovery, the ripple effect his theories had on the subsequent generations, both the factually accurate and the mistaken aspects were influential in the total picture of the advancement of knowledge.

A more recent example is the construction of the National Ignitions Facility in Livermore, California, that will be the first facility in the world, using the most powerful laser ever produced, to allow for the study of inertial fusion energy. The conditions that will be created in NIF's special fusion chamber only exist naturally in the center of stars. However, this incredible research is not just happening for the sake of advancing human knowledge. Many organizations have played a pivotal role in dictating how the construction was done and what it would be used for. The first and most powerful force determining the kind of research that will be done at this facility is the United States Federal Government. "When NIF is completed, it will be able to provide data for (nuclear weapon) simulations by replicating the conditions that exist inside a thermonuclear weapon. In addition… the program is developing a number of innovative technologies for homeland security and national defense."[19] The second objective is to develop fusion for powering the world. Finally, the third objective is to come to a greater understanding of the universe. Fuller made the comment that, "Those who called for a

[19] https://lasers.llnl.gov/ (accessed May 28th, 2009.)

distinction in contexts typically admitted that much of the inspiration or initial ideas for doing science came from outside science itself… including religion, technology, economics, and history."[20] Kuhn's notion that normal science simply proceeds along, apart from any other influence or external factor, is extremely naïve and narrow-minded. His theory does not describe the reality of scientific progress either in the past or the present day.

Finally, Kuhn's notion that the progression of science has no end goal in mind has serious consequences. This critique is by no means admitting that the human race does have a grand vision of what perfect and complete knowledge of the total universe is, but it is saying that the discipline of science needs objectives to pursue. As was just mentioned with the development of the National Ignitions Facility, before the construction is even completed - a process that has taken the last twelve years - there are hoped-for outcomes of research which the radical new equipment will allow. The present day world of science is very much driven by the reality of economics. Major scientific endeavors require large amounts of money that can only be acquired with grants from wealthy sponsoring organizations and governments. To even be considered for such grants, the head researchers need to show that the investigations that will be conducted in the laboratories will have useful and beneficial outcomes. Science is a perpetually evolving and growing system, but the growth and the drive for an ever-greater understanding are fueled by both short-term and long-term teleological goals that are not yet attained but could be in the future. Lakatos's reading of Kuhn's notion of science is that "it is non-inductive and irrational… In Kuhn's view there can be no logic, but only psychology of discovery."[21] If science proceeds as Kuhn proposed, of plodding through normal science until too many

[20] Fuller, (2000), 34.
[21] Imre Lakatos & Alan Musgrave, eds., *Criticism and the Growth of Knowledge* (New York: Cambridge University Press: 1970), 179.

anomalies arise, thus forcing a random revolutionary change to the next paradigm without any direction or purpose or mission, then very little progress will happen.

Worse than that, if science both forgets about past theories and remains so focused on the present that it has no vision of the future, it becomes susceptible to repeating past mistakes and getting caught in a very small revolving circle of decline. No progress, revolutions, radical inventions, or greater understanding can occur in such a trap of the human mind. Fuller quotes Raymond Aron in saying, "The past is never definitely fixed except when it has no future."[22] Kuhn's theory of letting go of a future goal has dangerous consequences. His desire for a greater appreciation of the present scientific paradigm is not how science functions and will not bring about the ever greater and deeper understandings of the world.

Kuhn's depiction in *The Structure of Scientific Revolutions* of the scientific enterprise consisting of long periods of normal scientific investigation within a set structure of beliefs, the rise of anomalies and crises, and the radical awakening into a new paradigm by a scientific revolution, has many powerful points and has made a great impact on the academic world. However, Fuller made the comment that, "It might be said that *Structure* has a philosopher's sense of sociology, a historian's sense of philosophy, and a sociologist's sense of history."[23] There are many controversial, inaccurate, and even dangerous aspects to Kuhn's proposed theory of scientific progress. Because of these anomalies, there becomes a need to search for a new and more accurate theory that gives a more precise description to scientific progress while not committing the mistakes that led Kuhn away from the truth.

The Lonergan Enterprise

[22] Fuller, (2000), 423.
[23] Ibid., 32.

