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Science: Method, Myth, Metaphor? *

Abstract

Ideas about the place of science in human life have always existed within the scientific community. My discussion focuses on how these kinds of ideas influence scientific development and speculation. Using the formation of cosmological models as a historical counterpoint to recent discussions about science what science is and ought to be, I illustrate how scientists have merged preconceptions and prejudices with our ability to ask questions and our inventiveness in stabilizing scientific models. In addition, I show that scientific speculation has proved to be motile because scientific inquiry cannot be isolated from other approaches to life.

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Karl Popper once asserted that the aim of science is to find satisfactory explanations of whatever strikes us as being in need of explanation. His point was that it may be naive to speak of the "aim" of science, for clearly different scientists have different aims, (Miller, 1985). Scientists also offer more than one explanation of how science fits within the culture-at-large. For example, at present, the physicist David Peat suggests that the maps of science have reached so high a degree of abstraction and sophistication that they have lost their deeper meaning and connection to the world in which we live. Peat urges we recapture something of the living quality in ancient mythology. 1 The cosmologist Joseph Silk, on the other hand, infers that science retains this living quality when he says that the creation story as now told through the Big Bang might be regarded by those who follow us as a late twentieth century myth, one similar to the creation stories of antiquity. **2** All scientists, however, do seem to agree with the assessment of the astronomer Martin Rees. As Rees points out, the success of the Big Bang does not mean we should not question it. Like all scientific theories it remains falsifiable. In time we may find that the theory was simply comparable to adding a new epicycle to the Ptolemaic model, (Rees, 1995).

Ideas about the place of science in human life, like those expressed above, have always existed within the scientific community. This paper focuses on how scientific ideas are a part of human consciousness and how this influences scientific development and speculation. Using the formation of the Pre-Platonic, Ptolemaic, and Copernican cosmologies as a counterpoint to today's science, I consider scientific development and speculation in four ways. First, I explore the Greek discovery of the mind and science. Then I illustrate how scientists have merged preconceptions and prejudices with our ability to ask questions and our inventiveness in stabilizing scientific models. Third, I show that scientific speculation has proved to be motile because scientific inquiry cannot be isolated from other approaches to life. Finally, I look at how scientific studies use method, myth, and metaphor. My conclusion is that all of us can benefit from developing a comprehensive grasp of how cultural beliefs and human consciousness impact scientific investigations and why the scientific method continues to change the face of science as scientists continually question and re-evaluate their assumptions.

A. The Greeks

The development of Western scientific techniques is usually associated with the Greeks. The intriguing aspect of this is that the ancient Greeks were not a cold-hearted and detached people so much as a people passionately engaged in seeking to rationally answer the questions life posed. In fact, it was this passion to know more that led them to see the world as a question to be answered. Their efforts to answer this question also compelled them to seek to define the underlying principle of the cosmos and nature, (Kitto, 1951; Snell, 1982).

Four aspects of the Greek experience stand out. First, the early Greeks were trying to explain all things by one of several principles - themselves being considered as among these things,**3** (Gilson, 1941). Second, the

Greek experience and the Greek "discovery" of the mind were not limited to an individual's perception of the world but, rather, moved into individual consciousness while, simultaneously, becoming a part of how a people communally re-defined their perspective on living. Third, in the process of trying to explain nature, they discovered their personal identities to a larger degree. This point cannot be emphasized strongly enough for it was not the intention of the Pre-Platonic natural philosophers[4] to deify logic and objectivity, (Jaeger, 1967). Nor was it their intention to lay the foundations for science and philosophy. Their hope was to form a ground for better living. They saw reason as a way of exploring (among other things) whether there was consistency within life, and how humans were - or could be - involved with what their lives contained. Finally, dialogue was the technique the Greeks used in their pursuit of knowledge. This relational method of exchanging ideas became a key component of Western theology and science. No doubt, if the ancient Greek tradition was never broken in the West it was because the Greek dialogue served as the foundation for the supernatural theology of Christianity, (Jaeger, 1967). It is also at the heart of the methods we find in Modern thought.

1. The Greek discovery of the mind

The organic and finite worldview of the Homeric religion, which emerged around the eighth century BCE, seeded the dialogue that led to the Greek discovery of the mind. Homeric culture is aptly described as one that moved the Greek culture out of a Dark Age into a vision of life in the sun. Homer's epics provided the religious foundation for this Olympian belief system and its basic premise was that life in the sun was beautiful, although painful, but, nonetheless, always moving as it should.

Gilbert Murray (1955) notes that the Homeric religion was a step in the self-regulation of Greece. In Murray's opinion, as a religion it attempted, and failed, to bring order into chaos, moralize the cruel and socially offensive aspects of the old rites and rituals, and to create a social organization for the community. The Olympian religion did, however, succeed in generally permitting progress by not only encouraging obedience to virtues but also urging humans to use their power of thought, daring, and endurance. These attributes were thus engaged and focused on defining proper living and purging the more humanly degrading aspects of the old religions, (Murray, 1955).

What stands out here is that the Homeric vision, despite the Homeric negation of the possibility, was actively seeding the development of the self-aware mind by creating a more effective means for education and a code for social order. The religion was also planting the seeds that would broaden discussion about nature (physis), autonomous identity, social place, and social function. This was because the Homeric tradition began to codify the oral tradition, or to define what was "known" and what was "believed." The key point here is that while moving into a proactive framework the Olympian religion both moved beyond the "darkness" of the early religions and, simultaneously was representative of them. "To parody the words of Anaxagoras, 'In the early religions all things were together, till the Homeric system came and arranged them," (Murray, 1955).

Let me emphasize that the evolution of Homeric culture was subtle, as is evident when we examine how the culture seeded the idea of personal autonomy. Initially, as E.R. Dodds has pointed out, the Homeric concept of personal ego was virtually undeveloped. Many (Havelock, 1963; Jaynes, 1976) have also noted that the quality of Homeric consciousness was almost like being hypnotized or in a dream state. Contextually this meant that the Homeric human had no unified concept of what we would call "soul" or personality. Rather, in the Homeric world, unsystematized, non-rational impulses and the acts resulting from them tended to be excluded from the self and ascribed to an alien origin, [5] (Dodds, 1951). Thus, the people did not see their shortcomings self-consciously, partially because the Homeric epics encouraged a passivity of surrender to experience that was accomplished through the use of the emotions and motor reflexes. Let me stress that it was through this instinctive activity of surrender that the people were educated and socialized to know the mores of the traditions.

> "When confronted with an Achilles, we can say, here is a man of strong character, definite personality, great energy and forceful decision, but it would be equally true to say, here is a man to

> whom it has not occurred, and to whom it cannot occur, that he has a personality apart from the pattern of his acts. His acts are responses to his situation, and are governed by remembered examples of previous acts by previous strong men. The Greek tongue . . . [at this point] . . . cannot frame words to express the conviction that "I" am one thing and the tradition is another; that "I" can stand apart from the tradition and examine it; that "I" can and should break the spell of its hypnotic force," (Havelock, 1963, p. 199).

Yet, and despite the fact that the concept of an independent identity was foreign to the Greek mind, the Homeric stories offered a means for people to reflect on questions concerning nature, identity, and being. The stories initally they brought ideas that were alien to the people into their minds and the cultural environment. In effect, the stories acted like metaphors in the following way: First, on hearing the stories the Greeks were exposed to ideas that were not actually a part of their worldview. Then, through discussing the content of the stories they were able to conceptualize possibilities outside of their experience interpersonally. I cannot emphasize strongly enough that this was an experiential endeavor, one which gave them the experience of holding two frames of reference simultaneously and eventually this experience brought about what we would call Greek rhetoric.

How the initial experience worked is best explained through looking at an example from the Iliad. In the Iliad we find Achilles wrestling with an unsolveable contradiction. On the one hand, he wants to do his duty and fight with his companions. On the other hand, he is not permitted to join them. Achilles reflects on his predicament, and his ruminations offered people an example of what it meant to reflect on the nature of one's place and function as a member of the group.

