Revisiting 'The Two Cultures'

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Art is good only if it is subservient to logic.
-- Plato

The nineteenth-century literary school referred to as "Modernists" and contemporary scientific schools of thought seem to have been formed on the same Platonist foundation. Each struggled with idealistic notions of truth and beauty, and they continue to serve as contrasts in how intellectuals deal with societal change. Gustave Flaubert (1821-1880), the most ardent of the Modernists, drew a direct analogy to science by advocating that literature needed to "arrive at the precision of an exact science."[1] However, upon a closer examination, how much did Flaubert really have in common with scientists? For that matter, how often did scientists and Modernists actually reach their shared goal of revealed truth through objectivity?

While Modernist schools existed in Britain and the United States, the France of novelists Flaubert and Marcel Proust (1872-1922) serves as a demonstrable case, since it was a creative center of both literature and science. For example, French writers, such as Honoré Balzac[2] (1799-1850) and Victor Hugo[3] (1802-1885), had established themselves as giants of a more romantic style of literature. Likewise, Jean Bernard Léon Foucault (1819-1868), the Parisian physicist, made determinations of the speed of light, was one of the first to show the existence of the eddy currents generated by magnetic fields, and devised a method of testing telescope mirrors for surface defects.[4] The Nobel laureate and physicist Pierre Curie (1859-1906) and his

[1] Croisset, Friday night, 1 o'clock, July 22, 1853 (Flaubert 325).

[2] Honoré Balssa Balzac is generally considered the major early influence on realism, or naturalism, in the novel and one of the greatest fiction writers of all time. In a vast series he collectively called La Comédie Humaine (The Human Comedy), eventually numbering some 90 novels and novellas, he sought to produce a comprehensive picture of contemporary French society by presenting all the varieties of human nature ("Balzac, Honoré de." Britannica Concise Encyclopedia, 2005).

[3] Victor Hugo was an accomplished poet before age 20 and emerged as an important figure in Romanticism. His best-known novels are The Hunchback of Notre Dame (1831), an evocation of medieval life, and Les Misérables (1862), the story of the convict Jean Valjean. Their popularity made him the, at that time, most successful writer in the world. In later life he was a politician and political writer. Hugo was made a senator in 1876, and he was buried in the Panthéon as a national hero ("Hugo, Victor." Britannica Concise Encyclopedia, 2005).

[4] Jean Foucault was educated in medicine, but his interests lay in physics. In 1850 he measured the speed of light with extreme accuracy. He also invented the Foucault pendulum and used it to provide experimental proof that Earth rotates on its axis ("Foucault, Jean." Britannica Concise Encyclopedia, 2005).

wife Marie Curie (1867-1934), also a Nobel laureate, are best known for their work on radioactivity.[5] Flaubert, one of the most strident constructionists of the period, was certainly influenced by the zeitgeist of impressive scientific developments that culminated in the nineteenth century, although he disdained technological progress.

This leads one to consider the common characteristics of the scientific and Modernists schools and to what degree they are what Lord Charles P. Snow (1905-1980) called "The Two Cultures."[6] While delivering the Rede lecture at Cambridge in 1959, Snow, himself a scientist and minor novelist, looked back at a century of intellectual activity and recognized a "problem of the entire West." Having intimate friends among both scientists and writers, Snow found that,

> "I was moving among these two groups – comparable in intelligence, identical in race, not grossly different in social origin, earning about the same incomes, who had almost ceased to communicate at all, who in intellectual, moral and psychological climate had so little in common that instead of going from Burlington House or South Kensington to Chelsea, one might have crossed an ocean. In fact, one had travelled much further than across an ocean – because after a few thousand Atlantic miles, one found Greenwich Village talking precisely the same language as Chelsea, and both having about as much communication with MIT as though the scientists spoke nothing but Tibetan" (Snow 2-3).

Like Plato, literary Modernists obsessed over an unbiased search for truth and they thought that perfect forms would provide the path to enlightenment. Flaubert made direct references to Plato's idealized forms in his letters and, according to Leo Bersani in his introduction to Madame Bovary, Flaubert had "an almost Platonic view of reality" (Flaubert xvi). Of course, the western scientific tradition has also been heavily influenced by Platonic logic and Aristotelian observation. Like the classical Platonists, Modernists sought the perfect form as an intellectual quest, rather than as a physical one. In this way, they also shared their quest with scientists -- at least in the most idealistic of characterizations -- since the purest of scientific quests are often thought to have been driven by intellectual curiosity rather than engineering practicality. Like the scientific search for intellectual satisfaction through the harmony and simplicity of physical laws, Modernists, such as Flaubert, had a never-ending quest for aesthetic joy through the exploration of language and literary technique.

Objectivity as the Means to 'RevealedTruth'

The Modernists sought to employ scientific objectivity, but just what did they mean by the word 'scientific'? For our purposes, let us define *science* as the body of knowledge obtained by methods of observation. It is derived from the Latin word *scientia*, which simply means knowledge, and the German word *wisenschaft*, which means systematic, organized knowledge. Thus, science, to the extent that it is equivalent to *wisenschaft*, consists not of isolated bits of knowledge, but only of that knowledge which has been systematically assembled and put together in some sort of organized manner (Fischer 5-7).

The twentieth-century German philosopher Martin Heidegger (1889-1976) defined science as the "theory of the real" (Heidegger, Question Concerning Technology 157). In particular, the science with which we are concerned is a body of knowledge that derives its facts from observations, connects these facts with theories and then tests or modifies these theories as they succeed or fail in predicting or explaining new observations. In this sense, science has a relatively recent history, perhaps four centuries (Platt). In addition, science is usually considered

[5] "Curie, Pierre," Microsoft® Encarta® Online Encyclopedia, 2005.

[6] Snow observed scientific culture as having common attitudes, standards, patterns of behavior, approaches, and assumptions that cut across religion, politics, and class. He saw the 'traditional' culture of literary intellectuals as anti-scientific (Snow 9-11).

by Western society as one of the highest forms of mental activity; one with truth as its goal. Heidegger notes that, "…science, as a theory of the real, …stakes everything on grasping the real purely. It does not encroach upon the real in order to change it. Pure science, we proclaim, is disinterested" (Heidegger, Question Concerning Technology 167). But, what is disinterested reality?

The roots of western scientific inquiry can be traced back to the classical philosophies of the Greeks.[7] Much of the modern scientific method of rational scientific inquiry owes its approach to the mimetic assumptions and Socratic logic of Plato, the Ionian Greek classical definitions of truth and beauty, and to the substantial refinements to Plato's metaphysics by the later Hellenic-era Aristotle.[8] Aristotle, the son of a physician and Plato's pupil of twenty years, took his master's basic philosophy, added more structure and advocated verification of intuitive natural laws with objective observation (Loomis vii-xiii). Unlike Plato, Aristotle did not believe in a world of ephemeral appearances of changeless ideas. Louise Loomis, editor of a 1940's translation of Aristotle's Metaphysics, notes that Aristotle argued that, "…the world really is, has been, and will continue to be, regardless of human eyes and imaginings" (Loomis xvii-xviii). Hazard Adams commented that Aristotle believed that reality was the process by which form manifests itself through the concrete and by which the concrete takes on meaning working in accordance with ordered principles. Aristotle believed that change was a fundamental process of nature, a creative force with a conscious direction toward perfection (Adams 49).

Both a great thinker and a great scientist, Aristotle set the tone for future scientists by his method of inquiry and an avowed determination to yield to observation as the final arbiter. Like Plato, Aristotle thought it necessary to first understand and explain the workings of the human mind and to show what kinds of reasoning were valid and could be relied upon to provide knowledge with surety.[i] Having channeled the power of Greek philosophical thought into a logical system of scientific classification, Aristotle came to exercise an enormous influence over European science for the next two thousand years (Loomis, xi-xxxviii).

When Europe awakened from the feudal Dark Ages and the Medieval suffocation of theocracy[ii] to an enlightened approach to knowledge that included the works of Francis Bacon, Sir Isaac Newton, and Nicolaus Copernicus, it embraced the process of observation, generalization, explanation, and prediction that was fully rooted in an earthy materialism, indicative of the age. Aristotle's metaphysics defined a valid approach to seeking knowledge and his poetics defined metrics by which the scientific community still determines truth. This view of knowledge became pervasive, changing assumptions not only in science but also in the entire social fabric of Europe. Europe came to understand that the physical realm of nature is real, orderly, and, in part, understandable, or as Max Planck stated, "That is real which can be measured" (Heidegger, Question Concerning Technology 169).

Two aspects of these scientists' work stand as foundations of modern science. They include the empirical approach based upon objective, rational observation, and the use of mathematics to describe nature. The two criteria for the dynamic entity of scientific truth, either one of which is generally sufficient to cause persons to accept a principle, are first, that it can be checked by observation in a manner in which its consequences lead to its support rather than to contradictions; and second, it can be derived from intelligible principles (Fischer, 49). These principles laid the groundwork for modern scientific methods of inquiry and were forcefully argued

[7] The Ionian Greeks had an earthy tradition that stressed the enjoyment of life, commercial property, aesthetic refinement, and acceptance of newcomers. This allowed free thought and inquiry to flourish. From its earliest manifestations, the Greek mind had turned to natural philosophy, which was indistinguishable from Greek science. Led by Thales of Miletus, the Greeks saw the formation of the earth by natural processes, no longer through an act of the gods. "The Ionians conceived of nature as a completely self motivating entity," according to science historian, Thomas Goldstein. The workings of the universe occurred as mere extensions of the primordial chaos, automatic functions of its basic elements. Matter possessed its own evolutionary quality. 'Order' and 'law' were mere concepts superimposed by the human mind on the autonomous processes of nature. It was Pythagoras who is credited with the introduction of the vision of an intrinsic natural order and Plato adopted this vision (Goldstein 52).