Bernard Lonergan also developed a theory of the universal advancement of knowledge. His magnum opus, *Insight, A Study of Human Understanding*, was published five years before *Structure* and had a completely different approach from that of Kuhn. As opposed to being a 'hard-scientist' by training, Lonergan's expertise was in philosophy, with some training in economics. His focus became Thomistic theology, in which he taught and wrote about immensely. His aim in *Insight* "was neither to advance mathematics nor to contribute to any of the specialized branches of science but to seek a common ground on which men of intelligence meet."[24] This common ground, which Lonergan slowly uncovers, is the pure desire to know: to know the self, the universe, and the divine. Lonergan's main premise is that the human person, by its very nature, questions. There is a curious desire to come to a knowledge of everything about everything. This drive propels scientists into their experiments, urges mathematicians deeper into their equations, and pushes theologians to immerse themselves further into the mysteries of existence. It is through this questioning that humans experience the intricacies of life. The human mind takes in these experiences so as to make sense of the world. Then, according to Lonergan, unique to humans, is the act of judgment analyzing whether the understandings are true or not. Only when this critically reflective act of judgment occurs is there an advance of human knowledge. As more and more knowledge is acquired, it is processed to form theories, combined to make postulates, expanded to overcome past shortcomings, refined to establish solid definitions, and constantly tested to come to what Lonergan refers to as the virtually unconditioned. All this then leads to, not a Kuhnian revolution, but an ever-higher viewpoint, a greater knowledge of all things. This section of the paper summarizes Lonergan's

[24] Bernard Lonergan, *Insight: A Study of Human Understanding*, Frederick E. Crowe and Robert M. Doran, eds., vol. 3, *Collected Works of Bernard Lonergan,* (Toronto: University of Toronto Press, 1957, 1992), 7.

theory of the advancement of knowledge and how this alternative approach both relates to Kuhn's theory and how it avoids Kuhn's errors.

In order to understand the world, Lonergan explains that humans need to understand their own process of understanding. If this is done, he says, "not only will you understand the broad lines of all there is to be understood but also you will possess a fixed base, an invariant pattern, opening upon all further developments of understanding."[25] Unlike Kuhn, who developed his whole analysis of the advancement of science by speaking of the external forces and paradigms of the world affecting, moving, and changing the scientist, Lonergan starts from the inner drive of the human being. He describes *Insight* as being written from below upwards as "it consists in one's own rational self-consciousness clearly and distinctly taking possession of itself as rational self-consciousness."[26] Having such consciousness requires that the person be aware of and in tune with the personal experiences of life, of living in the world. And this world, according to Lonergan, is rich and full of meaning. Everything that exists has a purpose and holds a relevance to its existence. And when the human being feels a rock, grasps the concept of a circle, or experiences the embrace of a loved one, this meaning is manifested. Meaning is not simply a description of objects, but is an explanation of what the particular thing is. Meaning is knowledge. It is the answer to the question, "What is it?" Meaning establishes purpose for the things of the world and leads to the notion of value. By analyzing the process of how humans experience the world and the intellectual method used to arrive at an understanding of this meaning, Lonergan hopes to accomplish two goals. First, he studies the activity of human knowing, an event consisting of the "general empirical method" of experiencing the world, understanding the experiences, and judging whether the understanding is so. Secondly,

[25] Ibid., 22.
[26] Ibid., 13.

Lonergan studies what is known when this process of knowing is taking place within the individual. "Insight is studied as knowledge, as an event that under determinate conditions reveals a universe of being."[27] Thus, Lonergan's theory of how knowledge advances consists of coming to a greater understanding of the process of knowing as well as a greater appreciation for the meaning of that which is known.

Lonergan establishes five differentiated realms of meaning in order to make the knowledge of everything about everything more manageable. Each of these realms "has arisen in response to the different conscious aspirations and demands of the human spirit during the many millennia of our existence on earth."[28] Similar to Kuhn's notion of the paradigm, which consists of a shared set of viewpoints, models, theories, and practices by a community of investigators, Lonergan's realms are also shared models and sets of viewpoints. Likewise, they do not describe a reality but are rather useful mental constructions providing the structure for one to describe a reality. In Lonergan's psychological analysis of the human person he found that consciousness naturally divides into these different realms. As a human being grows and experiences more of the world and learns how to think and reason and evaluate and to make decisions, and to do actions that promote the human good, each of these different realms gradually comes into play.