> "Achilleus weeping went and sat in sorrow apart from his companions beside the beach of the grey sea looking out on the infinite water. . . . Never now would he go to assemblies where men win glory, never more into battle, but continued to waste his heart out sitting there, though he longed always for the clamour and fighting." (Homer, 1961, The Iliad, I:349.490, , p. 68, 72)

This reflection was believable in the context of the poem because Achilles was part God by birth. **6** According to Greek mythology only a God, or someone who had the blood of a God, could actually consider place and function in the immobile Homeric culture, where roles were defined by birth and reinforced by the community. **7** Thus Achilles' parentage thus gave him the legitimacy to question how he could want to fight with his companions and not be permitted to do so. His situation and his questioning of it in turn exposed to people the possibility that "I" could be one thing and the "tradition" could be another.

In sum, through considering questions like whether Achilles' conflict was a part of a cosmic justice - or more aptly seen as injustice - people engaged in a process of differentiating possibilities and considering what individual beliefs and group acceptance meant in the scheme of things. Let me emphasize that this was a long process and it was only over time that individual and cultural changes were apparent. Eric Havelock offers a wonderful description of how this change in human consciousness added a level of individualized awareness not previously apparent in the Western psyche.

> " . . . some time towards the end of the fifth century before Christ, it became possible for a few Greeks to talk about their 'souls' as if they had selves or personalities which were autonomous and not fragments of the atmosphere nor of a cosmic life force, but what we might call entities of real substances . . . as late as the last quarter of the fifth century, in the minds of the majority of men, the notion was not understood, and . . . in their ears the terms in which it was expressed sounded bizarre. Before the end of the fourth century the conception was becoming part of the Greek language and one of the common assumptions of Greek culture." (Havelock, 1963).

Four exceptional aspects of this cultural exercise are important to this discussion. First, as mentioned above, the method the Greeks used resulted from a group process that was also particularized in the experience of many individuals. Second, there was no pre-defined model in the Greek experience that the people could turn to help them frame the idea of autonomous personhood. It was precisely because there

was no existing model for their "model" that they created a new way of perceiving the world, and in the process of creating this new way of seeing the world, they allowed it to come into existence, (Snell, 1982).

Third, the process differed from the kinds of revelations we find in religious thought. This too can be attributed to the Greek emphasis on dialogue. Although the Greeks often credited their insights to divine origin, their process was more dynamic and more relational than direct revelation. Their exchange did not confirm revealed insights so much as it helped them to develop new ways of seeing their relationship to the world. Concepts emerged as abbreviations of their insights. These concepts, in turn, enhanced their interpersonal communication because the concepts gave the Greeks a shorthand that enabled them to cover more territory. Again, these concepts were not objectively discovered nor objectively invented - for there were no aims involved. The new way was effected in the process of revealing itself.

Finally, and possibly most noteworthy in terms of our world today is that it would be nonsensical to separate the religious and the scientific in looking at this early Greek process. The Greeks of this period believed their Gods still lived in the world. Humans were perceived to differ from gods only because they were mortal, (Guthrie, 1950; Tarnas, 1991). The Greek gods loved and hated, helped humans, harmed humans, and appeared among them as they did so. **8** These gods had created neither matter nor humans. Humans and matter, like the gods, were infused with spirit and divinity - because it was assumed that all was by nature divine. It would have been nonsensical to them that it could be otherwise. Thus their emerging conceptual language, like their polytheistic culture, included both the intuitive and the spiritual in its essence. **9**

This conceptual union is particularly evident in the Greek view of the cosmos. The cosmos at this point was seen to be unified, divine, self-organizing, and dynamic. Perceived as alive, the cosmos was presumed to have both a physical and a biological nature. This view of reality would be called a cosmobiology or a living systems view of reality today.

Moira 10 was the word used to connote the self-organizing process, presumed to be the nature of everything that exists. As an impersonal principle, and thus not to be confused with "God," Moira represented the life principle which governs the cosmos, keeps order, assigns limits, and designs each fate (moira) in the sense that all have a proper place and a proper function within the organic self-regulation. 11 This means that Moira's microcosmic counterpart, moira, comprises all particulars in relation to this self-organization - be they human life, cities, rivers, horses, etc. Every particular thing has its moira. The key point here is that the concept attempted to contextualize that a two-in-one quality was the nature of the whole. 12 One could also say that Moira/moira was believed to include the overall dynamic, the whole, the parts that comprise the whole, and the changing functions of both the parts and the whole. 13

It was when the natural philosophers (e.g., Thales, Anaximander, Heraclitus, and Parmenides) began exploring the nature of Moira that the foundations for Western cosmology, ontology and epistemology began to take form, (Cornford, 1991; Guthrie, 1950). Three ramifications of their initial probings must be emphasized.

First, their active method of questioning was born in the Homeric tradition. In addition, it was limited to a select group, despite the way the aristocratic Homeric worldview came to define the cultural mind and the formal design of the culture. Moreover, the conclusions of these few defied the community's views and frequently overlooked the value of many of the treasured, redeeming, and nurturing qualities of the general populace, (Murray, 1955). This means that even while being adopted by the culture, the new ideas were creating a conflict with the sense of security - and identity - provided by the old, and known, religious tradition. 14

This cultural polarization is important to acknowledge today as many people challenge the value of science and the reductionistic logic that resulted from the process of differentiation. If I may editorialize, it is critical to see the limitations in the "discovery" of science but, I would suggest we do ourselves a disservice if we use these limitations as reasons to romanticize the holistic, two-in-one quality of premodern cultures,

like the Homeric culture. This kind of romantization often fails to acknowledge that there were real incentives for the people who did so to look more closely at their culture. Clearly, being regularly forced to face the violence, murder, and lack of civility evident in many traditional rituals and practices provided a legitimate reason to try to see beyond life as it was known. 15 Given the overall situation it is really not surprising that many saw reason, differentiation, and logic as positive additives to life.

> "The medieval plan of burning heretics alive had not yet been invented. But the history of uncivilized man, if it were written, would provide a vast list of victims, all of them innocent, who died or suffered to expiate some portent or monstrum . . . with which they had nothing whatever to do, which was in no way altered by the suffering, which probably never really happened at all, and if it did was of no consequence. The sins of the modern world in dealing with heretics and witches have perhaps been more gigantic than those of primitive men, but one can hardly rise from the record of these ancient observances without . . . feeling within him that the lightening of this cloud, the taming of this blind dragon, must rank among the greatest services that Hellenism wrought for mankind," (Murray, 1955, p. 36-37).

Second, the Presocratic use of dialogue and logic came to define the scientific method. In saying this I cannot stress strongly enough that the nature of their enterprise does not correlate with key prejudices about scientific practice today. For example, their efforts to analyze the world "as if it were objective" represented an attempt to share information in a way that would take them beyond cultural assumptions, individual biases, and prejudices in general. Their efforts were not a rejection of religion or of anything that we would call the humanities. These kinds of idea do not even fit within their cultural mind. The Presocratics simply wanted to reach beyond the unverifiable narrative of myth. Their efforts were not impersonal so much as interpersonal. Stimulated more by passion than skepticism, they believed there was a value in reaching beyond accepted understandings of reality, (Guthrie, 1950; Havelock, 1963).

Third, as both Havelock (1963) and Dissanayake (1989) point out, in Homeric Greece, as in prehistoric societies generally, and in preliterate groups today, political and social institutions were necessarily transmitted and preserved in an oral tradition, or a memorized "encyclopedia" of the information that was considered essential for the perpetuation of the group. In the Homeric tradition the identification with the oral performance was how the social code was kept in place. Learning was embodied through how the rhythm of the poetry encouraged a state similar to hypnosis. This state encouraged a total involvement with the sounds, sensations, and emotions transmitted to human lives through their embodying of the poetic experience.

2. Plato and the beginnings of Cosmology

It is with Plato that we find the oral tradition moving into a literate and visual framework, (Dissanayake, 1988). This conceptual change, which was problematic from the beginning, became more problematic over time. Briefly, while the early natural philosophers had established a rational counterpoint to the Homeric story when they studied physis, Plato brought reason (logos) and divinity (theos) together and defined what became the underlying assumptions of Western cosmology, creativity, duality, theology, philosophy, art, and science. Philosophically, as I show below, Plato also revolutionized the Presocratic method by systematizing it, defining it, and rejecting its organic foundations. "Plato was the first who used the word 'theology,' and he evidently was the creator of the idea. He introduced it in his Republic, where he wanted to set up certain philosophical standards and criteria for poetry," (Jaeger, 1967).