[8] Thales of Miletus, Anaximander, Pythagoras, Socrates, and Plato developed many of their ideas using earlier ancient works as their base (Williams 34-38).

by Rene' Descartes, the philosopher, and Francis Bacon, the theologian (Capra 15-120). This new approach also included the process of generalization, explanation, and prediction, or what can be thought of in modern terms as the *hypothesis*, *theory*, and *law*.[9]

Just as scientists have been on a quest to understand the inner workings of nature, philosophers and poets have been trying to understand our role in the natural order of the universe. Borrowing from science, the Modernists strove for objectivity in their literary work. Flaubert stressed in his letter to Mlle. Leroyer de Chantepie that "…by ruthless method, Art achieved the precision of the physical sciences!"[10] "Literature will increasingly adopt the methods of science; it will be above all *educational*, which does not mean didactic."

As an example of Flaubert's precise choice of words to vividly portray a scene (he would argue that he accurately and objectively portrayed the scene), consider the following passage from Madame Bovary.

> "But it was especially at mealtimes that she felt she could bear her life no longer, in that little room on the ground floor with its smoking stove, squeaking door, sweating walls and damp stone floor. All the bitterness of her life seemed to be served up to her on her plate, and as the steam rose from the boiled meat, waves of nausea rose from the depths of her soul. Charles was a slow eater; she would nibble a few hazelnuts, or lean on her elbow and idly make lines in the oilcloth with her knife" (Flaubert 56).

This dinner scene is juxtaposed to a previous scene at a ball, hosted by a wealthy aristocrat, and, by doing so, vividly contrasts the lives of the nobles with those of the middle class. Instead of the world of wealth and splendor, we see Emma and Charles Bovary return to their modest home. It is a depressing return for Emma, but a thankful one for Charles (Flaubert 48). Flaubert paints a visual picture of Emma and Charles in a very normal setting, filled with very little physical action, but with Emma's mind swelling to the breaking point with emotional tension. In addition, Flaubert's choice of words to describe the setting provides deep symbolism and contrasts Emma's imaginary world of romance with the dull reality of her life. The setting compares the humble "little room" of Charles and Emma, with its "creaking door," "damp floor," and "sweating walls," to the majesty of the home of the Marquis which occupies Emma's thoughts. Emma desires the chateau's marble floors, high ceilings, and waxed dance floor (Flaubert 40-48). Instead of a dining room filled with "blazing candelabras" and fragrant flowers that "enveloped [her] in a warm atmosphere," one imagines a rather dark and smoky room. Indeed, the room seems to be decaying along with Emma's life, as depicted by the slowly flowing sweat, smoke, and squeaks. Instead of "fine linen" and "silver dish covers," Emma is stuck with waterproof "oilcloth" to cover her dinner table. The "ground floor" room is a reminder to Emma that she is not upper class.

"We must present a picture, show nature as it is, but it must be a complete picture, we must paint the underside as well as the surface," argued Flaubert in his letter to his mistress, the poet Louise Colet.[11] However, he felt that understanding the objective world of external reality

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[9] A *hypothesis* is a tentative assumption made in order to test its scientific consequences, but which as yet has received little verification or confirmation. A *theory* is a plausible, scientifically acceptable statement of a general principle and is used to explain phenomena. A *law* is a statement of an orderliness or interrelationship of phenomena that, as far as is known, is invariable under the stated conditions (Fischer 47). It should be stressed that the term law is used differently in reference to scientific knowledge than to other areas of everyday life. A scientific law is descriptive rather than prescriptive. It is a statement used to describe regularities found in nature, and is not a statement of what should happen. It is not correct to consider that natural objects obey the laws of nature; rather, the laws of nature describe the observed behavior of natural objects. In contrast, the laws of a human government are prescriptive in that they prescribe how people should behave.

[10] Paris, March 18, 1857 (Flaubert 328).

[11] Croisset, Wednesday evening, midnight, April 6, 1853 (Flaubert 323).

came from "a profound understanding, a penetration," and "if we are to reproduce it well, [external reality] must enter us until we almost scream."[12]

Another way in which the Modernists strove for objectivity is in their passion for describing scenes in complete detail, even at the risk of boring all but the most serious readers. Consider this passage from Marcel Proust's Swann's Way in which the author uses a stream of consciousness to mimic how the brain processes the detail in something as simple as tea.

> "After waiting a minute, I would go in and kiss her; Françoise would be making her tea; or, if my aunt were feeling 'upset,' she would ask instead for her tisane, and it would be my duty to shake out of the chemist's little package on to a plate the amount of lime-blossom required for infusion in boiling water. The drying of the stems had twisted them into a fantastic trellis, in the interlacings of which the pale flowers opened, as though a painter had arranged them there, grouping them in the most decorative poses. The leaves, having lost or altered their original appearance, resembled the most disparate things, the transparent wing of a fly, the blank side of a label, the petal of a rose, which had all been piled together, pounded or interwoven like the materials for a nest. A thousand trifling little details – a charming prodigality on the part of the chemist – details which would have been eliminated from an artificial preparation, gave me like a book in which one knows, the pleasure of finding that these springs of real lime-trees, like those I had seen, when coming from the train, in the Avenue de la Gare, altered indeed, precisely because they were not imitations but themselves, and because they had aged. And as each new character is merely a metamorphosis from something earlier, in these little grey balls I recognized green buds plucked before their time; but beyond all else rosy, lunar, tender, gleam that lit up the blossoms among the frail forest of stems from which they hung like little golden roses …Presently my aunt would dip a little Madeleine in the boiling infusion, whose taste of dead leaves or faded blossom she so relished, and hand me a piece when it was sufficiently soft" (Proust 55-56).

Descriptions like this can go on for pages in Proust's works. In contrast, the British Modernist novelist Virginia Woolf (1882-1941) can get her message across with either detailed descriptions or an extreme economy of words. In To the Lighthouse, Woolf describes the passage of a stormy night in this way.

> "The nights are full of winds and destruction; the trees plunge and bend and their leaves fly helter skelter until the lawn is plastered with them and they lie packed in gutters and choke rain-pipes and scatter damp paths. Also the sea tosses itself and breaks itself, and should any sleeper fancying that he might find on the beach an answer to his doubts, a sharer of his solitude, throw off his bedclothes and go down by himself to walk on the sand, no image with semblance of serving and divine promptitude comes readily to hand bringing the night to order and making the world reflect the compass of the soul. The hand dwindles in his hand; the voice bellows in his ear. Almost it would appear that it is useless in such confusion to ask the night those questions as to what, and why, and wherefore, which tempt the sleeper from his bed to seek an answer" (Woolf 128).

She also shows how human life is merely incidental, in the overall scheme of time.

> "[Mr. Ramsay, stumbling along a passage one dark morning, stretched his arms out, but Mrs. Ramsay having died rather suddenly the night before, his arms, though stretched out, remained empty.]" (Woolf 128)

[12] Croisset, Thursday night, 11 o'clock, July 7-8, 1853 (Flaubert 324).

In just a few parenthetical words, Woolf eliminates the most significant character found in the first two-thirds of the novel. Woolf's economy of words is almost like Japanese haiku.

> "[Macalister's boy took one of the fish and cut a square out of its side to bait his hook with. The mutilated body (it was alive still) was thrown back into the sea.]" (Woolf 180)

Those two sentences compose the entirety of a chapter.

Flaubert's "profound understanding" of life started with imagining certain caricatures. According to the novelist Guy de Maupassant,

> "In Madame Bovary, each character is a type, that is the essence of a series of persons belonging to the same intellectual order. Proceeding by deduction, he made these persons perform those characteristic actions, which must inevitably perform with an absolute logic, given their temperaments. The country doctor, the dreamy provincial woman, the pharmacist,…the priest, the lovers, and even all the minor figures are types, endowed with a three-dimensionality that is all the more effective because in them the writer has distilled quantities of related observations, and all the more lifelike because they represent the most typical examples of their class" (Flaubert 341-342).

In this manner, Flaubert used his style of logic to fill in where observation was not possible or, through stereotyping, demonstrate that observation was not needed.

Thousands of years earlier, in his *Organon*, Aristotle outlined the steps by which a science or body of knowledge may be firmly built up from its starting point in certain fundamental axioms or obvious statements, perceived intuitively to be true. Every science, as Aristotle pointed out, must begin with a few general truths. They cannot be logically proved, but our minds by simple intuition accept them as obviously true. Without such assumptions as foundations, we could never start to build anything (Loomis, xi-xxxviii). Louise Loomis noted that he reasoned like Plato, from ideal abstract principles, whenever the subject of the reasoning lay outside his field of observation. Through caricatures and stereotyping, Flaubert uses the same abstraction technique and we are compelled to follow the lives of the characters to their logical conclusions.

Truth and Perfection as a Function of Form and Technique

Discovering truth is a core human passion that is fundamental to the tangible processes of scientific inquiry. "Perhaps, because we know so few things with certainty, we value the search for truth," notes science journalist K.C. Cole (Cole 147). Using an allegorical style, Plato argued that reality was to be found in 'ideas' or perfect 'forms,' not in the world of 'appearances' (Adams 11). He believed that there was another world of ideas and truth around us that we could not directly touch with our human senses.

To Plato, life was a never-ending search for these ideal forms, truth, and beauty. Likewise, Modernists searched for truth embodied in ideal forms. According to Flaubert, writing to Louise Colet,

> "There is no such thing as a beautiful idea without beautiful form, and vice versa. Beauty is secreted by form in the world of Art, as in our human world form gives rise to temptation and love. Just as you cannot separate from a physical body the qualities that make it up, that is, color, size, solidity, without destroying it, just so you cannot remove the form from the Idea, for the Idea exists only by virtue of the form." [13]

Drawing an analogy to Plato, Flaubert goes on to comment on the importance of structure and harmony in his letter to George Sand.