The first and most basic realm is that of common sense. Before getting into abstract thought experiments, analyzing one's feelings, or discerning a difficult life decision, common sense is a time when the consciousness is undifferentiated. It is the concern of ordinary living and moving and being. This mode of human existence consists of the routines one has when getting out of bed or getting ready for bed, actions that are done that do not even need to be

[27] Ibid., 16.
[28] William Walsh S.J., *Realms of Desire; An Introduction to the Thought of Bernard Lonergan* (Washington D.C.: Woodstock Theological Center, forthcoming), 6.

thought about. Common sense is the particular, personal areas of thought that never aspire to universal viewpoints, systematic definitions, or technical language. The stage of common sense is the dealings of human consciousness with things that are familiar in the world as they relate to one's personal senses. This is a very important realm that cannot be discarded. "After all, men of common sense are busy. They have the world's work to do… (because) they deal with the immediate and practical, the concrete and particular."[29]

There comes a time where a human is pushed from the familiar to the unfamiliar, from the obvious to the recondite. The second realm of consciousness is one of theory and logic. It is at this level where scientists function as they perform their experiments, develop theories, wrestle with abstract problems, and, as Kuhn would say, puzzle-solve. It is pulling away from particulars and experiences of the physical, material world, and reaching toward universal theories and abstract understandings. The big difference between this realm and that of the commonsense is that it is the realm of a person using logic and reasoning to figure out how objects of the world relate to each other rather than how they relate simply to the person. Science for Lonergan consists of the investigation of those internal relations of things and developing an objective knowledge through experimentation that leads to explanations rather than myth or mere description. Thus, scientists use technical language to discuss their theories and express their meanings. The sciences can then be further differentiated within this realm of meaning. "The laws of physics hold for subatomic elements; the laws of physics and chemistry hold for chemical elements and compounds; the laws of physics, chemistry, and biology hold for plants. The laws of physics, chemistry, biology, and sensitive psychology hold for animals; the laws of physics, chemistry, biology, sensitive psychology, and rational psychology hold for

[29] Lonergan (1957), 202.

men."[30] Each different discipline has its own special language, theories, laws, explanations, sets of problems to solve, challenges to face, and meanings to develop.

When a human shifts from merely knowing the meaning of things to seeking out the source, operations, and acts of the meaning, then he has entered the third realm. This realm is that of one's own inner consciousness and thought processes. More than simply understanding how to solve a math problem, decipher a riddle, or logically figure out a puzzle, one who is in this realm is able to reflect back upon the thinking process that she just did and analyze that very process itself. No longer is this merely the common, routine, particular, or habitual experience. It is more than developing the skills or the knowledge it takes to pass a test with the rest of the students. This stage of meaning is a personal appropriation of one's own mind and actions. Lonergan's whole project is to guide the reader to the point of the self-affirmation of "I am a knower."[31] It is a process that requires each individual person to enter this self-reflective, critical thinking level of meaning. "No one else, no matter what his knowledge or his eloquence, no matter what his logical rigor or his persuasiveness, can do it for you."[32] It is only when one has determined that he or she is a knower that the awareness of the deeply rooted desire of the human nature to know is made manifest. Rather than blindly carrying out the methods and following the protocol of the science in which one is working, the true knower is conscious of the deeper implications of knowing and is able to describe how he is personally affected by the actions he is performing. More than just a Kuhnian 'puzzle-solver,' the Lonerganian 'knower' is fully thinking, where "thinking is a moment in the unfolding of the pure desire to know…it is purposive. It is the tentative determination of the all-inclusive notion of being."[33] It is in this

[30] Ibid., 281.
[31] Ibid., 351.
[32] Ibid., 13.
[33] Ibid., 383.

third level of interiority and at this moment of thinking when one is fully alive as an authentic human being.

Lonergan elaborates extensively about this third level of meaning. This cognitional activity has many deep implications including the very existence of the universe. Lonergan says, "cognitional activity is itself but a part of this universe, so its heading to being is but the particular instance in which universal striving towards being becomes conscious and intelligent and reasonable. Such is the meaning we would attach to the name finality."[34] The human cognitional process is truly a marvel within the whole of the universe. The meanings of all things emerge through this process of perceiving the existence of the world, rationally investigating abstract concepts, and reasonably reflecting on the deeper implications of all that exists. Thus, it is through the human process of cognition that objective knowledge of the world is acquired and how the becoming of proportionate being comes about. What Lonergan means by proportionate being is whatever is to be known by the ordered set of the human acts of experience, intelligent grasp, and reasonable affirmation.[35] When this process of cognition happens and the set of actions takes place, knowledge advances and can continue to advance until everything about everything is known. This, for Lonergan, is the ultimate goal, the final fulfillment of the universe. This is the most natural and authentic and uniquely human method of existing, that Lonergan, for the first time in human history, clearly establishes. The heuristic structure of human understanding allows for the rich and "fruitful unfolding of the anticipations of intelligence."[36] This structure is composed of rules or what he calls the canons of operation of

[34] Ibid., 471.
[35] Mark D. Morelli and Elizabeth A. Morelli, eds., *The Lonergan Reader* (Toronto, University of Toronto Press, 1997), 230.
[36] Lonergan (1957), 93.

the empirical method. By carrying out this process in the structure of the canons, each person can come to a more profound knowledge of the universe.

