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CATHOLIC & HINDU SCIENCE: ANCIENT AND NEW

Without a doubt science had transformed the world and defined human progress for the past millennia. Coming to maturity only in the last century, science has changed the face of the world and the foundations of human cultures irreversibly. However, where has this change lead us? What new and continuing problems have yet to be addressed by the tensions stemming from the rise of science within a generally religious population? In order to understand and discuss the future, the past must first be understood. Therefore, the science-religious history is explored through time in the hope of a deeper and more useful understanding of this dynamic.

Hinduism and Vedic Science

India, besides having one of the world's most diverse cultural populations, is also one of the oldest civilizations on the planet. With a literary tradition reaching back millennia, the so-called religion of India[1], Hinduism, has undergone countless changes and witnessed dramatic transitions within the Indian subcontinent. In this essay, the dynamic and historical relationship between Hinduism and the general concept of science will be uncovered. Let us look first to the ancient practice of yoga.

Yoga and Science

Rising to popularity after having spread through the west like wildfire, the very core of yoga is central within both Hinduism and Hindu culture. The practice of yoga is one of the oldest and most established aspects of Hinduism (Flood). Unannounced to general understanding, yoga is actually one facet of an ancient yet authentic science. In order to probe this understanding more fully, an 'eastern' understanding of science must first be discussed.

[1] If there can be a singular entity to name the eclectic group of religions within India, let it be called Hinduism.

Eastern mysticism, the cultural background in which Hinduism developed, tends to be seen as a purely metaphysical and pre-philosophical religion. While this understanding of the culture may have its uses, it is much more fruitful and enlightening to see early Hindu mysticism as the eastern equivalent of Greek philosophy. Both Greek religion and Hinduism originated from a similar cultural and socio-economic dynamic (Perrett). It was from this common dynamic that Hindu thought emerged, albeit notably predating the rise of Greece. While the early science generated by the Hindus "tended to be quite philosophical in nature" (Raman), the applications and perspective of the tradition evolved in a way that mirrored the Greek development. Once philosophical methodologies where emplaced, a rigorous science could develop around them.

The grand perspective of the Hindu tradition provided a means to tackle concepts as far reaching as the universe, the self, and perception in a way modern science still finds useful. It has been said that within the Hindu philosophical framework the "greatest minds of the ages have striven to explain the wonders of Nature and of the universe" (Raman 84). Besides being a statement suitable in describing MIT or NASA, it shows that Hindu thought provided a scientific perspective to understand the world. Within Hindu Holy Scriptures and other adjunct texts, there is never a rejection of inquiry. This statement really boils down to an observation that within the aforementioned texts, questions are always welcomed. Consider the following passage:

> *Arjuna said: O Kṛṣṇa, first of all You ask me to renounce work, and then again You recommend work with devotion. Now will You kindly tell me definitely which of the two is more beneficial?*
>
> *Bhagavad Gita – 5:1*

Questions akin to this occur frequently within the Bhagavad Gita and do not represent an anomaly within Hindu texts. Observe the lack of concern or inhibition displayed by Arjuna while he asks the supreme deity, *Kṛṣṇa*, about his apparent contradiction of words. Such a bold inquiry would have

been unthinkable if questions were not cultivated within the religious culture. As a whole Hinduism is quite receptive to questions, and from this the scientific method can develop.

Continuing with this view of Hindu science, the scientific value of yoga can be uncovered. Unfortunately, the earliest creation and development of the yogic tradition has been lost in time, but one possible motivator for yoga has been uncovered recently by science. Yoga may have been the outcome of ancient Hindu thought via scientific development. Through recent studies, there is evidence to connect the practice of yoga with a menagerie of health benefits. Although the full list may never be completely known, the benefits imparted by the practice of yoga include such diverse effects as reductions in blood pressure, reductions in stress hormones, decreases in subjective pain levels and possibly even improvements in disease outcomes and longevity (McCaffrey; Ross)

Together these health benefits suggest that yoga may have been the natural outcome of ancient Hindu application of the scientific method. As health benefits were noted by people who partook in stretching and other yogic practices, the recognition of the casual relationship between yoga and the benefits would have become clear. The only prerequisite necessary to make this connection would be a scientific methodology such as that enjoyed by early Hindus as already discussed. Once the benefits of yoga were realized, the practice of yoga was developed and incorporated naturally into the Hindu tradition and religion. Perhaps we shall never know the actual origin of yoga or why it was incorporated so deeply within Hinduism, but a natural evolutionary process is an appealing theory.