What I want to emphasize is that theology for Plato still included science and philosophy, and his science was unlike that of the natural philosophers who proceeded him. The Presocratics, who are especially relevant because they bridged the Homeric and Platonic cultures, only appear to take a non-theological position ontologically if we compare them with contemporary views. It cannot be stated strongly enough that the Presocratic focus on nature did not negate the divinity of the world and had nothing to do with religion or theology. Their world is divine and undifferentiated rationally. Through posing questions they began to put the cosmos into a context that facilitated them in gaining a deeper and a broader insight into

the particulars of nature (physis). Factoring in that when the Greeks began enlarging their conceptual awareness they did not see themselves as independent personalities - but rather as functioning parts in relation to a whole - highlights that rationale and differentiation were useful in developing a sense that each one of us could offer different insights about life and reality. In addition, while the natural philosophers concentrated on facts ascertainable by the senses and wanted to see beyond the myths, Plato distrusted the senses and created his own myths to explain his "vision," using dialogue as a philosophical technique.

The impact 16 and limitations of Plato's philosophy have been well- documented. In sum, Plato's rational solutions to social problems encouraged manipulating human consciousness and emotions in order to turn people toward his system, which he saw as turning people toward the Good, for he saw his system as the Truth. There were four key elements within this: (1) Plato's philosophy was grounded within a living systems, or cosmobiological philosophy as well as a reaction to this kind of philosophical foundation, 17 (Hamilton and Cairns, 1989; Jaeger, 1967). (2) As noted earlier, Plato created the change from an oral to a literate tradition, (Dissanayake, 1988; Havelock, 1986). (3) Plato's view was dualistic. The human world was represented by Plato as the cave, where shadows appeared to be real. The real was actually within a divine and transcendent realm which included the archetypal forms and the mathematical symbols. (4) Finally, although Plato's philosophy included his concern with how the oral tradition manipulated human consciousness and emotions, (Dissanayake, 1988; Hamilton and Cairns, 1989), he was oblivious to the fact that he too adopted manipulative tactics in his rational philosophy, 18 (Dodds, 1951; Havelock, 1963)

Plato's cosmological model, which was based on reason and geometry, integrated his philosophy into the cultural milieu. 19 The model itself offers some perspective on how the Greeks in general brought their realistic and visionary views together.

Using the circle as a symbol of harmony and perfection, the model assumed that any valid physical model of the cosmos could only be perfectly stated if it used circular celestial trajectories (or a combination of circles). While there is reason to believe that the spherical theory of the universe was first advanced by the mystic Pythagoras, and that he may have been inspired by Babylonian, Egyptian, and Eastern philosophies, it is in Plato's Timaeus that the first geometrical cosmology is given for the "music of the spheres." Eudoxus, Plato's pupil, mapped the first design for this spherical universe 20 which, eventually, became the circular Ptolemaic cosmology. 21 The circularly-based Ptolemaic cosmology was, in turn, used until the beginning of the seventeenth century when Kepler realized that planets move in oval, not circular, orbits. In The Sleepwalkers Arthur Koestler summarizes how all of the models intertwined with the various individual and cultural prejudices.

> "Plato had merely thrown out, in semi-allegorical language, a suggestion . . . it was Aristotle who promoted the idea of circular motion to a dogma of astronomy. . . . In Plato's world the boundaries between the metaphorical and the factual are fluid; all such ambiguities disappear as Aristotle takes over. . . . The God of Aristotle no longer rules the world from the inside, but from the outside. . . . Aristotle's God, the Unmoved Mover . . . is the God of abstract theology . . . Beyond the sphere of the moon, the heavens are eternal and unalterable. This splitting-up of the universe into two regions, the one lowly, the other exalted, the one subject to change, the other not, was to become another basic doctrine of medieval philosophy and cosmology. It brought a serene, cosmic reassurance to a frightened world by asserting its essential stability and permanence, but without going so far as to pretend that all change was mere illusion, without denying the reality of growth and decline, generation and destruction." (Koestler, 1959, p. 60-61).

B. From the Hellenistic Era to the Modern Era

The Hellenistic period followed on the heels of Plato and Aristotle and changed the foundationally optimistic and aspirational focus which germinated the earlier period into one of synthesis. 22 Scholars have offered diverse insights about what the relationship between reason and spirituality during this period meant and how it took form. Gilbert Murray, for example, claims the West lost its vitality when the Hellenistic quest for ataraxia (peace of mind) subdued the mood and the tone of the population.

> "Any one who turns from the great writers of classical Athens, say Sophocles or Aristotle, to those of the Christian era must be conscious of a great difference in tone. There is a change in the whole relation of the writer to the world around him. The new quality is not specifically Christian: it is just as marked in the Gnostics or Mithras - worshipers as in the Gospels and the Apocalypse, in Julian and Plotinus as in Gregory and Jerome. It is hard to describe. It is a rise of asceticism, of mysticism, in a sense, of pessimism; it is a loss of self-confidence, of hope in this life and of faith in normal human effort; a despair of patient inquiry, a cry for infallible revelation; an indifference to the welfare of the state, a conversion of the soul to God. It is an atmosphere in which the aim of the good man is not so much to live justly, to help the society to which he belongs and enjoy the esteem of his fellow creatures; but rather by means of a burning faith, by contempt for the world and its standards, by ecstasy, suffering and martyrdom, to be granted pardon for his unspeakable unworthiness, his immeasurable sins. There is an intensifying of certain spiritual emotions; an increase of sensitiveness, a failure of nerve,"(Murray, 1955).

Responding to this idea of a failure of nerve E. R. Dodds' (1955) suggested it was not so much a failure of nerve as a fear of freedom. Dodds says that it was this fear of freedom which stymied the original impulse which had birthed the Greek awareness of themselves as individuals who were not simply parts of a larger unity. Dodds asserts that the Medieval Christian world formed as it did because of how the Greeks failed to include an adequate instrument for actually understanding, much less controlling, the importance of that which was not reasonably understood - that which went on below the surface or below the threshold of consciousness.

Weighing these two viewpoints, Peter Brown asserts that both Murray and Dodds are imposing modern factors in their conclusions. In Brown's opinion, before we talk of anxiety and disillusionment as pervasive and distinguishing features of the period we must ascertain whether we are using the standards of antiquity or our own. In his words, "Disillusionment assumes illusion, and ancient men kept themselves studiously free of illusions about what life could offer them . . . ," (Brown, 1978).

All who study this period, however, do seem to agree that the Hellenistic world was exceedingly different from the one preceding it and that even by the second century CE the difference was not so much the rising influence of Christianity as it was the cultural mood in general. Probably this is because the pagans and Christians actually agreed on many things.

Perhaps the best example of this is how both pagans and Christians viewed personal fulfillment in hierarchical terms. When people observed that some pagans and some Christians "found" spiritual sustenance, while others merely aspired to this sense of spiritual wholeness, both Christians and pagans concluded that some were elect. (Dodds, 1965). This belief that those who felt fulfilled were closer to divinity encouraged a hierarchical social structure, which of course eventually came to be the governing body of the Church.

It is imperative to acknowledge that this hierarchy on earth gradually came to mirror the hierarchical Platonic cosmology. Gradually is the key word here. Initially, the Platonic cosmological picture had come into the cultural imagination sub-dividing space into levels of reality while retaining the general cultural perception that the whole structure was the expression of a divine order. It depicted the earth as a globe suspended in space at the center of a system of concentric moving spheres. This order was felt to be beautiful, worthy of worship, and alive or informed by a living spirit. Three points are critical in conceptualizing the cultural evolution. First, again, initially the whole cosmos was believed to be alive. Second, it was also assumed to be interdependent, linked by sympatheia. 23 Third, and most important when looking at the historical story, it was because the assumed mutuality between the parts and the whole did not seem to be reflected in human life that the people began to question it. For example, given the many inexplicable aspects of life, especially the tragic ones, the people could not ascertain why it was assumed there was an equality between the human and the divine. Clearly the divine was higher and more powerful!