> The empirical scientist advances to higher viewpoints, not solely by the construction of symbolic images [as in mathematics], but more fundamentally by the expansiveness, the constructiveness, the analyses, the constant checking, and the systematizing tendencies of the canon of operations. In virtue of that canon, fresh data are ever being brought to light, to force upon scientific consciousness the inadequacies of existing hypotheses and theories, to provide the evidence for their revision, and in the limit, when minor corrections no longer are capable of meeting the issue, to demand the radical transformation of concepts and postulates that is named a higher viewpoint'[37]

Much like Kuhn's notion of the scientific revolution, Lonergan's conception of the higher viewpoint is a leap in understanding that give the human race a whole new perspective of meaning. It is the accumulation of many insights made by many inquiring and critical intellects driving towards an ever-greater understanding. Primitive terms and relations are altered, past mistakes are overcome, insufficient gaps of understanding are filled with the proper knowledge, and the lower viewpoint gives rise to the higher. With this new viewpoint, a more expansive vision of all the sciences often takes place. Thus, seemingly unrelated sciences can be united and differences in definitions, terms, theories, and models can be overcome. Due to the new perspective and a clearer knowledge brought by the higher viewpoint, a higher order of meaning between all things becomes articulated. A unity and simplicity and elegance of all things are glimpsed as successively higher viewpoints are attained. "Behind every change, there is an underlying unity, and that unity may be formulated explicitly on the level of heuristic anticipation or of a consciously adopted method or of a dialectical metaphysics."[38]

The mentality that supports, sustains, and promotes this higher viewpoint, Lonergan calls a cosmopolis. This mentality is much like Kuhn's use of the scientific community who all share

[37] Robert M. Doran, "October 9, 2003, Part 2" in "Lonergan's *Insight* Class Notes"
[38] Lonergan (1957), 760.

the same paradigm and all go through the scientific revolution together. Lonergan, on the other hand, takes a more idealistic and hopeful stance. He says that this community, who has attained and is perpetually in pursuit of higher viewpoints has reached a level of understanding above political policies and regulations that only clog the system. In fact,

> It is neither class nor state, that stands above all their claims, that cuts them down to size, that is founded on the native detachment and disinterestedness of every intelligence, that commands man's first allegiance, that implements itself primarily through that allegiance, that is too universal to be bribed, too impalpable to be forced, too effective to be ignored'... Cosmopolis is concerned to make operative the timely and fruitful ideas that otherwise are inoperative. So far from employing power or pressure or force, it has to witness to the possibility of ideas being operative without such backing.[39]

Lonergan's ideal community is run by the true love of wisdom and the pure, detached, disinterested desire to know. This, then, leads to the fourth realm of meaning. More than the everyday experiences of common sense, more stimulating than the intellectually developed theories, and even more profound than the interior self-reflective insights, is the level of self-transcendence. It is at this level that the questions of being and existence are raised. To answer them no longer requires common sense, logic, puzzle-solving, genius or self-knowledge. Rather, one must acquire faith. The language is one of symbols, myth, the mystics, and silence. It is the level of consciousness where the person can simply be aware of being, the being that unites the whole universe. It is the realm of the sacred.

The final realm of human conscious is one about which Lonergan wrote very little. Later scholars have speculated on what is still missing in the whole spectrum of human knowing. The most agreed-upon theory is that of beauty and art. "Art presents the beauty, the splendor, the glory, the majesty, the plus that is in things, the profundity of the pattern in things, indeed, as

[39] Ibid., 263-264.

Hopkins said, 'the dearest freshness deep down things.'"[40] Human knowing consists of all of these dimensions and realms of meaning. Authentic human living is ever seeking a higher viewpoint or revolutionary breakthrough of experiences in the common sense realm, of understanding in the realm of theory, of reflection in the realm of interiority, of faith in the level of transcendence, and of awe in the realm of art and beauty. Human beings will never be satisfied with mediocre experiences, partial understandings, limited self-reflections, half-hearted acts of faith, or the mere standard or ugly. Rather, Lonergan stresses humanity will be ever searching until that moment of finality when everything that can be known about everything is known.