[13] Croisset, Friday, 10 P.M., September 18, 1846 (Flaubert 313).

> "In the precision of the structure, the reality of the elements, the polish of the surface, the harmony of the whole, is there not an intrinsic value, a species of divine force, something as eternal as a principle? (I speak as a Platonist.)"[14]

Platonists, scientists, and Modernists often searched for the properties of an ideal, rather than the reality of an ideal. Guy de Maupassant commented that Flaubert, "believed in style, that is, in a unique, absolute manner of expressing a thing in all its color and intensity. For him, in the work of art the material inevitably imposes the unique and right expression, the measure, the rhythm, all the elements of form. Obsessed by this absolute belief that there exists only one way of expressing a thing, one noun to name it, one adjective to qualify it and one verb to set it in motion, he engaged in a superhuman labor in order to discover for each sentence that noun, that epithet, and that verb" (Flaubert 343). Erich Auerbach noted that Flaubert held a conviction that, "Every event, if one is able to express it purely and completely, interprets itself and the persons involved in it far better and more completely than any opinion or judgment appended to it could do" (Flaubert 376).

In this manner, Flaubert packs significant imagery, emotion, and meaning in even his simpler passages. The very location of a paragraph, coupled with Flaubert's choice of words, provides deep insight into the thinking processes of his characters. In the dinner scene of Madame Bovary, the food itself provides an indicator of social class. Emma saw the wealthy eating lobster, almond milk bisques, truffles, pomegranates, pineapple, maraschino ice, and drinking champagne, and wines from Spain and the Rhone region. In contrast, she and Charles are stuck with boiled meat, onion soup, and hazelnuts (Flaubert 41-48). Just as the steam rose from the boiled meat, every aspect of the dinner with Charles caused bitterness and nausea to well up in Emma. The scene itself is a climax in the chapter, a turning point in the story, and a critical transition in Emma's development. It comes after Emma's night at the ball, where "contact with wealth had left something on [her heart] which would not wear away." It created a "gap in her life," and, as such, she decided to no longer bear her life with Charles (Flaubert 48).

Structure and imagery through words were critical to Flaubert's ability to accurately portray the scene of Charles and Emma. But, how accurate can one be when the scene is being created in one's mind? Plato, relaying the point of view of his teacher, Socrates, in his *Dialogues*, affirmed the belief that real knowledge was unobtainable. It depended on an absolute definition, which was inaccessible (Stone 39). To Plato absolute truth was unattainable because he believed that what we see around us is merely an image. Likewise, K.C. Cole notes that, "…truth can be highly counterintuitive and sense is hardly common" (Cole 6). She explains that there is great difficulty in getting true information from what we call the 'real world,' since we only glimpse that world through patterns or signals that are created, at least in part, outside ourselves (Cole 39).[15] Plato was correct -- Humans cannot know all things.

However, Plato separated form and content in a way that allowed the power of reason, logic, and allegory to get one closer to the truth. In the *Allegory of the Cave*, in which the cave

[14] Croisset, Monday evening, April 3, 1876 (Flaubert 328).

[15] K.C. Cole notes that scientists can only measure those things that are known or suspected to actually be there (Cole 48). We also miss a great deal because we perceive only things on our own scale and the sheer complexity of nature, where every part influences every other part, creating a tight weave of causes and consequences are much too knotted to untangle (Cole 58, 77). In addition, signals make sense only in context. In a different context, the same message can have no meaning at all. Cole explains that if you send someone a message in code, but they have no way to decode it, your message has no more information than total nonsense (Cole 86). Therefore, if one understands human limitations, one will be forced to understand the limitations of science and why science alone cannot capture the breathtaking enormity of the world outside human senses. Likewise, Carl Sagan pointed out that our modern scientific method of inquiry is also based upon our senses. Since we inhabit physical space and time, phenomena outside this realm, things of the microscopic world of the interior of atoms or the macroscopic world of the universe, are beyond our physical senses. Although, one may use electron microscopes to probe the atom or radio telescopes to study the universe, we cannot escape the fact that these are merely devices that transform signals into the forms that our senses can recognize (Sagan, Broca's Brain 15-16).

represents the realm of belief or faith, and the light represents the realm of truth and knowledge, Plato's mimetic philosophy of natural order holds that the ability to attain true knowledge is accomplished through a difficult path of acquisition (Adams 11). The path that Plato recommends is a journey within the mind. Platonic logical truth and unambiguous conclusions are found by following clear rules of deduction.[16] Truth, in this Platonic sense, is relative to the seeker's level of knowledge. One experiences this today. When science makes a discovery, it seems to only peel off layers of a never-ending "ever juicier mystery," as Frank Oppenheimer called it (Cole 49). Therefore, to Plato, truth emerged through the power of reason and only then would he observe truth as making sense.

However, to what extent can one actually know nature? Aristotle believed that the truth was in the material and he searched for the universals that lead one to truth. In modern science, getting closer to the truth in the real world requires dealing with probabilities, natural variations, and perfect blocks of logical propositions.[17] As Cole suggests, "You see something and then try everything you can think of to make it go away; you turn it upside down and inside out, and push on it from every possible angle. If it's still there, maybe you've got something" (Cole 96). Virginia Woolf would agree. Near the end of To the Lighthouse, Lily realizes that she would need more than fifty pairs of eyes in order to gain a complete understanding of Mrs. Ramsay (Woolf 198). As such, Woolf uses the technique of allowing the reader to view characters, and even objects, such as the lighthouse, through the consciousness of competing points of view.

Cole suggests that, "The fact that patterns repeat allows us to formulate laws of nature – really, recipes encoded in equations that describe relationships that repeat over and over again" (Cole 72). She concludes that math helps scientists articulate, manipulate, and discover reality (Cole 7). We may never understand everything, but one can get some pretty good indications that allow rational conclusions to be drawn.[18]

Objectivity is a Myth

The Modernists were very proud of their commitment to three-dimensional realism and objectivity. Therefore, if one were to take Flaubert at his word, one would believe that his style of narration strictly followed an explanation he gave in a letter to Mlle. de Chantepie, "…the way God is in the creation, invisible and all-powerful; he should be felt everywhere but seen nowhere."[19] However, Flaubert's style of narration, on the surface detached and objective, is revealed, through complex layering and juxtaposition of language, as providing a very opinionated point of view. The narration, seemingly objective in Madame Bovary, is in fact interpreted through Emma Bovary's eyes and is subject to her increasingly biased perspective, which is filled with contempt for her husband Charles and the provincial lifestyle with which he is

[16] The ascension out of Palto's cave, from belief to knowledge, is a painful journey, but once positive movement is made, it can be seen to be a move in the right direction toward reality. When one is out of the cave and one's eyes adjust to the light, there is yet another truth -- namely that the light is actually produced by the sun.

[17] The Marquis de Laplace (1749-1827) noted that, "…nearly all our knowledge is problematical; and in the small number of things we know with certainty, even in the mathematical sciences themselves, the principle means for ascertaining truth – induction and analogy – are based on probabilities" (Cole 147). Alternatively, Albert Einstein (1879-1955) noted, "As far as the laws of mathematics refer to reality, they are not certain, and as far as they are certain, they do not refer to reality" (Cole 147).

[18] Carl Sagan eloquently expressed our potential and limitations as he compared our physical realm to the world of a grain of salt. Since there are more atoms in salt than connections in our brains, we can never expect to know everything with certainty in the microscopic world of a grain of salt. Sagan explained that the one thousand trillion sodium and chlorine atoms in a grain of salt would overwhelm our ability to understand salt if we were forced to know about every atom. This is because the human brain has a limit of approximately ten trillion neurons and dendrites, the connections between neurons. Just as unknowable are phenomena on the cosmic scale of the universe (Sagan, Broca's Brain 15-16). However, if we use the empirical approach and seek out regularities and principles, we can understand both the grain of salt and the universe through extrapolation.

[19] Paris, March 18, 1857 (Flaubert 328).

comfortable. For example, at the Marquis d'Andervilliers' ball at La Vaubyessard, Emma seems to overlook the wretchedness of the "pendulous-lipped old man" Duc de Laverdiere, because of his higher social class.[20] She saw him as "awe inspiring" and "extraordinary" (Flaubert 42). However, no such tolerance or even pity is given to Charles. "Good natured and unpretentious," Emma sees Charles as having "crude manners," such as "making gulping sounds each time he swallowed a spoonful of soup," and being no more interested in Emma's world of fanciful romance and high society as her greyhound, the logs in the fireplace, or the pendulum of the clock (Flaubert 53). In Emma's mind, while at the ball, "everything beyond it was shrouded in darkness." As Flaubert narrates, "In the dazzling splendor that now surrounded her, the memory of her past life, hitherto so vivid, began to fade away completely, and she almost doubted that she had ever lived it" (Flaubert 44).

Flaubert argued for an approach to literature that was all-knowing but objective. "The reader must feel in every atom, on every surface, a concealed and infinite indifference," notes Flaubert.[21] However, Guy de Maupassant, writing in an 1885 essay, questioned Flaubert's objectivity and whether his technique of defining characters as an archetype could ever lead to objectivity. "One need only read Madame Bovary intelligently to realize that nothing could be further from realism. A realist is a writer who concerns himself with the bald fact alone without understanding the relative importance or noting repercussions. For Gustave Flaubert, a fact by itself signified nothing. His work method, his artistic method relied much more on penetration than on observation" notes de Maupassant. He goes on to quote Flaubert, "The only truth is in relationships, that is, in the way in which we perceive objects" (Flaubert 341).