Thus, the people, both pagans and Christians, increasingly accepted the dualism of the Platonic cosmology, where the celestial and terrestrial realms were separate and operated under different laws. The apparent inequality of the parts and the whole led the dualistic model to stabilize with the assumptions that (1) the locus of "divine power" was supernatural and (2) the higher celestial realm was the realm of the Divine order. This divine order was also presumed to differ from the evident nature of human life, (Dodds, 1965). I cannot state strongly enough that the supernatural was not only a different realm, it was also a different substance from the natural - even when they were philosophically defined as a unity. Experientially, this view placed the realm of science within the physical world and the realm of religion in some metaphysical relationship to the physical world. The translation of these ideas into the social context resulted in a culture that was progressively withdrawing divinity from the material world and, in effect, changing the human relationship to divinity, 24 (Brown, 1978).

Again, I must emphatically state that this belief in levels of reality was neither specifically Christian nor specifically pagan. Nor was it specifically Western. 25 My point is that when this cultural idea emerged in the West it created the consensual view that there was an antithesis between the celestial and terrestrial worlds. Let me again emphasize that the terrestrial world was increasingly seen to be that of mortals, (Dodds, 1965)

Two points stand out here. First, as the people discussed the ideas it became increasingly difficult to see the human spirit as equal to that of the divine and it became easier to ask if matter was spirit and to see them as different, allowing ideas of a supernatural to be tied into ideas of incarnation, and divinity, and ideas about bringing the spiritually elect into "power." 26 Second, this situation weighed in favor of Christianity becoming the preferred worldview because of the desire for a defining philosophy much like what the Christian belief represented to the people of that period. It is critical to recognize this so as to acknowledge that the religion was not simply imposed on the populace when Constantine became a Christian and officially established Christianity as the state religion in 313 CE.

Actually four psychological conditions favored Christian growth. First, the refusal of Christianity to concede any value to alternative forms of worship was considered a strength at this time, not a source of weakness. The knowledge that one was on the "right" path not only offered a sense of security, it relieved believers of the burden of continually weighing and judging alternatives. According to Christianity, since there was one - irrevocable - choice, the road to salvation was clear. In addition, Christianity gave the people a new kind of certainty. Believers had a sense of place and a sense of belonging because the institutionalized beliefs offered a universal code for living. Second, because Christianity made no social distinctions, in principle it was open to all. Third, in a period when life on earth was increasingly devalued and feelings of guilt were widely held, Christianity held out the promise of a better inheritance in another world. Finally, the benefits of becoming a Christian were not confined to the next world. A Christian community brought its members together in this world by offering a way of life, (Dodds, 1965).

In sum, science, the cultural cosmology and social system reinforced particular beliefs. In the overall cultural context these ideas favored a model like the Christian Church because both pagans and Christians alike wanted some kind of overriding religious vision that would feel coextensive with their lives. They wanted a social structure that would give them a sense of meaning 27 and this search for meaning brought diverse views together. In fact, if any cultivated person of the second century had been asked to put in a few words the difference between the pagan view of life and the Christian one, the reply would probably be that it was the difference between logismos and pistis, between reasoned conviction and blind faith, (Dodds, 1965). By the fourth century, the situation had changed. On the one hand, Christianity had - through theology - added rationale to its beliefs and the rational pagan focus had added faith to compensate for a lost vitality, (Dodds, 1965) What is key within this is that pagans felt spiritually drained. Their loss of vitality was a sharp contrast to the emotional commitment found among Christians. It was because Christianity had become a religion that people were willing to die for - and did die for - that Christianity appealed to the people. Christianity was judged to be a religion worth living for. 28

C. The invention of the modern worldview

Christian supremacy began to be challenged around the twelfth century when social contradictions as well as emerging views on law and governance began to subtly erode Church power, (Huff, 1995). Eventually the religious monopoly on life and belief gave way to secular views, allowing the people a greater degree of individual choice and autonomy. Cultural revisions, moreover, aligned with scientific, religious, and philosophical revolutions. The interpenetration of all these revolutions is perhaps easiest to see through looking at the cosmological revision.

Paul Dirac, one of the pioneers of quantum physics, once said that the great breakthroughs in physics always involve giving up some great prejudice, (Goswani, 1995). In the case of Modernism it was the assumption that any valid model of the cosmos needed to presume all orbits were circular. This proved to be an implicit assumption - one never questioned - rather that an operative law. As it turned out, the ongoing contextual debate that had developed in regard to earth-centered and sun-centered theories was resolved with the discovery that the planets had elliptical rotations. 29 This perception gave the system a new look, and a precision never evident in any of the many circular cosmologies - including the Copernican heliocentric theory. The earth-shattering nature of this can only be appreciated contextually and in relation to why the earth-centered view of the universe had become predominant.

As I noted earlier, Claudius Ptolemy, a Egyptian-born Greek astronomer and geographer who lived in Alexandria in the second century CE, proposed the first plausible explanation for complex celestial motions. His earth-centered description, based on the Platonic cosmology, stated that the earth did not move and that the stars and planets moved around earth. Ptolemy's model also resolved the occasional retrograde, or backward, motion of planets. This was a tremendous accomplishment because retrogradation was perhaps the greatest scientific challenge of that time.

The concept of retrograde means that while, most of the time a planet like Mars appears to move from east to west across the background of stars, every so often the planet's motion is retrograde: that is, for a few weeks it appears to slow, stop, and reverse direction with respect to what appears to be a fixed background. This is critical to the study of the heavens because the movement of the planets needed to be explained if the stars were to be believed (and useful) in predicting the religious calendar, facilitating travel, or whatever. Ptolemy's explanation, 30 the epicycle, was viable and successfully predicted planetary motions, eclipses, and a host of other heavenly phenomena with relative accuracy, despite its complexity. The problem was that "[b]y the time Copernicus tackled the problems of motions of the planets . . . [the] theory required a total of seventy-seven circles to describe the motion of the sun, moon and the five planets known then. To many astronomers . . . the theory was scandalously complex," (Kline, 1985, p. 70). Let me emphasize that the complex and now rejected theory was one of the longest lived scientific theories ever derived. It prospered for 1500 years and, as time went on, the longevity of its use was one of the reasons often given to validate it.

In analyzing the long-term acceptance of the geocentric model I must stress that it survived because it seemed to match the appearance of the world, more than the other options proposed. We often forget that many ancient and medieval natural philosophers had suggested the universe was heliocentric or sun-centered. For example, the Presocratic Anaximander (611-548 BCE) postulated a heliocentric universe, as did Aristarchus, a Pythagorean astronomer who was born in 310 BCE, (Koestler, 1959). Their ideas were rejected, however, because the geocentric cosmologies appeared to work - at least to some degree - and the heliocentric theories did not seem to fit as well with reality as it was known and experienced.

The empirical evidence clearly indicated that the sun moved around the earth in a circle. One could see this every day, for the sun rose every morning, traveled across the sky, and then set in the evening. In addition, people could not feel the earth move. Also, when objects were dropped, they fell straight down, as if the earth were standing still and nothing seemed to get let behind as a result of earthly "movement." These experimental perceptions of earthly centrality were also supported by the religious views. It was "known" that the earth was the center of the universe, just as humans were central to God's plan. Knowing, too, that divinity lived in another realm, because some people were "closer" to divinity, came to strengthen the overall cultural and earth-centered perception because people could see the duality. One need only look at

the stars in the heavens to see that they appeared fixed, as if they followed one set of laws, the divine laws; while another set of laws was operative on earth, where things changed.

As noted above, it was the precision offered by the elliptical rotations that convinced scientists they should adopt the sun-centered system. The story that has come down to us is that it took Kepler six to ten years to deduce the pattern that he used to create the elliptical formula. 31 Kepler derived the elliptical formula after studying data about the physical world complied by the astronomer Tycho de Brahe over twenty years of observing the movements of the planets. I might add that Kepler did not know the formula he derived was that of an ellipse.

> "After six years of incredible labour, he held the secret of the Martian orbit. . . . But he still did not realize that this formula specifically defined the orbit as an ellipse. Nowadays, a student with a little knowledge of analytical geometry would realize this at a glance; but analytical geometry came after Kepler. He had discovered his magic equation empirically, but he could no more identify it as the shorthand sign for an ellipse than the average reader of this book can; it was nearly as meaningless to him. He had reached his goal, but he did not realize he had reached it." (Koestler, 1959). (Italics are Koestler's)

Once Kepler perceived the elliptical formula he was able to use the information to mathematically define it. Adding empiricism, logic, and efficiency to his insight in turn allowed him to define the cosmic pattern so that phenomena fit together in a way that had not previously been perceived, at least not in any kind of logical way. It must be emphasized that first Kepler had the insight and then he was able to concisely correlate what had previously been only a massive amount of unrelated information. The exceptional aspect of this is that the elliptical model was a radical departure from the principle of uniform circular motion which had been considered self-evident and inviolable from the earliest times. This innovative quality cannot be emphasized enough. Nor can the precision the mathematics brought to the picture.