I now look back at the critiques charged against Thomas Kuhn and show that Lonergan's system has sufficiently avoided the errors. The first comment was that Kuhn's notion of the scientific revolution implied a complete break from past theories and models as each successive paradigm was incommensurate with the last one. As has been shown, Lonergan's theory is not so much about breaking from the past with each successive higher viewpoint, but rather a reformulating of past theories, an adapting of the primitive models, and a melding together of the lower viewpoints because of the unity that emerged with the acquirement of the new knowledge. Lonergan is acutely aware of the importance of each stage of successive insights. He uses the simple example of the transition from arithmetic to algebra. Just because one has mastered the old rules and formulated new ones for simpler, more exact, and more efficient operations does not mean that the old rules are useless or forgotten. In fact, Lonergan even says that there may be times when the person must go back to the old rules to recall how those operations worked, practice them, and see again how the transition to the higher viewpoint of new rules and

[40] Walsh (Forthcoming), 7.

operations occurred. Past theories and the lower viewpoints, for Lonergan, are extremely important.

The second critique of Kuhn was his elitist position of pointing out the true scientists who are remembered for being the main instigators of the great revolutions and forgetting about everyone else. Again, Lonergan's premise is for each and every human person to go through the process of self-appropriation and come to the realization for him or herself that "I am a knower". Of course Lonergan would admit that there were important people through the history of science who made great contributions with their insights. However, for Lonergan the advancement of knowledge is a human enterprise in which each and every person has a vital role to perform so as to contribute to the total universal viewpoint of all things. The third critique of Kuhn, that he fails to acknowledge all of the factors at play within scientific advancement, is a non-issue for Lonergan. He wrote about every realm of human knowledge, from the common sense of daily life, to theories and science, to feelings and interior dispositions, to the levels of faith and the sacred, and even onward to the area of beauty and art: Lonergan covers the whole spectrum of possible influences that affect each person, who is a member of the scientific communities, which are parts of the whole society. Lonergan does admit that there are some details that are irrelevant to what an insight accomplishes and he calls these details 'empirical residue.' The type of tree that Isaac Newton may have been sitting under when he first formulated the idea of gravity is such an example. However, by no means can he be accused of leaving out important details involved in the development of human knowledge.

Finally, Lonergan, from page one to page 770 of *Insight*, continually stresses the final goal of the human enterprise. Humans by their nature desire an unrestricted knowledge of everything about everything. Whether or not this is possible, it is an ideal and a motivating force

that ever impels humanity to an ever-greater understanding of what is objectively true. It draws each person toward an even higher viewpoint, and thus a more authentic being. The very notion of transcendence implies a going beyond, a going beyond mere present conditions, and a going beyond human limitation. Lonergan's work itself,

> began from insight as an interesting event in human consciousness. It went on to insight as a central event in the genesis of mathematical knowledge. It went beyond mathematics to study the role of insight in classical and statistical investigations. It went beyond the reproducible insights of scientists to the more complex functioning of intelligence in common sense, in its relations to its psycho-neural basis, and in its historical expansion in the development of technology, economics, and polities. It went beyond all such direct and inverse insights to the reflective grasp that grounds judgment. It went beyond all insights as activities, to consider them as elements in knowledge. It went beyond actual knowledge to its permanent dynamic structure… it has been confronted both with man's incapacity for sustained development and with his need to go beyond the hitherto considered procedures of his endeavor to go beyond.[41]

Thomas Kuhn and Bernard Lonergan were both personally intrigued by the fundamental inquiry of what it is in humans that gives them the ability, ingenuity, creativity, and insight to see the world in a new way and advance the realm of human knowledge. Kuhn came at the question from the perspective of perception psychology and ingrained mind-sets imposed upon a community of scientists by means of a paradigm. Only when problems arise and a crisis forces a change does a major revolution take place and a new, radically different viewpoint ensue. Lonergan, on the other hand, started with the fundamental desire that lies within all human beings; to know, in an unrestricted fashion, everything about everything. This desire drives humans to come to experience the world in a simple, commonsensical way as well as in a complex, theoretical, and abstract way. Both Kuhn and Lonergan make explicit the human desire for true knowledge. Kuhn feels this happens naturally with the self-correcting process of shifts from inadequate paradigms to increasingly better ones. Lonergan says true knowledge is

[41] Lonergan (1957), 659.

only gained by the intentional, critical, self-reflective act of judgment. The affirmative response to the question 'is it so?' through the heuristic structure of human cognition leads to facts. As these facts accumulate and coalesce, an increasingly higher viewpoint of what there is to know about the universe takes shape. Kuhn stops here and says that humanity should be satisfied with what has been accomplished and what is currently known. Lonergan makes clear that humanity cannot accept incomplete knowledge and the lack of total being. There is a level of transcendence above and beyond human limitation and rational understanding. There is a realm of beauty and perfection that fulfills every human longing.

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