In its purest sense, science is also based upon a search for the truth, but in reality, it does so in a society that bends the truth to suit its needs. Jacob Bronowski stated it this way:

> "The society of scientists is simple because it has a directing purpose: to explore the truth. Nevertheless, it has to solve the problem of everyday society, which is to find a compromise between man and men. It must encourage the simple scientist to be independent, and the body of scientists to be tolerant. From the basic conditions, which form the prime values, there follows step by step a range of values: dissent, freedom of thought and speech, justice, honor, human dignity, and self respect" (Bronowski 68).

In an absolute sense, truth and neutrality in science are limited to the facts of nature that are there for observation via our senses. In a less absolute sense, truth in science is limited to that which is directly observed and sensed by the observer. Even here any expression of absolute truthfulness is limited by the time and space relationships between the observer and that which is being observed, and also by the restrictions inherent in the use of language to express the observation. Anything beyond this is, in effect, a *belief* rather than absolute, true knowledge. In brief, it is impossible to separate fact in nature from one's own interpretation of it (Fischer 5-7).

Far from an objective realist, Flaubert's technique of painting a visual image through inner monologues gives the reader a peek into Flaubert's biases. Martin Turnell's view is that,

> "We cannot fail to notice that he was continually tipping the scales, …trying to give these sordid provincials an importance which they were far from possessing. For Flaubert's figures will not bear the weight of symbolism that he tried to attach to them. …We remain unconvinced by the irony as we are unconvinced by the pessimism. …Flaubert's pessimism, whether it is a mature conception of life or an immature cynicism which is masquerading as mature vision…[is a] carefully planned attack on human nature. …For when we look into the structure of Madame Bovary, we find that so far from being a detached study of sexual mania and in spite of its superficial moral orthodoxy, it is an onslaught

[20] Duc de Laverdiere is rumored to have lived a life of duels and debauch and to have slept with Marie-Antoinette (Flaubert 42).

[21] Croisset, Thursday, 1 P.M., December 9, 1852 (Flaubert 319).

> on the whole basis of human feeling and all spiritual and moral values" (Flaubert 400-402).

Using this technique, Flaubert seems to exhibit a mix of objectivity in observing a scene and subjectivity in portraying the thoughts and feelings of his characters. In the dinner scene, Emma is bored beyond her ability to bear it.[22] The dinner scene portrays her boredom physically as she "leans on her elbow" and "makes lines in the oilcloth with her knife." As far as she is concerned, nothing exciting ever happened to or with Charles. He is even a bovine-like "slow eater" in contrast to the "riotous supper parties" of writers and actresses that Emma envisions is occurring in Paris (Flaubert 50). Such free indirect discourse, where the narrator attributes thoughts and feelings without attribution or quotation marks, betrays Flaubert's insistence on pure scientific objectivity.

Truth in science is also transitory. A study of the history and evolution of aesthetics helps one understand that every society determines reality, truth, beauty, and values in accordance with its own worldview and its evolutionary point in time. Likewise, cultural development has been facilitated by evolving, sometimes revolutionary, paradigms. [23] By examining the structure of scientific change, one notices parallels with the evolution of aesthetic theories, each of which are products of their particular time, culture, and worldview.[24] The worldviews held by individuals or by groups are very influential in determining behavior, as well as in determining motivations, attitudes and actions. Scientists and engineers, being fully human, also experience the effects of paradigms. They and their findings are influenced by the mainstream of social thought framed by current technology and prevalent belief systems. By using knowledge of the universe, creativity, and a scientific approach to problem solving, scientists develop new paradigms.[25] As Heidegger reminds us, "[Even though] every phenomenon emerging within an area of science is refined to such a point that it fits into the normative objective coherence of the theory…that normative coherence itself is thereby changed from time to time" (Heidegger, Question Concerning Technology 169). Even Aristotle was willing to reject or change his theories when a closer examination of nature proved them wrong. He was quite aware that his work was only the beginning, to be corrected and developed by those who came after him, citing, "Inventions are either the elaboration by later workers of the results of previous labor handed down by others, or original discoveries, small in their beginnings but far more important than what will later be developed from them" (Loomis xxv).

Similar to the evolution of metaphysics among philosophers and critical aesthetics among artists, the process that causes scientists to accept new evidence and change schools of thought was thoroughly examined in 1962 by MIT professor Thomas Kuhn, a science historian and philosopher (Kuhn 1-181). Kuhn noted that paradigm development goes through several predictable structural stages from 'normal science' to new paradigm acceptance. Normal science looks somewhat like aesthetic theories based on seventeeth-century 'Neoclassicism,' in which

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[22] Prior to the scene, we learned of Emma's longing for something romantically magical to happen. "In the depths of her soul, she was waiting for something to happen." Instead, she has a series of "identical days," "innumerable," "regular," "monotonous," and a future that was a "long dark corridor with only a locked door at the end" (Flaubert 54-55).

[23] Thomas Kuhn described a *paradigm* as a way of seeing the world and practicing science in it. The characteristics of a new paradigm include new scientific achievements sufficiently unprecedented to attract an enduring group of adherents away from competing modes of scientific activity and, at the same time, sufficiently open-ended to leave all sorts of problems for the new group of practitioners to solve (Kuhn 163-166).

[24] Whether philosophical worldviews guide scientific inquiry, or whether scientific discoveries catalyze new worldviews is beyond the scope of this essay. Regardless of the causal effect, it is clear that there is interplay between the cultural philosophy of an era and the approach to that era's scientific search for truth.

[25] Within the community of scientists, the validity of scientific truth, or probable truth, is based on statistical arguments. The community relies on truth by consensus, better known as 'peer review.' This peer review is based on a shared paradigm or worldview of how to evaluate evidence and come to agreement, or at least temporary agreement, until it is overruled by new insights and information. Cole describes scientific truth as "…less a collection of facts than a running argument" (Cole 127).

nature has structure and follows rules.[26] As Alexander Pope (1688-1744) suggested, there is an unchanging 'methodized' nature of structure, genre, harmony, and symmetry, which was the standard for developing and judging artistic forms (Adams 273-274). It is somewhat like John Dryden's (1631-1700) acceptance of rules of time, place, and action to the aesthetics of poetry and rests on Immanuel Kant's (1724-1804) treatment of *apriori* assumptions to his systems-like theory of aesthetics in a 'phenomenal' world of sensory data (Adams 213-240, 374-386). Likewise, by accepting Newtonian physics as a framework of inviolate rules, this freedom allowed members of the scientific community to concentrate exclusively upon the subtlest and most esoteric of the phenomena that concerned it. Inevitably, this increased the effectiveness and efficiency with which the group as a whole solved new problems, according to Kuhn.

However, there are always competing schools of thought, each of which constantly questions the very foundations of the others. It is these competing schools that provide science with a self-correcting mechanism that ensures that the foundations of normal science will not go unchallenged (Kuhn 163). The overthrow of scientific paradigms look somewhat like nineteenth-century Expressive Theories of aesthetics, involving creativity and imagination, where, as William Wordsworth (1770-1850) suggested to his contemporaries, intuition and feeling become the basis of imagination that gives one the power to grasp nature (Adams 436-446). In a similar fashion, scientific revolutions are inaugurated by a growing, often intuitive sense, restricted to a narrow subdivision of creative minorities within the scientific community, that an existing paradigm has ceased to function adequately in the explanation of an aspect of nature for which that paradigm itself had previously led the way.[27] So as the crisis, that common awareness that something has gone wrong, shakes the very foundations of established thought, it generates a scientific revolution (Kuhn 163-166).

Scientific truth evolves based upon new knowledge and an internal competition among ideas within the scientific community. The Modernists, however, claimed to be independent of other authors. They believed their work to be unique and revolutionary. For example, Flaubert denied the influences of his predecessors and his contemporaries. According to Emile Zola,

> "I argued twenty times with him on this subject without being able to make him admit, even when confronted by the evidence, that writers do not appear as isolated phenomena; they influence each other, they form a chain which brings about certain developments, according to the climate of the times. He, like the fanatical individualist he was, would shout outrageous things at me: that every writer was independent, that society had nothing to do with literature, that you had to write in a beautiful style, and that was all (Flaubert 334). He absolutely refused to see anything other than literature in the novels of others and even in his own: he denied that they had anything to do with, I won't say the progress of ideas, but even with the history of ideas; beautiful language, nothing more" (Flaubert 335).

The scientific community is not innocent of the charge of intellectual tyranny either. As such, Western science has traditionally rejected the value to the human spirit of faith, emotion, intuition, hope, and general use of the emotional part of the brain. There has been a mechanistic claim among scientists that living organisms are nothing more than very complex physico-chemical systems (Hempel 101). This led to a view among scientists that scientific theories could be applied to social phenomena, and they should be described, analyzed, and explained in terms of the situations of the individual agents involved in them and by reference to the laws and

[26] Normal science as defined by Kuhn means the body of research firmly based upon one or more past scientific achievements that some particular scientific community acknowledges for a time as supplying the foundation for its further practice (Kuhn 163). The findings of such achievements are the bases for all underlying scientific assumptions and free the scientific community from constantly re-examining its first principles.

[27] This sense of crisis drives a re-evaluation of the existing view and need not be generated by the work of the community that experiences the crisis. For instance, new instruments such as the electron microscope or new laws like Maxwell's wave theories may develop in one specialty and their assimilation may create a crisis in another (Kuhn 163-166).

theories concerning individual human behavior (Hempel 110). This view has also been called *scientism*.[28] Robert Jastrow, the founder of NASA's Goddard Institute, observes:

> "Scientists cannot bear the thought of a natural phenomenon, which cannot be explained, even with unlimited time and money. There is a kind of religion in science; it is the religion of a person who believes there is order and harmony in the universe. Every event can be explained in a rational way as the product of some previous event; every event must have its cause" (Jastrow 113).