> "The numerous observations made by Tycho Brahe, with a degree of accuracy never before attained, had in the skillful hands of Kepler revealed the unexpected fact that Mars describes an ellipse . . . the genius and the astounding patience of Kepler had proved that not only did this new theory satisfy the observations, but that no other hypothesis could be made to agree with the observations, as every proposed alternative left outstanding errors, such as it was impossible to ascribe to errors of observation. Kepler had, therefore, unlike all his predecessors, not merely put forward a new hypothesis which might do as well as another to enable a computer to construct tables of the planet's motion; he had found the actual orbit in which the planet travels through space.' (Dreyer, 1953, p. 392).

Again, let me emphasize that once the implicit pattern - the pattern that none had previously perceived - became explicit, the elliptical idea was in a position to change cosmological assumptions and the cultural dialogue. What had not even existed in a metaphysical context, now became defined in relation to the physical world. In short, once the explicit description evolved, the cultural dialogue expanded to include ideas on orbits that were not circular. For example, David Fabricus, a clergyman and amateur astronomer who maintained a correspondence with Kepler from 1602 through 1609, (Dreyer, 1953) wrote Kepler:

> "With your ellipse you abolish the circularity and uniformity of the motions, which appears to me the more absurd the more profoundly I think about it. . . . If you could only preserve the perfect circular orbit, and justify your elliptic orbit by another little epicycle, it would be much better." (Koestler, 1959).

The larger point is that men like Descartes, Kepler, and Newton, who are often accused, often applauded, for bringing forward the ideas that led to what many now say is a godless model without life and spiritual consciousness, were deeply religious men, trying to assert something vitally and deeply alive within them, something they often equated with God. If we can believe their own words, they did not separate science

and religion in their minds, in their hearts, or in their consciousness - despite the fact that their ideas came to be connected with "materialism," "physicality," and the loss of human centrality in the cosmic picture.

For example, when Kepler conceptualized the mathematics he needed to describe the three basic laws that bear his name, he joyfully credited God, saying,

> "I thank thee, Lord God our Creator, that thou allowed me to see the beauty in the work of creation; I exult in the works of thy hands. See, I have completed the work to which I felt called; I have earned interest from the talent thou hast given me. I have proclaimed the glory of thy works to the people who will read these demonstrations, to the extent that the limitations of my spirit would allow." (Davis and Hersh, 1981).

As Kepler's words indicate, he saw his insights as a revelation. Thus, despite the fact that Kepler's laws are considered to be the first "natural laws" in the modern sense, (Koestler, 1959), they were derived in an effort to define the perfection of God's creation. Moreover, Kepler's commitment to God's perfection was so strongly aligned with the cultural prejudice that cosmic perfection could only be defined using "circles" that he, too, subscribed to the circular ideal. This was why when Kepler discovered that planetary orbits were elliptical, he had a hard time accepting this possibility. Yet, eventually, the simplicity and the clarity of the new design won him over, (Koestler, 1959).

Newton, who was also a deeply religious person, used Kepler's innovative insight as the foundation for his laws. His cosmological design was infinitely more revolutionary that Kepler's insight for Newton's Laws allowed much that had formerly been defined as if it was of the supernatural to be defined in relation to the natural world. This is the beauty of the Newtonian model [32] which redefines what had been seen as two realms, heaven and earth, each with its own pattern, as one. Describing the celestial and terrestrial domains as a unity also brought astronomy and physics under one set of laws.

Yet, again, Newton, who defined the framework which eventually took God out of the physical workings of phenomena studied nature in order to more fully understand God and God's creation, (Burtt, 1954; Koestler, 1959; Thayer, 1974). Newton's revised cosmological model offered him a means to more effectively speak about God's presence and omniscience by pointing to God, the Creator he believed we could never know. Let me emphasize that it was because Newton used God as the keystone for his theory of everything that it retained the spiritual dualism of Christianity. Clearly Newton's dualism assumed that a Creator God was a part of the overall unity. It was the metaphysical assumption that was needed by Newton to articulate that there is an objective reality created by an unchanging, absolute - God. As Newton wrote:

> "God is the same God, always and everywhere. He is omnipresent not virtually only but also substantially; for virtue cannot subsist without substance. In him are all things contained and moved, yet neither affects the other; God suffers nothing from the motion of bodies, bodies find no resistance from the omnipresence of God. It is allowed by all that the Supreme God exists necessarily, and by the same necessity he exists always and everywhere. . . . As a blind man has no idea of colors, so have we no idea of the manner by which the all-wise God perceives and understands all things. . . . for all our notions of God are taken from the ways of mankind by a certain similitude, which, though not perfect, has some likeness, however." (Thayer, 1974).

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I cannot stress strongly enough that the physical world, res extensa, may have authored God's demise but the scientific activity of Galileo (1564-1642), Kepler (1571-1630), Descartes (1596-1650), Huygens (1629-1695), and Newton (1642-1727) and most of the other mathematicians who are credited with bringing this about sought - and expected to find - broad, profound, immutable, and God-created rational principles either through intuition or immediate sense perception. Thus the irony within the birth of Modern science is that it was in affirming God and God's perfection in the eternal language of mathematics that the "godless mechanistic" model we ascribe to Modernism became possible. The model needed God. God was the point

of origin. God was the creator of the symbols used in the model to speak about God's creation and the eternal realm. He was also the symbol that had been created to designate a Creator. Therefore, His realm was assumed to be complete, and was assumed to be beyond human cognizance and the nature of the world in which we conduct our lives.

These philosophical paradoxes, which framed the birth of Modernism, can be attributed to a few cultural factors 33. First, the Renaissance approach was developing ideas that differed from Church assumptions, but it still reflected the educational base and the logical approach of Medieval Scholastics, (Burtt, 1954; Kline, 1985; Koestler, 1959). Second, the Renaissance symbologies came to celebrate God's supremacy in impersonal Platonic terms. Thus they assumed that "the knowledge at which geometry aims is the knowledge of the eternal," (Hamilton and Cairns, 1989) which was, of course, perfect and outside of the natural imperfection of the earth. This means that the revised symbolic language of mathematics, being scientific, philosophical, and outside of the redefined realm of nature, was not applied to relationships that existed between spirit, nature, and the individual on earth - which still were defined as somewhat inferior to that which was purely divine. 34

To be sure, science was freed to pursue the now spirit-less and value-less matter of the physical world and this revised framework allowed scientists to pursue science without having problems with the religious authorities. 35 But now there were other problems. One problem was that the same God supported the scientific philosophy and the religious philosophy and the two did not align. Another problem was that science still assumed God had set the mechanistic universe in motion. He, however, was reduced to a point of reference in the model. He became only the metaphysical force behind the world. He retained His position of authority because He was defined as the origin. He was the first cause. He was the reason for the cosmos, The Author of Nature. Yet, all in all, He was a stillborn God, 36 (Gilson, 1941). He had set the universe in motion and then became almost unnecessary to how the (mechanistic) universe functioned.

Let me emphasize three points before turning to the twentieth century. First, ironically, it was the very mathematical foundation that made it possible to expand our understanding of the cosmos that also made the model more of a religious than a scientific one. During the Middle Ages the mathematical symbols had been placed in the divine realm, the belief being they had been created by God, (Kline, 1985). Second, faith per se was not put aside in the minds of the people. What changed was the focus of human experience. Finally, the turn toward earthly concerns could as easily be attributed to social conditions as it could be attributed to the revised cosmology. Events such as the plagues which ravaged Europe in the 14th and 16th centuries had led people to ask questions like: Why does the Church have no power to stop the horror of this deadly disease? The people answered these kinds of questions actively, trying to find more effective ways to address their lives. More to the point, after the disease killed more than one fourth of the population of Europe it was painfully clear that the Medieval religious approach was completely ineffective in doing anything about this kind of disaster. Every technique and all of the symbols known to the Medieval world were employed in the attempt to control the plagues - prayer, ecstatic mysticism, scapegoating, medicine based on sympathetic magic, and so forth, (Leshan and Margenau, 1982). The continuation of the massive death, however, led people to conclude that if the culture was to be able to address and survive catastrophes like the Black Plague, people needed better methods for studying how to understand and control their world.