Because we have adopted a faith in science, it is clear that modern humanity will reject any non-rational explanation of causes and cures. However, Aristotle warns of the need for careful application of logic.[29] In all syllogistic or deductive reasoning, one must make sure that the *apriori* proposition is comprehensive enough to cover every case. If A is only sometimes B, then C, though included in A, may not be B. He also reminds us that, with inductive reasoning, one must be constantly on guard not to draw conclusions too hastily. Unless the number of instances on which we ground our generalization is large enough to be thoroughly representative, there may be instances we have overlooked (Loomis xiv-xv).

In addition, scientific reduction of causes and effects to pure mechanistic explanations is contrary to human experience and will also likely be rejected. "… certain characteristics of living systems, such as their adaptive and self-regulating features, cannot be explained by physical and chemical principles alone, but have to be accounted for by reference to new factors of a kind not known to the physical science, namely entelchies or vital forces," cites philosopher of science Carl Hempel (Hempel 101). K.C. Cole observes that, "The universe is full of things that cannot be understood – ever – simply by understanding smaller and more fundamental parts" (Cole 62). Scientism's assignment of an omnipotent role to science, of solving all problems and clarifying all things, and of deifying nature while secularizing religion can lead science to what Robert Fischer refers to as, "…like other ideologies, [science] tends to be systematic, authoritarian, and to be held tenaciously" (Fischer 68).

Science cannot ever hope to realistically answer the big questions facing humanity. Being based upon observation and testing, science is at an impasse when it comes to things that cannot be observed, measured, tested, and predicted. Social problems transcend mathematical description and involve emotions that cannot be touched, measured, or manipulated successfully. Worse still, technical solutions often only address changes in technique that might relieve the symptoms, but do not demand changes in human values or morality, which ultimately affect many underlying causes (Meadows 155-159).

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[28] Scientism is not science. It is the affirmation that there is no other realm than matter and energy, no knowledge other than scientific knowledge, and no areas of investigation, including philosophy, humanities, and social sciences, should be spared scientific scrutiny (Fischer 68). Scientism has its roots in the perspectives of many great philosophers and scientists. For example, Spinoza and Einstein believed that God was the sum total of all the physical laws which describe the universe. Heisenberg notes that physics is bent on, "…being able to write one single fundamental equation from which the properties of all elementary particles, and therewith the behavior of all matter whatever, follow" (Heidegger, Question Concerning Technology 172). "When Pierre Simon, the Marquis de Laplace, presented a copy of his work on the mathematics of physical laws to Napoleon in 1798, the Emperor asked as to the mention of God in the text. Laplace's response was an arrogant, "Sire, I have no need for that hypothesis" (Henahan 9). Francis Bacon proclaimed science as the religion of modern emancipated man (Durant 47).

[29] Aristotle's own reliance on logic shows the modern practitioner its limitations and biases. Aristotle could not agree with the followers of Pythagoras, who took the earth to be itself one of the stars circling around a fire at the center of things and creating day and night by its own turning on its axis. He declared their reasoning as not from facts to theory, but one that forced the facts into their preconceived theory. He believed that the center spot had to be the most precious location in the universe and that is why the earth had to be there (Loomis xxiv).

Skeptics and Cynics

How did Modernists, such as Flaubert, and his contemporary nineteenth and early twentieth-century scientists relate to their fellow citizens? One view might be that Modernists reduced humanity through cynicism. Modernists hated the rapidly industrializing world and had contempt for those who actually did things with their hands. "If the scientists have the future in their bones, then the traditional [literary intellectual] culture responds by wishing the future did not exist," observed C.P. Snow (Snow 11). Again, Flaubert provides the most striking example. According to his contemporary Emile Zola, Flaubert had a "hatred for the modern world…[that] burst out in everything he said. Here were the same diatribes against all our inventions; the mere sight of a machine threw him into a rage, a fit of nervous revulsion" (Flaubert 335). Jean-Paul Sartre noted that, for Flaubert, "train rides were a terrible ordeal," and he "regarded the railroad as the symbol of an industrial civilization he loathed and a social progress in which he did not believe" (Flaubert 404). Flaubert had "a contempt for the new manners and the new arts," according to Zola, and he had a "regret for the old France." He had a "self-imposed blindness to the future," noted Zola (Flaubert 336).

Alternatively, scientists reduced human subjectivity through skepticism and had very little appreciation for literature, according to Snow.

> "Their [scientists] culture is in many ways an exacting and admirable one. It doesn't contain much art, with the exception, an important exception, of music. Verbal exchange, insistent argument…The ear, to some extent the eye. Books very little…And of the books which to most literary persons are bread and butter, novels, history, poetry, plays, almost nothing at all…It isn't that they're not interested in the psychological or moral or social life. It is much more that the whole literature of the traditional culture doesn't seem to them relevant to those interests" (Snow 13-14).

Snow called literary intellectuals "natural Luddites" who were unable to understand the industrial revolution, much less accept it[30] (Snow 22). Likewise, referring to his discussions with Flaubert, Zola remembered how, "I would state my belief in the twentieth century, when I would say that our vast scientific and social movement was destined to lead to a flowering of humanity, he would look at me fixedly with his large blue eyes and shrug his shoulders. Ultimately these were general questions which did not concern him; he preferred to confine himself to literary technique" (Flaubert 336). Indeed, Flaubert's desire for perfection was "a real sickness which exhausted and immobilized him," according to Zola. He became preoccupied with form, reduced his vocabulary, and increasingly limited the humanity of his characters. Zola concludes that, "It was sad to see this powerful talent relive the ancient fable of the nymphs who were changed to stone. Slowly, from the legs to the waist, then to the head, Flaubert turned to marble" (Flaubert 340).

Explaining some of the potential causes of Flaubert's unrecognized biases, Jean-Paul Sartre described Flaubert's childhood as "imprisoned passivity." He believed that Flaubert was incapable of performing an act of affirmation and that he had no experience of reciprocity.

> "He had been condemned by the indifference of a gloomy mother to remain within the confines of simple belief. For this reason, he received language not as an organized body of tools that one assembles or disassembles in order to produce meaning, but as an interminable commonplace which is based neither on the intentions to describe nor on the object to be designated…Flaubert never

[30] The term *Luddite* has been resurrected from a previous era to describe one who distrusts or fears the inevitable changes brought about by new technology. The original Luddite revolt occurred in 1811, an action against the English textile factories that displaced craftsmen in favor of machines. Today's Luddites continue to raise moral and ethical arguments against the excesses of modern technology to the extent that our inventions and our technical systems have evolved to control us rather than to serve us and to the extent that such leviathans can threaten our essential humanity (Ryder, Martin. University of Colorado at Denver, School of Education. Luddism and the Neo-Luddite Reaction page. 5 March 2005. < http://carbon.cudenver.edu/~mryder/itc_data/luddite.html>).

> thinks…he does not take his real distances from himself and the world; consequently language reappears both in himself and in others as an obsessing materiality. One might call it *alienated thought* – materiality imitating thought or, if you prefer, thought haunting matter without being able to emerge from it. Language, organizing itself in him according to his own system of relations, robs him of thought and affects him with *pseudo-thoughts* which are received ideas and which belong to nobody since, according to Gustave, they are, in each of the others, other than himself…On this level, Flaubert does not believe that we speak: we are spoken" (Flaubert 404-405).

Scientists tend to be optimists, whereas, the Modernists seem to have been pessimists who lived tortured lives and saw the world through a peculiarly cynical prism. C.P. Snow reflected on this, noting the greater moral health of scientists as a group over literary intellectuals. Snow asserted that scientists are by nature concerned about the collective welfare and future of humanity. He contrasted that with the political decadence of the avant-garde of 1914 – Ezra Pound broadcasting for the Fascists and William Faulkner giving sentimental reasons for treating Negroes as a different species (Snow xxvi-xxvii). Snow believed that writers perceived a certain tragic nature of life. "Yeats, Pound, Wyndham Lewis, nine out of ten of those who have dominated literary sensibility in our time – weren't they not only politically silly, but politically wicked? Didn't the influence of all they represent bring Auschwitz that much nearer?" This attitude, "made up of defeat, self indulgence, and moral vanity," was not found in the scientific culture, according to Snow (Snow 5-7).

Moreover, what happens to the cynics and the optimists throughout the course of their lives? Consider a few comparative illustrations. By the time of his death in Saint-Cloud, Louis Pasteur (1822-1895) had long since become a national hero. He was given a state funeral at the Cathedral of Nôtre Dame, and his body was placed in a permanent crypt in his institute.[31] Pierre and Marie Curie shared the 1903 Nobel Prize in physics with French physicist Antoine Henri Becquerel (1852-1908) for fundamental research on radioactivity. After Pierre's death, Marie was appointed to his professorship and became the first woman to teach at the Sorbonne. In 1911 she won a Nobel Prize for Chemistry for discovering polonium and isolating pure radium, becoming the first person to win two Nobel Prizes. The Curies' daughter, Irene, later became a famous scientist and Nobel laureate herself. Throughout much of her life Marie Curie was poor, and she and her fellow scientists carried out much of their work extracting radium under primitive conditions. The Curies refused to patent any of their discoveries, wanting them to benefit everyone freely. The Nobel Prize money and other financial rewards were used to finance further research. She died of leukemia caused by her long exposure to radioactivity. In 1995, she became the first woman whose own achievements earned her the honor of having her ashes enshrined in the Pantheon in Paris.[32]

If Snow was right, Modernists like Gustave Flaubert remained tortured cynics, unable to care and uncaring of humanity. Flaubert was struck with epilepsy in 1844 and died of a stroke in 1880. His life was "filled with apprehension that drove him to lead a hermit's life" (Flaubert, Blair trans., biographical sketch). "After his mother's death in 1905 Proust, suffering from asthma, retreated from active social life and secluded himself in a cork-lined room in his Paris apartment" (Proust, Moncrieff trans., biographical sketch). Virginia Woolf's life was dominated by mental illness, terrible headaches, and emotional breakdowns. She drowned herself in the River Ouse in 1941.

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[31] In 1888, Louis Pasteur founded a special institute in Paris for the treatment of the disease. It became known as the Institut Pasteur and it is still one of the most important centers in the world for the study of infectious diseases and other subjects related to microorganisms, including molecular genetics ("Pasteur, Louis," Microsoft® Encarta® Online Encyclopedia 2005).

[32] Curie, Marie." Britannica Concise Encyclopedia. 2005 and "Curie, Marie," Microsoft® Encarta® Online Encyclopedia 2005.

The Select Few

It is instructive that much of our great intellectual tradition and many of our most important scientific discoveries came from wealthy aristocrats, who had time to think and create. Starting with the Renaissance, when the hope given by the Church was no longer needed, new morals and money provided the impetus for Europeans to cast the Church aside in favor of a new age. Suddenly, being earthy and gauche was popular. Again Europe entered an age of free inquiry, but this time a novel twist accompanied the new age. The new twist was represented by a view of life advocated by a new breed of wealthy philosopher/scientist or the talented middle-class artist, who like Leonardo di Vinci, were not wealthy but were the beneficiaries of wealthy patrons.[33] With this financial support system in place, the European Scientific Revolution of the sixteenth and seventeenth centuries began with Nicolaus Copernicas who overthrew the geocentric view of Ptolemy and The Bible that had been accepted for over a thousand years. After Copernicus, the earth was no longer the center of the universe but merely one of the many planets that circled a minor star in an insignificant galaxy. Radical in its impact, this view of the world robbed humans of their proud position in the center of God's creation. Without dogmatic theological constraints, other scientists such as Johannes Kepler who is credited with the laws of planetary motion, Galileo Galilei the re-discoverer of many of the principles of gravitation and the invention of the telescope, and Sir Isaac Newton who combined much of his previous work into the laws of motion each contributed to the Renaissance's spirit of inquiry.

By the nineteenth century, major intellectual contributions were also being made by a small cadre of aspiring, but snobbish, bourgeoisie who distanced themselves from the workers. This seems to have accompanied the rapid industrialization in Britain, which later came to France. Britain was the first major country to base itself on an industrial and commercial economy. As the population migrated from the countryside into the cities in the eighteenth and nineteenth centuries, social and political institutions formed to deal with this new situation (Budge 7). One might also note that political institutions sought to meet the interests of the commercial class and their sustained need for workers. The Industrial Revolution's abject poverty, overcrowding, and risks to the public health as well as to the labor supply, led Britain to establish itself as a liberal democracy, which, by the early 1900s also began to recognize the needs and rights, not just of the landed gentry and the commercial class, but also the industrial workers. To many of the European upper and aspiring upper class, this major cultural shift was a threat to the social order. So, a fairly rigid caste system developed throughout Europe. Flaubert and Proust depicted the French version of this social stratification.

Proust's Swann's Way depicts a certain snobbery that accompanied a caste system that constrained both those seeking upward mobility and those in the upper class who dared to cross boundaries downward.

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[33] During the Renaissance, the newly enlightened, urban, nouveau riche became important patrons of artists and artisans. Leonardo was able to develop and apply his genius due to the largesse of his wealthy patrons, who also gave him time to observe and think. Since Leonardo was not formally educated, he became a product of the guild system and he managed to take advantage of the patronage and contacts that came his way. In addition to the Duke of Milan, Leonardo was associated with the political operative Niccolo Machiavelli, the sinister Cesare Borgia, and the Medicis, plus he had a rivalry with Michelangelo (DeCamp 398-399). George Plekhanov argues that Leonardo was a product of the Renaissance, "Leonardo da Vinci and Michelangelo did not create this trend; they were merely its best representatives" (Plekhanov 171). The Church also became a powerful patron of the arts. Notably, Leonardo's Last Supper was painted for the monastery of Santa Maria delle Grazie (Murray 238). Likewise, after his publication of *Starry Messenger (Sidereus nuncios)*, Galileo parleyed his new fame into a move from the University of Padua to a much more prestigious and well-paid position as Chief Mathematician and Philosopher at the Medici court in Florence (McClellan 225). Later, he also became a member of the Academia dei Lincei (Academy of the Lynx-Eyed), patronized by the Roman aristocrat Federico Cesi. According to McClellan and Dorn, Galileo fashioned himself into a scientific courtier, in competition with the established professors at the university. The Renaissance courts of Italy, private solons, and informal associations of amateurs provided a new social support system for scientists. They also provided a flexibility of research and a seat of change not found in the static university system. They legitimized and defined the role of science and scientists in the seventeenth century. The patronage system provided financial support, but the patrons also gained influence and enhanced reputations from the scientists they supported (McClellan 226-227).

> "But on occasion my grandfather read a newspaper that M. Swann was one of the most regular attendants at the Sunday luncheons given by the Duc de X_____, whose father and uncle had been among our most prominent statesmen in the reign of Louis-Philippe…My great-aunt, on the other hand, interpreted this piece of news in a sense discreditable to Swann; for anyone who chose his associates outside his 'proper station,' automatically lowered himself in her eyes. It seemed that such a one abdicated all claim to enjoy the fruits of the splendid connections with people of good position which prudent parents cultivate and store up for their children's benefit, and she actually ceased to 'see' the son of a lawyer of our acquaintance because he married a 'Highness' and thereby stepped down – in her eyes – from the respectable position of a lawyer's son to that of those adventurers, upstart footmen or stable-boys mostly to whom, we are told, queens have sometimes shown their favors" (Proust 22).

Swann, a distinguished socialite, used to the salons of dukes, participated in, but was condescending to the bourgeoisie salon participants that were clearly below his class. Referring to the petty bourgeoisie in Madame Verdurin's salon – a woman who was described by Proust as excessively rich and wholly undistinguished – Proust the narrator toys with them and castigates Swann for even associating with them.

> "Now there was nothing whatsoever in common between the 'little nucleus' and the society which Swann frequented, and true socialites would have thought it hardly worth while to occupy so exceptional a position in the fashionable world in order to end up with an introduction to the Verdurins… [He was] a man of fashion in which he had squandered his intellectual gifts on frivolous amusements and made use of his erudition in matters of art only to advise society ladies what pictures to buy and how to decorate their houses…Just as it is not by other men of intelligence that an intelligent man is afraid of being thought a fool, so it is not by a nobleman but by an oaf that a man of fashion is afraid of finding his social value underrated" (Proust 208-209).

The European tradition of the aristocratic gentleman scientist, such as Thomas Merton, Victor Rothschild, and Louis-Victor de Broglie, was complemented by the proletarians Michael Faraday and Ernest Rutherford. In fact, many of the great leaders of science came from humble roots.[34] According to Snow, "Compared to the rest of the intellectual world, considerably more scientists in this country [Britain] and probably in the U.S. come from poor families" (Snow 10).

Some of the most notable French scientists were also rooted in the middle-class. Louis Pasteur was the son of a tanner, and grew up in the small town of Arbois. Yet, after earning a doctorate at the École Normale in Paris in 1847, with a focus on both physics and chemistry, he went on to become the world-renowned French chemist and biologist, who founded the science of microbiology, proved the germ theory of disease, invented the process of pasteurization, and developed vaccines for several diseases, including rabies.[35] Maria Skłodowska, known as Marie Curie, was born in Warsaw at a time when Poland was under Russian domination. Her parents were teachers, but soon after Maria was born, they lost their teaching posts and had to take in

[34] This tradition dates back to the Renaissance. For example, being the illegitimate son of the middle-class Ser Piero Da Vinci, Leonardo, as was typical of the bourgeois society of his day, was effectively ostracized from his father's world. According to biographer, Michael White, "He was prevented from attending university and could not hope to enter any of the professions, such as medicine or law, because it was strictly against the rules of the professional guilds to accept anyone with his background. Although he achieved wonders in a vast range of studies, Leonardo was never able to come fully to terms with the fact that he had been deprived of a formal university education" (White 15-16). Galileo Galilei's (1564-1642) father served at the Medicis at court as a musician. Galileo attended medical school at the University of Pisa and secretly studied mathematics. This disgruntled, undistinguished professor at a second-rate university stumbled onto the telescope in 1609, which would be the vehicle for his fame (McClellan 223-224).

[35] "Pasteur, Louis," Microsoft® Encarta® Online Encyclopedia 2005.

boarders. Their young daughter worked long hours helping with the meals, but she won a medal for excellence at the local high school. No higher education was available to women in Poland at that time, so Maria took a job as a governess. She sent part of her earnings to Paris to help pay for her older sister's medical studies. When her sister qualified as a doctor and married a fellow doctor in 1891, Maria went to join them in Paris. She entered the Sorbonne (now the Universities of Paris) and studied physics and mathematics, graduating at the top of her class. In 1894 she met the French chemist Pierre Curie, and they were married the following year. Albert Einstein was the son of an unsuccessful businessman, and, atypical of the genius stereotype, he exhibited no precocious talents and dropped out of high school. He attended the Federal Polytechnic School in Zurich. After college he was refused a position as a schoolteacher because of his Jewish ancestry, so Einstein took a minor position in the Swiss patent office. He was then able to have enough time to earn a doctorate from the University of Zurich in 1905 (McClellan 345).