D. The twentieth century

Things of course changed as time moved on and today we are again living in a transitional era. I would suggest that we are too close to the challenges surrounding us to accurately perceive how the culture is in fact changing. Our legacy has yet to formalize.

Perhaps what is most evident from our vantage point is that science has again been dramatically revising long accepted assumptions about reality. In my opinion, just as the naked eye of premodern cultures gave way to the telescopes and microscopes that revised, expanded, reduced, and formed the Modern vision of reality; Modern ideas are being replaced and somehow what is taking their place is "connected" to our

global and "post" Modern vision. I have deliberating written "post" Modern so that I can underline that Postmodernism as a philosophy is a Western construct that distorts the actuality: we are becoming "post" Modern because Modernism was a Western point of view, belonging to a particularly triumphant epoch, and we are trying to learn how to live effectively in a world where Western and non-Western traditions interpenetrate to a larger degree.

The challenge of becoming a global community includes bringing Western, non-Western, premodern, modern, and postmodern views of reality into some kind of working relationship. Clearly, the nature of the problem has led people all over the world to intensely debate questions debated by cultures throughout time. Is one vision preferable for all or does this kind of universality diffuse traditions and identity? Does a universal vision allow diversity within the community? Do technologies help or harm human community? How do religious technologies best relate to and interface with scientific technologies? Should we trust our senses or do they deceive us? Are there realms other than this world which hold our living? How can we best address social and ethical concerns? Can science help us answer these kinds of questions?

Consciously reflecting on the dialogue surrounding these questions I am as struck by the passion within the dialogue as I am by how adept we are at developing many, often contradictory, versions of reality. Reviewing the versions offered shows that many have turned to twentieth century scientific theories to help frame new possibilities and to re-contextualize old ones, (Harman, 1988; Hayward, 1987; Holton, 1993; Kuhn, 1970; Suppe, 1977; Tipler, 1994)

Science has, of course, encouraged these new visions of reality by virtue of having revised its conclusions about reality. For example, now, in the twentieth century, we no longer see ourselves in a static Newtonian universe where absolute time and absolute space are accepted assumptions. Instead, we have quantum complementarity in our expanding omnicentric universe. Euclidean geometry, once believed to be a perfect fit with physical reality, has proved to be limited. As a result, we have developed other geometry's, often more facile in dealing with the multi-dimensional reality we have come to know. Yet, even given these revisions, social solutions and personal concerns continue to challenge human consciousness.

Considering that "we" are very much a part of the problem, it seems prudent to consider that since Plato the West has offered endless philosophies to comment on how science interfaces with society as well as on how individuals, and cultures interpenetrate. If one aspect of the story can be generalized it is that individuals and groups frequently spawn elegant and appealing theories about everything under the sun that in turn become problematic when they are mapped onto societies, (Popper, 1962a; Popper, 1962b).

This also affects subcultures, like the scientific community. In science the vision of one "truth" has often encouraged what Thomas Kuhn calls "normal science." During period of normal science the community of scientists practice (learn) one overriding metaphysic that becomes how reality is seen to such a large degree that people overlook whatever falls outside of the idealized picture, (Kuhn, 1970; Popper, 1992). While I believe Kuhn oversimplifies some key elements, I still agree with the essential feature of his idea that vision frequently narrows during periods where scientists are pretty much in agreement. As Karl Popper has pointed out in response to this idea, the problem here is that integration into this kind of scientific community does not speak about what science can be so much as how people learn to be scientists, (Popper, 1992). I would quickly add that scientific training does not always encourage creative investigation so much as it encourages a particular kind of focus, one which really trains technicians. When coupled with scientism this kind of scientific culture can effectively perpetuate itself and close off options for genuine creative envisioning of new possibilities while doing so. 37

This kind of culturally-biased and politically-correct harness is not nearly as hard to challenge as many spiritual solutions. Spiritually-based societies often encourage believers to frame their understanding of life and experience in accordance with the vision of a chosen tradition. Being subjective, intersubjectively validated, and integrated into the social system as "truth," this kind of perspective encourages the one-sided vision the Church brought to society in the Middle Ages. Integration in this kind of society requires the kind of political correctness that made it difficult to bring new ideas into the vision of the Church.

In sum, narrowly defined perspectives have a great deal of difficulty questioning their favored assumptions. As a result, they lack the capacity to factor in that learning as an ongoing, intergenerational, and creative process includes grappling with all existing metaphysics on an ongoing basis. It is because this kind of narrow focus (1) is present in both spiritually-based and scientific communities, (2) is often encouraged to a greater degree than a "creative" orientation, and (3) is born of human consciousness that my final point is how science uses method, myth, and metaphor.

E. Method, myth, metaphor

Turning first to method, I would assert that to suggest science has a method can too easily miss the art of science: the floundering that precedes a discovery, the alertness needed to see another possibility, and the process of translating the discovery into something others can access, (Briggs, 1990; Ghiselin, 1952). Since, in science, the insight is incomplete if the scientist does not offer it in a way that allows others to comment on it, replicate it, and often improve on it as well; the implication that there is a method one can use that will lead to some kind of discovery or understanding is misleading. It diffuses the emergent quality of invention - so actively a part of scientific creativity and so necessary for discovery. (Briggs, 1990; Einstein, 1973).

If it sounds as if I am suggesting that science has no method and simply invents myths, likely tales, this is in not my intention. Rather, I am inferring that for many who engage in science the subjective and the categorization processes interface, (Einstein, 1973), much as they did in the experience of the Presocratics. The effort of the scientist is not only reductionistic because it includes using insights - and insight is the critical skill in scientific invention.

Scientific insights are meaningless unless they are combined with technical virtuosity and a passion to know more about how the world is connected. This passion includes the quality of myth, for it includes the desire to explain the world to a greater degree. However, unlike many cultural myths which are often harder to see, 38 scientific myths are explanations that are under constant scrutiny by those who believe in science the most! Science is science because it encourages an ongoing discourse and the refinement of ideas in light of new information. 39

This point must be emphasized if we are to see learning as an ongoing and critical component of scientific speculation and development. Yet even learning is a complicated activity. It can mean learning by rote and it can mean developing the ability to expand one's frame of reference. The latter approach 40 continually changes the conceptual basis (biases?) and can be compared to Kepler's realization of elliptical orbits, which differed significantly from how people had learned to see, believe in, and reinforce the Ptolemaic geocentric system for 1500 years. The larger point is that Kepler's insight was able to add information to the cultural discussion and offered a means others could use to move to another level when discussing possibilities. 41

I see this enlargement of our shared body of knowledge as closely intertwined with how we use metaphors. As I showed earlier, in the Homeric culture ideas outside of the cultural experience became a part of the people's experience through the attempts of the people to grapple with their foreign nature. These metaphors came into being experientially, as a result of a desire to understand something "mysterious" to a greater degree. Like all metaphors, they were created in the sense that we use a metaphor to say this, 42 when we mean that, because we cannot say what this is directly. In ther Homeric world, however, the metaphors were not purposefully created so much as they were social constructions. Like all metaphors, the Homeric metaphors allowed people to reconstruct information. the new form in turn made something formerly mysterious more accessible to others. Scientific metaphors - whether used in they theories, thought experiments, or whatever - are not an exception to this description. They make information more explicit among us. Yet, even when under the umbrella of so-called "objective' science they are potentially problematic because they are closely intertwined with our intentions and values.

If a culture values confirmation of "the" pre-existent cultural truth, whether it be a scientific, philosophical, or religious truth, it is a different kind of science, philosophy, and religion, than one which continually probes for more effective ways to re-construct information. I prefer the latter approach, for I believe it equates with keeping an open mind. It encourages an ongoing re-evaluation of what is "known" and what is "believed."

"Heart" may inevitably be very much a part of this for science includes who we are. Stuart Kauffman, a biologist affiliated with The University of Pennsylvania and the Sante Fe Institute, captured this in his introduction to The Origins of Order, a biologically based study of self-organization and selection in evolution.

> "Like many other books by scientists, this one is ineluctably autobiographical. It witnesses one mind's sense of mystery. The famous physicist Wolfgang Pauli is said to have remarked that the deepest pleasure in science comes from finding an instantiation, a home, for some deeply felt, deeply held image. I share this odd sense. . . . The greater mystery, after all, is not the answers that scientists contrive, but the questions they are driven to pose. Why? Why this question rather than another? Why this search, hope, despair, rather than another?" (Kauffman, 1993).

In sum, perhaps it is because the existence of the universe cannot be sensibly disputed that our questions about how it works and whether it "came to be" are intriguing. Exploring the answers humans have proposed, we find that scientists have not been able to reduce their investigations to objective methodology, despite their desire to engage in 'unbiased' inquiry. It is with this in mind that I am led to conclude that all of us can benefit from developing a comprehensive grasp of how cultural beliefs and human consciousness impact scientific investigations and why the refining process that science uses continues to change the face of science as scientists continually question and re-evaluate their assumptions.

Notes

*An abbreviated version of this paper was delivered on April 10, 1996 as a part of the "Science and Epistemology" Session at the "Towards a Science of Consciousness '96: Tuscon II" Conference, sponsored by The University of Arizona, Tucson, Arizona,

1 "Maps, symbols, mandalas, petroglyphs, and other symbolic works are used all over the world to express the link between the inner and the outer, between the self and the world, the individual and the environment. Such maps enrich us and bind us together . . . they are synchronicities, patterns of meaning and connection between the mental, spiritual, and material worlds. But in our own society one set of maps - the maps of science - have become the most powerful of all devices, overshadowing all other earlier maps and reducing them to the status of myths, legends, and "primitive" representations. Scientific maps have reached a high degree of abstraction and sophistication, but on the way they have lost their deeper meaning and connection to the world," (Peat, 1991, p. 14).

2 John Noble Wilford of the New York Times interviewed Joseph Silk, author of the book A Short History of the Universe in 1994. At that time, according to Wilford, Silk conceded that the creation story told through the Big Bang theory might in a thousand years be regarded as a 20th century myth, like the creation stories of antiquity. Wilford notes that Silk hastened to add, "I am an optimist who finds our current paradigm so compelling that I can only imagine it will eventually be subsumed into a greater theory, without losing its essential features." (Wilford, 1994).

3 It seems imperative to differentiate here between the Greek perception of being a thing - at their point of consciousness development - and that of Descartes in the seventeenth century. For the Greeks, the idea of being a "thing" does not correspond to the Cartesian idea of being spiritless matter. Rather the Greeks perception of each individual as a "thing" meant that each was a part of the larger, breathing, vital, organic whole. The key points being that the Greeks had not yet discovered a self conscious identity and did not "objectify" nature. This point will be expanded as this paper develops.

4 While these philosophers are more commonly called the Presocratics, I will often refer to them in this paper as the Pre-Platonic natural philosophers.

5 The Greeks had a word for these non-rational impulses that were supposedly alien in origin, até , which is a temporary state that sometimes clouds or bewilders and moves an individual or the group away from a clear or a normal vision, state of being, or perception. The Homeric worldview said, "Delusion [Até] is the eldest daughter of Zeus, the accursed who deludes all; her feet are delicate and they step not on the firm earth, but she walks the air above men's heads and leads them astray," (Homer, 1961).

6 His mother, Thetis, was a goddess. His father, Pelius, was a mortal.

7 "[T]he strongest moral force which Homeric man knows is not the fear of god, but respect for public opinion, aidos: . . . In such a society, anything which exposes a man to the contempt or ridicule of his fellows, which causes him to "'lose face,' is felt as unbearable,"(Dodds, 1951) .

8 This is evident in the Greek language where their word theos, for example, is usually translated as god and is a predicative. Thus, theos was a quality to the Greeks, (i.e., God is not love, but love is a God). It is also important to remember that the gods of the Greeks were of the earth, (Tarnas, 1991).

9 Until the time of Xenophanes (c. 570-475 BCE) it was assumed that anthropomorphic gods existed. The gods, moreover, co-existed with metaphysical ideas like the apeiron of Anaximander, which suggested an unlimited ground for the cosmos. Xenophanes formulated the religious universalism that in later antiquity and Christianity became an essential feature of God in any "true" religion, (Jaeger, 1967)

10Not to be confused with the three fates or Moirae, who were a later development.

11 It is worth noting that this kind of idea is a necessary prerequisite of science today.

12Because it is sometimes incorrectly equated with the twentieth century idea of quantum complementarity, let me stress that comparisons of ideas like Moira and quantum complementarity often overlook that the ideas are incommensurate, mainly because the framework of quantum complementarity is totally foreign to the holistic belief system that framed the idea of Moira. For example, according to quantum theory we have a two-in-one complementarity because unmeasured electrons are waves and measured electrons are particle. In addition, how we look at them is subject to the limitations imposed by Heisenberg's indeterminacy principle, which means we cannot measure both position and momentum simultaneously. These quantum relationships describe a scientific (mathematical) framework. Clearly, the Greek people, at this point, could not have possibly conceptualized the complexity described by the mathematics. Thus, the essence of the quantum ideas would have been nonsensical to them.

13 Essentially Homeric Moira could be equated with the Indian idea of Ritam, the Chinese Tao, and other ancient principles of the cosmos which refer to an organic, just, dynamic, self- organizing, and self-correcting principle.

14 E. R. Dodds suggests the Greek Enlightenment and the absence of universal education was instrumental in creating an environment which divorced the beliefs of the intellectuals from those of the people, to the detriment of both. In Dodds' words, "The first signs of this regression appeared during the Peloponesian War, and were doubtless in part due to the war . . . Cracks appeared in the fabric and disagreeably primitive things poked up here and there through the cracks . . . As the intellectuals withdrew further into a world of their own, the popular mind was left increasingly defenseless . . . a growing number relapsed with a sigh of relief into the pleasures and the comforts of the primitive," (Dodds, 1951).

15 Despite how many like to romanticize non-Western and premodern cultures, social problems are neither particular to the West nor the result of Modernism . ((Edgerton, 1992).

16 According to A. N. Whitehead, "The safest general characterization of the European philosophical tradition is that it consists of a series of footnotes to Plato," (Whitehead, 1929, p. 53).

17 "The city, then, is best ordered in which the greatest number use the expression 'mine' and 'not mine' of the same things in the same way . . . For example, if the finger of one is wounded, the entire community of bodily connections stretching to the soul for 'integration' with the dominating part is made aware, and all of it feels the pain as a whole, though it is a part that suffers, and that is how we come to say that a man has a pain in his finger. And for any other member of the man the same statement holds, alike for a part that labors in pain or is eased in pleasure . . . the best-governed state most nearly resembles such an organism," (Hamilton and Cairns, 1989, Plato, The Republic, V. 462d).

18 In its final form Plato's society decreed, "The principal thing is that none, man or woman, should ever be without an officer set over him and that none should get the mental habit of taking any step, whether in earnest or in jest, on his individual responsibility: in peace as in war he must live always with his eye on his superior officer, following his lead and guided by him in his smallest actions . . . in a word, we must train the mind not even to consider acting as an individual or know how to do it. " (Plato, Laws: 942AB).

19 The integration of Plato's ideas in large part did not follow any kind of rational pattern. George Sarton writes, "if Greek thought was a triumph for rationalism this was even more the case when we factor in that the rationalistic assumptions of Plato were developed in the highly superstitious Greek culture, (Sarton, 1952).

20 "Plato, though fully aware of the impressive number of astronomical observations made by the Babylonians and Egyptians, emphasized that they had no underlying or unifying theory and no explanation of the seemingly irregular motions of the planets. Eudoxus, who was a student of the Academy . . . took up the problem of 'saving the appearances.' His answer is the first reasonably complete astronomical theory known to history, (Kline, 1982, p. 24).