Several prominent leaders of the Modernist school, though not aristocracy, came from the upper levels of European middle class society. Unlike the scientists profiled above, who came from modest means and grew to prominence through merit, the Modernists seem to have had a certain social advantage by virtue of their families' positions in a socially stratified Europe. For example, Gustave Flaubert was born in Rouen in 1821 into the family of a distinguished surgeon, similar to the character, Dr. Lariviere, in Madame Bovary. He studied law but turned his attention to writing. Having sacrificed his modest fortune to help his niece, Flaubert lived out his life isolated and in financial stress (Flaubert, Blair trans., biographical sketch). Marcel Proust was born and died in Paris. He was educated at the Lycee Condorecet, studied political science and law, and served a short tour in the military. Like Charles Swann in Swann's Way, Proust was part of the Parisian society of salons during the *belle époque*.[36] Virginia Woolf was born into a family of prestigious literary intellectuals. Her father was Sir Leslie Stephen, the editor of the Dictionary of National Biography and her mother was the daughter of the writer William Thackeray. Growing up among influential British intellectuals, Woolf wrote for the Times Literary Supplement and became a member of the "Bloomsbury Group," London's most important literary community.

Elitism Separates the Doers from the Thinkers

Flaubert, not unlike other intellectuals of the nineteenth century, disdained the bourgeois – the middle class people whose industrial age jobs did not require physical labor, but who lacked the independent wealth and ancestry so esteemed by society. Having "new money" did not lead to more refined tastes. Indeed, Flaubert portrayed them as gaudy, materialistic, self-indulgent, and shallow. They led mediocre lives, yet they were pretentious. In Madame Bovary, Flaubert mocks the pharmacist, Homais for his long speeches on scientific subjects that he really doesn't understand. He shows how dangerous such pretensions can be by having Homais and Charles – not a doctor, but a medic by modern standards – operate with tragic results on Hippolyte's club foot and later try to save Emma from arsenic poisoning, with equally tragic results. It is only the real doctors – Monsieur Canivet, "a famous doctor of high standing" and "great self assurance" and the esteemed, learned, yet condescending Dr. Lariviere -- that are able to amputate Hippolytes' gangrenous leg and diagnose Emma. Flaubert demonstrates the incompetence of Charles and Homais in their search for an antidote to Emma's arsenic poisoning.

> "Charles tried to consult his medical dictionary but he could not read; the lines danced before his eyes. 'Be calm!' said the apothecary. 'All we have to do is administer some powerful antidote.' 'All right,' said Homais, 'we'll have to make an analysis.' For he knew that an analysis must be made in all cases of poisoning; and Charles, who did not understand, replied, 'Make one, then, go ahead! Save her!" (Flaubert 275).

[36] The *belle époque* was a culture-rich era of Parisian society that included the Impressionist artistic school, exemplified by Vincent Van Gogh and Claude Monet, the introduction of the cinema by the Lumiere Brothers, the scientific discoveries of Louis Pasteur and Pierre and Marie Curie, plus the engineering achievement of the Eiffel Tower (1889).

Upon the failure of the antidote, Homais exclaims, "What the devil…But she's purged, and since the cause has been removed …The effect must cease…It's self evident" (Flaubert 276).

In contrast to the bumbling medic Charles, the bombastic apothecary Homais, and even the provincial doctor Canivet, Flaubert describes Dr. Lariviere as belonging "to that great surgical school engendered by Bichat, to that generation, now vanished, of philosophical practitioners who cherished their art with fanatical love and exercised it with enthusiasm and wisdom" (Flaubert 277). His revulsion for Charles and Homais is seen by his simple statement that they could have had a better chance of saving Emma if they had put a finger down her throat, rather than trying some exotic treatment that they had read about, but had no true scientific understanding (Flaubert 279).

One could say the same for the wooden contraption that Charles and Homais forced on Homais after they cut his Achilles tendon. Canivet "laughed with undisguised contempt when he saw Hippolyte's leg" (Flaubert 156).

> "Now there's a Paris invention for you! A brilliant idea from the capital! It's like strabotomy, chloroform and lithotricity – there ought to be a law for such atrocities! But some doctors want to be smart, so they use all sorts of remedies on their patients without worrying about the consequences. The rest of us aren't that smart, we're not scientists or dandies or fashionable fops – we're practitioners, healers, and we wouldn't dream of operating on someone who's in perfect health! Straightening a clubfoot! Whatever made anyone think such a thing could be done? It's like trying to straighten a hunchback!" (Flaubert 157)

In both cases, Flaubert mocks the bourgeoisie's faith in technologies that it doesn't fully comprehend.

Jean-Paul Sartre sees the irony, indeed the hypocrisy, of Flaubert's disdain for the bourgeois. "In fact, it is his own bourgeois nature which comes to him like a stranger and which he hastens to deny. He would have us believe that he is amusing himself, that he is imitating the clerks and shopkeepers…In fact Flaubert is not imitating the bourgeois: he talks like bourgeois because he is bourgeois. He did not write the offending sentence in order to mock his class: it came spontaneously to his pen" (Flaubert 406-407).

Traditionally, scientists also have held such elitist views and have separated their intellectual pursuits from the crass implementation world of engineers and technicians. As Snow observed,

> "Pure scientists have by and large been dim-witted about engineers and applied science. They wouldn't recognise that many of the problems were as intellectually exacting as pure problems, and that many of the solutions were as satisfying and beautiful. Their instinct – perhaps sharpened in this country [Britain] by the passion to find a new snobbism wherever possible and to invent one if it doesn't exist – was to take for granted that applied science was an occupation for second-rate minds" (Snow 32).

In a manner very similar to Flaubert's intellectual pursuit of literary form for self-satisfaction, Snow noticed that, "We [Cambridge research scientists] prided ourselves that the science we were doing could not, in any conceivable circumstances, have any practical use. The more firmly one could make that claim, the more superior one felt" (Snow 32).

But that has changed over the past century. As discussed, science has many facets. In essence, it seeks to be pure neutral knowledge extracted painfully from nature through systematic means for dissemination to all humanity. However, much of the relevance of science to society arises by way of *technology*.[37] As Heidegger observed, "…the only important quality

[37] The origin of the word *technology* gives valuable insight into its meaning. It is derived from the Greek words, *techne* and *logos*. The former means art or craft and the latter signifies discourse or organized words. The practice of technology frequently is that of an art or craft, as distinguished from science, which is precise and is based upon established theoretical considerations. Even though we do not normally think of technology as consisting of written or spoken words, as implied by logos, it does involve the systematic organization of processes, techniques and goals.

has become their readiness for use…their only meaning lies in their being available to serve some end that will itself also be directed toward getting everything under control" [38] (Heidegger xxix). Even Aristotle, in his *Metaphysics*, distinguished between theoretical knowledge, whose goal is truth, and practical knowledge, which seeks action (Loomis 11). As such, technology is how we do things, not how we think of them. Suffice it to say for our use that technology is science plus purpose. While science is the study of the nature around us and subsequent development of scientific 'laws,' technology is the practical application of those laws, in sometimes non-rigorous ways, toward the achievement of some material purpose (Dorf 1). Snow attributes "the only qualitative changes in social living that men have ever known" to the "agricultural and the industrial-scientific" revolutions, and the technological advances that enabled them. "For, of course, one truth is straightforward. Industrialization is the only hope of the poor" (Snow 22-23).

Conclusion: Partial Reconciliation

Modernist and scientific schools of thought both claimed to seek pure knowledge, without personal bias. According to Bersani, "Flaubert came to have a polemical distrust of all fictive versions of reality" (Flaubert xvi). Modernists sought a de-historical, de-politicized, de-personalized, and de-romanticized empiricism. Flaubert wrote to Louise Colet, "Let us always remember that impersonality is the sign of strength. Let us absorb objective reality and allow it to circulate within us and then reproduce itself externally, without betraying anything about this marvelous chemistry. Let us be magnifying mirrors of external truth."[39] "Everything must de done coolly, deliberately."[40] In this respect, Flaubert and Proust had more in common with their scientific contemporaries, such as Pasteur, Currie, and Foucault, than popular writers of romantic novels or newspaper editors.

Such idealized empiricism was not humanly achievable and, though a noble goal, fell victim to the interpretation of reality through the experience and biases of fallible humans. Both groups claimed to seek pure knowledge, without regard to practical applications. As such, both schools deified the pursuit of science, art, and truth into an intellectual snobbery. They were condescending, if not antagonistic, to those who practiced engineering, invented things, and wrote prose for the common people. Whether artists, philosophers, or scientists were wealthy, benefited from patronage, or were recent bourgeois, there seems to have been a reluctance to appreciate that their intellectual freedom often meant that they stood on others' shoulders for food, clothing, shelter, and security. They did not seem to understand or acknowledge that, as Abraham Maslow later codified it, self-actualization can only occur when the basic needs have been met; in their case, these needs had been partially met by others.

Where the Modernists and scientists differed, however, is in the degree to which they either recognized or rejected those shoulders. Scientists came to embrace the linkages with technologists, whereas Modernists like Flaubert rejected the notion that their work was based on any literary predecessors. In this sense, Flaubert would agree only with the second part of Aristotle's contention that, "Inventions are either the elaboration by later workers of the results of previous labor handed down by others, or original discoveries, small in their beginnings but far more important than what will later be developed from them." To Flaubert, his work was original and more important than his predecessors and contemporaries.

Science has come to embrace those who implement its discoveries – the engineers and technologists. There are intimate relationships between science and technology; yet science is not technology and technology is not science. Technology relies very heavily upon basic scientific knowledge in addition to existing technologies. There is also a strong influence in the reverse

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[38] Heidegger refers to the undifferentiated supply or 'standing-reserve' of the available matter that is objectified by man via technology as a means to an end (Heidegger, Question Concerning Technology xxix).

[39] Croisset, Sunday, 10 o'clock, November 6, 1853 (Flaubert 325).

[40] Croisset, Sunday night, 1:30, February 27-28, 1853 (Flaubert 321).

direction. Modern science relies to a large extent upon current technology as well as prior scientific knowledge. Science and technology reinforce each other by complex interactions. Each one, science or technology, can build upon itself or upon a linkage from one to the other. Robert Fischer notes that, "Technology is dependent on science for knowledge of the properties of materials and energy and for predicting the behavior of natural forces. Science is equally dependent upon technology for its tools and instruments, for preparation of materials, for the storage and dissemination of information, and for the stimulation of further research" (Fischer 78). Indeed, science is not technology and technology is not science, but they are firmly interrelated. One could not exist in modern society without the other.