21 Ptolemy himself is quite explicit about why the idea of circular integrity must be foundational: "We believe that the object which the astronomer must strive to achieve is this: to demonstrate that all the phenomena in the sky are produced by uniform and circular motions" . . . Ptolemy also makes it clear why astronomy must renounce all attempts to explain the physical reality behind it: because the heavenly bodies, being of a divine nature, obey laws different from those to be found on earth," (Koestler, 1959).

22 At that time, like today, many were asking how to feel stable, connected, and alive within the context of a changing world. I would propose that the focus on paradigmatic thinking today benefits from probing this quest within the Hellenistic period and late antiquity because the open society which evolved out of Hellenic classicism culminated with the universal vision of the Middle Ages. This, in turn, led to the Modern worldview and the rejection of using a religious base for social and political structures.

23 Sympathia was a Stoic idea used to explain how all is interdependent rather than additive or independent. In this view the physical state is an organization of dynamic character, each element mutually sharing in the dynamic nature of the whole. This dynamic co-existence, or sympathy, is assumed to be a living organism because it mirrors the united structure of the living body, (Sambursky, 1973).

24 ". . . [in] the period between Marcus Aurelius and the death of Constantine . . . the locus of the supernatural had come to shift significantly . . . What changed in no uncertain manner, however, between the second and fifth centuries, were men's views as to where exactly . . . "divine power" was to be found on earth and, consequently, on what terms access to it could be achieved. In this period "divine power" came to be defined with increasing clarity as the opposite of all other forms of power. The "locus of the supernatural," where this unique power was operative, came to stand for a zone in human life where decisions, obligations, experiences, and information were deemed to come from outside of the human community, (Brown, 1978, pp. 8, 11).

25 For example, the Hindu tradition in Indian was devising similar ideas of a higher and a lower domain at this time, (Ione, 1995).

26 For a detailed discussion on how the ideas of incarnation and divinity were prevalent in late antiquity among Christians and pagans alike, see Pagan and Christian in an age of anxiety, (Dodds, 1965).

27 "Marcus Aurelius, whose days were spent in administering an empire could express at times the desolate sense of not belonging . . . "All the life of man's body is a stream that flows, all the life of his mind, dream and delirium; his existence a warfare and a sojourn in a strange land; his after - fame, and oblivion." He fought against the exclusive dominion of such thoughts with all the strength of his Stoic religion, reminding himself that his existence was part and parcel of the great Unity. But they were the thoughts of his time and he could not escape them: he could only ask, "How long," (Dodds, 1965, p. 21).

28 This is evident in how pagans like Lucian, Marcus Aurelius, Galen and Celsus were all, despite themselves, impressed by the courage of the Christians in face of death and torture. On the one hand, Christian courage must have been the starting point of many conversions (Justin's is one example), while under Christian rule there were few pagan martyr's - not because Christianity was more tolerant, but because paganism was by then too poor a thing to be worth a life, (Dodds, 1965).

29 Within reasonable limits of accuracy, the fact that the orbit is an ellipse is hardly in doubt, except within discredited or at least unfashionable paradigms such as that of the earth- centered universe. The explanation of an elliptical orbit, however, depends upon the paradigm adopted. Within Newtonian mechanics, it is deduced from the existence of an attractive force between the planet and the sun; the mental image is that of a ball being whirled around on the end of an elastic string. Within Einsteinian relativity, the almost elliptical orbit is a consequence of the curvature of space-time, and the mental picture is of a ball rolling inside a funnel. Different mental pictures lead us to pose different questions, (Cohen and Stewart, 1994).

30 Ptolemy's cosmology described the physical picture by attaching the planets to small spheres rolling inside of larger spheres. This picture accounted for the discrepancies in motion and retrogradation and matched the observations as closely as possible. Whenever there was a problem, additional circles (rotations) were added to the model.

31 Einstein used Kepler's discovery of elliptical rotations to articulate how knowledge cannot advance from experience alone - for it builds on how the inventions of the intellect correlate with observed patterns, (Einstein, 1973).

32 Newton showed that basic laws of motion and gravitation can be applied to varied situations in the heavens and on earth. The beauty of his laws is that the same quantitative relationships can be used in both domains.

33 The image of the machine would be another good example, for it was burgeoning and occupying in an almost mysterious way the imaginative space that formerly had been taken up by the image of God.

34 One could say that the Renaissance scientists were theologians with nature instead of God as their subject and the transcendent God-created symbols held the unity together, despite the philosophical dualisms. In the Medieval world there was the dualism of a realm of God and a realm of nature. Modern "dualism" was a more complexified dualism. In the Modern view, Cartesian duality supported two realms of Nature - one of spirit (which included mind) and one of matter. Of course this was necessary for God to remain supreme. And, of course, God's world continued to transcend both.

35 Examples of people who had problems with religious authorities were plentiful at that time. Bruno, for example, was executed and Galileo was condemned by the Church. What was especially tragic was that Galileo, who, when an old man, was also forced by the Church to deny his beliefs. Galileo said, "I, Galileo

. . . kneeling before you, Most Eminent and Reverend Lord Cardinals Inquisitors-General . . . having before my eyes and touching with my hands the Holy Gospels, swear that I have always believed, do believe, and by God's help will in the future believe all that is held, preached, and taught by the Holy Catholic and Apostolic Church. . . . I must altogether abandon the false notion that the Sun is the centre of the world and immovable and that the Earth is not the centre of the world and moves and that I must not hold, define, or teach in any way whatsoever, verbally or in writing, the said false doctrine . . . [which is] contrary to Holy Scripture . . . ," (Koestler, 1959).

36 "Descartes has come after the Greeks with the naïve condition that he could solve, by the purely rational method of the Greeks, all the problems which had been raised in between by Christian natural theology. . . what he did, at least in metaphysics, was to restate the main conclusions of Christian natural theology as if Christian supernatural theology itself had never existed. . . . the essence of the Cartesian God was largely determined by his philosophical function, which was to create and to preserve the mechanical world of science as Descartes himself conceived it. . . . the God of Descartes was a stillborn God,"(Gilson, 1941).

37 Even still, light continues to break through. For example, systems theories and complexity theories have been useful in opening scientific methodology. These theories were in fact invented to allow us to model non-linear and ever-emerging possibilities within a living and multi- dimensional reality. When used to look at complex systems - like human life and human consciousness - they clearly offer a means for visualizing alternative options. Also, when combined with new techniques, such as computer modeling, these kinds of theories have the capacity to help us model information in ways that were not possible in earlier periods of science - when scientists were limited to theoretical and experimental modeling. I might add that according to Heinz Pagels, just as the telescope and the microscope changed our perspective of material reality, so does the computer because it allows us to manage enormous amounts of data and to simulate reality. Through these options we can process information in a new way. Thus the computer offers a unique window and a means to see all facets of reality differently, (Pagels, 1989).

38 The belief in one God seems to be the best and probably the most controversial example.

39 The Nobel Prize winning chemist John Polanyi once said, people often act as if scientists go to conferences and write papers to announce new discoveries, when in reality what they do is denounce everyone else's work. I must note that he was overstating his position to underline that science does not encourage only silent insight, it also encourages an ongoing discourse and the refinement of ideas in light of new information.(Polanyi, 1994)

40 Child development is a good example of the kind of learning I am implying. A child does not simply build on ideas already learned, but repeatedly embodies new conceptual understandings. In doing so, she repeatedly reorients her relationship to life as previously known information is assimilated. Thus she uses newly discovered concepts to revise and re-form her vision of reality.

41 "Species that survive do not persist in basic errors but learn to correct them. The new solutions may likewise contain errors that come to light subsequently. Thus an endless vista is opened for learning. . . . Learning leads to the emergence of the differences between members of the same species and creates true individuals," (Laszlo, 1987).

42 "[A] metaphor is seeing one thing as something else, pretending "this" is "that" because we do not know how to think or talk about "this," so we use "that" as a way of saying something about it. Thinking metaphorically means spotting a thread of similarity between two dissimilar objects, events, or whatever, one of which is better known than the other, and using the better-known one as a way of speaking about the lesser known . . . metaphorical thinking constitutes the basis of human thought and language. From the time we are infants we construct our world through metaphor; this is just as young children learn the meaning of the color red by finding the thread of similarity through many dissimilar objects (red ball, red apple, red cheeks), so we constantly ask when we do not know how to think about something, "What is it like?" . . . we always think by indirection. . . ." (McFague, 1982, p. 15- 16).

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