Likewise, while there remain significant differences between Modernist literary and Western scientific schools, "literary intellectuals represent, vocalise, and to some extent shape and predict the mood of the general culture," as Snow stated. "They do not make the decisions, but their words seep into the minds of those who do" (Snow 61). While it is clear that, within both the scientific and literary communities, classical aesthetics frame the goals and provide the philosophical outlook that guides the search for truth, science has come to recognize the limit of empiricism. Likewise, though Flaubert believed there was a perfect word for everything, some human experiences are inadequately described by words alone.

However, the Modernists' search for beauty in form may not have been in vain. It may have helped bridge a gap in our thinking about the differences and similarities between art and science. As we entered the twenty first century, the search for simplicity has recently become the metric for truth. Scientists have come to believe that the simpler model is the more likely to be truthful and beautiful. Simplicity takes the form of invariants, those aspects of nature that are truly fundamental. Invariants are defined by symmetries, which in turn define which properties of nature are conserved (Cole 11). "These are the selfsame symmetries that appeal to the senses in art and music and natural forms like snowflakes and galaxies. The fundamental truths are based on symmetry, and there's a deep kind of beauty in that," observes Cole. Elements of Aquinas' trinity of wholeness, proportion, and brilliance can be found in this new Aristotelian metaphysical model (Adams 116-119). It also has elements of Neoclassicism's economic, clear, easy, mathematical plainness.

This search for simplicity and invariants comes at a time when physicists are encountering the strange new world of subatomic particles and interstellar phenomena that defy Aristotelian logic, Euclidean geometry, and Cartesian coordinates. The world of the very large and the world of the very small seem to show scientists that there is not just one right answer for every question. It turns out that the paradoxes of certain phenomena reveal that logic can lead to contradictory conclusions, point in different directions at once, and violate Aristotle's belief that one cannot be logical and contradictory at once. Modern mathematicians have introduced us to the multi-valued, somewhat ambiguous logical construct called 'fuzzy logic.' Unlike the two-valued logic of Aristotle, with its binary yes/no or true/false clarity, fuzzy logic provides a sliding scale of gray between the extremes of black/white logic (Cole 158-171).

In such a complex unknowable world of the infinitely large and the infinitely small, perhaps there is a role for art to help with nature's 'unconcealment,' as Heidegger would state it (Heidegger, *Origin of Art* 649-701). Aristotle also reminded us that art finishes the job when nature leaves something undone. In essence, he states that there is a place for both non-rational approaches and rational ones. This is an important lesson for a society that depends heavily upon science and technology. Indeed, as Snow reminded us, "It is dangerous to have two cultures which can't communicate. In a time when science is determining much of our destiny, that is, whether we live or die, it is dangerous in the most practical terms" (Snow 98).

A workable holistic approach for modern society is the reconciliation of the emotional, artistic, and religious schools of thought with the scientific community in a manner that recognizes that, rather than being inconsistent, these intellectual schools can be complementary.[41] Since

[41] The complementary nature of science and religion is not a merely a recent twenty first century concept. The twelfth century masters of the School of Chartres asserted that the laws of nature were worthy subjects of investigation by the human mind, since both are encompassed within the divine universe and its design (Goldstein 69-70). In the thirteenth century, Thomas Aquinas gave a sound philosophical argument that scientific rationalism and empiricism are perfectly

phenomena outside of the physical realm of experience are, by definition, foreign to science and native to religion and art, one's feeling, intuition, and connectedness can certainly assist in answering complex questions. Art, poetry, literature, and religion could tell one where to look, and science could determine how the process occurred. Science's focus on the physical realm of cause, effect, and cure, plus its values of truth, objectivity, dissent, independence, respect, and supranationality could help solve many of the most pressing social problems. Art, intuition, and belief, focusing on the non-physical realm, could help refine universal meaning, personal morals, interpersonal relationships, and societal values.

When scientists start appreciating artists and listening to theologians and mystics, and this latter group starts, not only listening, but also understanding and practicing science, society may be on its way to viewing these ultimate questions in a holistic fashion.

Suppose science and aesthetics could agree upon a scenario like this? How fascinating! How innately truthful! How beautiful! How utterly post-Modern!

God is behind all things, but all things conceal God.
-- Victor Hugo

compatible with mystic and religious concepts of the world, as long as rationalism remains aware of its metaphysical limitations (Goldstein 70).

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End Notes

[i] **Further Comments on the Medieval European Worldview** –

An atmosphere of sober empiricism distinguished the Hellenic Greeks from the Ionians, with Aristotle being credited as being a great dividing line in Greek history. Greek science, by the sheer process of speculation, argument, intuition, plus a dash of empirical reasoning, had moved, within the space of two generations, from the early mythical notions to a point that is surprisingly close to modern concepts (Goldstein 52). Aristotle's pupils and their successors carried on his teachings at the Lyceum for over 800 years, until, like Plato's Academy, it was closed by order of a Christian emperor in Constantinople (Loomis X).

The classic Roman civilization built upon Greek science to develop their mighty empire with its renowned technical prowess. The Romans, being driven by conquest, glory, commerce, and an increasing need to find new resources never really flowered as scientists. Free thought was not the hallmark of Rome. The Roman way of doing things was impressed upon its citizens and conquered states as a matter of standard procedure. The Romans did, however, undertake massive engineering feats such as extended roads, aqueducts and highly structured cities (DeCamp 172-280). Here technology flourished but no new ideas of philosophical importance stand out. Great translators of other works, the Romans were exploiters of resources and fantastic implementers of technology. As Rome crumbled under the weight of countless invasions, the cosmic vision of the Greeks and the technological achievements of the Romans shriveled.

With Europe over-run by the Germanic tribes, scientific inquiry was stunted for a millennium. Europe slept in a stupor of ignorance for one thousand years. "To those who lived through the catastrophe, it seemed that the utter breakdown of civilization had come, the ruin of everything humanity had ever tried to create over thousands of years, a verdict from a wrathful heaven," according to Goldstein (Goldstein 55). Europe reacted with a radical readjustment of mind, turning their backs on the world of the senses, which now seemed unworthy of intellectual scrutiny. The end of Roman civilization meant a steadfast attachment by Europeans to the dogma of Christianity. To Europeans it offered the only hope left.

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[ii] **Further Comments on Medieval Mysticism and its Impact on the Development of Science** –

"Medieval mysticism meant accepting the rule of invisible forces…within the Good Lord's mysterious blueprint …rooted in the beyond, over the tangible, everyday experience," according to science historian Thomas Goldstein (Goldstein 138). While judging religion and the state of scientific knowledge in the hindsight of history is somewhat unfair, it allows one to question whether religious dogma and reliance on faith instead of rational mental faculties slowed the development of the European scientific method and impeded medical progress when its adherents most needed it. Since ancient times, the educated elite knew the power of Aristotle's reasoning, Hippocrates', Herophilus', and Galen's observation and experimentation, and it knew that the Muslim scholars of the ninth to fourteenth-century Spain excelled in medicine and chemistry (White, Warfare of Science with Theology 2: 26-51). In spite of this knowledge, medieval society rejected this early scientific approach in favor of faith. In 1270, Thomas Aquinas, writing in his *Summa Contra Gentiles*, cautioned the faithful not to lift the veil from those ultimate mysteries that are destined to be concealed from the human mind. Referring to Aquinas, Thomas Goldstein notes:

> "The greatest rational thinker of the Middle Ages, in other words, privy to the most complete scientific knowledge of his time, was warning his own generation and the generations to come not to overestimate the power of rational thought, but to acknowledge the superior scope of mystic intuition and sheer faith as paths toward understanding" (Goldstein 249-250).

For hundreds of years, the medieval Church set up a series of obstacles to scientific inquiry including: attributing disease to demons; sanctioning and profiting from the supposed healing powers of the relics of the Christian martyrs; using the *Apostle's Creed* and its belief in the resurrection of the body to outlaw dissection in medical schools; promoting ideas that abasement adds to the glory of God, that cleanliness was a sign of pride, and that filthiness was a sign of humility. As late as the 18th Century, church leaders were preaching against the 'dangerous and sinful practice' of inoculation (White, Warfare of Science with Theology 2: 27-69). For example, during the 1721 breakout of smallpox in Boston, even though Zabdiel Boylston's inoculation technique was proven to produce a lower mortality rate than inflicted by the natural disease, it was widely opposed by the medical establishment as unsafe, and by the church as an interference with God's will (Tucker 17-18).

Throughout European history, schools of thought contrary to Church teachings were seen as blasphemous, and appropriate punishment was doled out. Prodded by St. Bernard, conservative theologians from Paris, Orleans, and Lyon hounded the masters of Chartres and summoned them to appear before a tribunal to face charges of heresy for teaching a scientific view of the intrinsic creative powers of nature -- a view that threatened the 700-year-old doctrine of nature as the passive object of God's creation (Goldstein 69-70). This was the mentality that burned at the stake Giordano Bruno in 1600 for uttering and publishing the heresy that there were other worlds and other beings inhabiting them (Sagan, Cosmic Connections 185). Staunch religious dogma was the reason for the Catholic hierarchy's imprisonment of the aged Galileo Galilei for proclaiming that the Earth moves (Drake 330-351). Johannes Kepler, after whom the laws of planetary motion are named, was excommunicated by the Lutheran Church for his uncompromising individualism on matters of doctrine and because of his writing of *The Somnium*, in which he imagined a journey to the moon. In addition, Kepler's mother was dragged away in a laundry chest in the middle of the night to be burned as a witch for giving birth to such a heretic and selling herbs (Sagan, Cosmic Connections 50-71).

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