Mathematics

Mathematics holds a special place within human society. Unlike virtually all other science-related disciplines, mathematics is immune to both perspective and change. Throughout history it is easy to find scientific theories overturned, outdated, or otherwise termed obsolete through the ever-active dynamics of progress. While the progress of mathematics has not been a linear advancement through time, it has advanced with remarkable persistence and resilience to regression. What makes mathematics special

amongst the sciences is that once a statement in math is 'proven' it need not be proven again, and unlike theories in physics or chemistry, it will remain true forever. This is the special property of mathematics alone.

Mathematics therefore has been a useful metric to gauge the intellectual progress and scientific aptitude of a culture. Classically the Greeks have been seen as the originators of geometry, logic, and science of all flavors; but a great debt is due to the Hindu underpinnings which much of the Greek and later work was based. In fact, it is not a stretch to claim that the Hindus invented numbers, a fundamental concept in mathematics usually taken for granted.

While number systems have been invented the world over throughout time from primitive tallies to elegant numerals, today we exclusively use the Hindu numeral systems (oft called the Arabic numerals for historical reasons). Through the development of the decimal system (inherent in the Hindu system) accounting, calculating, and entire other fields of mathematics became possible. In addition, the Hindu mathematical progress did not end with their numeral system. Their mathematicians developed trigonometric tables and advanced calculation techniques long before the rest of the world. These works required not only labor and money, but also an understanding of the need. Hand a table of sines and cosines to a layman and odds are that they would not have a clue about how to use it. The ancient Hindus understood its usefulness enough to make elaborate, lengthy, and detailed tables for use in further calculations. This alone claims a scientific aptitude unmatched by their contemporaries at the time. As before, this scientific aptitude required that the culture of ancient India be accepting of new ideas and possibilities. As any revolutionary inventor or scientist will attest, change is difficult but Hinduism apparently is progressive and pro-science enough to have facilitated early Hindu development.

Modern/Post-Colonial Development

It would be amiss not to mention the recent colonial period of India for within the past century the state of India has risen up to become a world power house of technological industry. This quick

adaptation and evolution is remarkable considering the immense number of people living in poverty as well as the highly limited infrastructure left by the British. This story is yet another place where Hindu culture can be cited as a chief motivator in bringing about this technological change. For the modern history of India, we are fortunate in having immediate access to information we did not have when describing the ancient Hindu and yogic developments.

After its achievement of independence, Indian culture was crippled to scientific advancement due to the oppression imposed by British rule. As such it is remarkable that Hinduism was able to provide the society with the means to recover and advance in their scientific pursuits so quickly. Soon after British disembarkation, the need for technological advancement became evident. It stemmed from Hindu thought that "science was an integral part of human civilization and not restricted to western civilization alone" (Lourdusamy). From this perspective it becomes evident that Hinduism assisted by catalyzing and accelerating the recovery of India. Science has already recovered in India to the extent that Hindu researchers and theoreticians are well respected in all scientific fields the world over.

Without the driving force of Hinduism compelling India to regain a competitive status in the world, India would have remained in similar economic straights as its neighbors such as the Philippines, Pakistan, and Afghanistan. Hindu thought promotes that "to remain as ignorant as the man of the stone period, is not only a matter of unspeakable shame, but one of awful irresponsibility" (Lourdusamy; Sircar). Therefore there was a religious mandate, of sorts, to regain competitiveness in the scientific disciplines. Hindu culture obviously has benefited the growth of science within India with great results.

Conclusion

All of this progression required not only a stable culture, but also a general acceptance and understanding of scientific thought, without which progress could not have been made. From this understanding and mindset, the ancient Hindus imbued their early society with a respect for science. With the mindset we have been discussing, the culture and society evolved, and the benefits imbued by this

pro-scientific prospective have benefited countless generations of Hindus: a benefit witnessed by the world with the sudden emergence of India in the world of bleeding-edge science. In summary, Hinduism positively affects promotion of scientific intrigue, understanding, and progress.

Although only a few areas of science were analyzed concerning religious predisposition and understanding, the outcome is expected to have been the same regardless of the specifics. The relationship between religion, culture, and science is homogenous enough between specific disciplines for the conclusion to be regarded as overarching.

Catholic History of Science

Stemming from one of the oldest religions of the Canaan region, Christianity has spread to become one of the few truly world religions. With this growth, there have been clear assimilatory events as well as issues of strife throughout the Mediterranean and European spheres. Over the course of its history, a number of notable interactions have taken place, but perhaps none is as relevant to modern society as the Catholic interaction with science.

Inheritance from Judaism

Culturally, Christianity and Judaism are distinct and independent religions, but their common origins require at least a brief remark. Although study of this topic has been largely biased towards the "privileged class of Greek tradition" (Reed 462), the slender body of work dedicated to science within ancient Judaism tells of a notable contribution. The scientific spirit within the oldest scriptures of Judaism provides information as to the religion's conception and understanding of science. Appearing after the Second Temple period, circa 70 CE, the *Ma'aseh Bereshit* presents a compelling case study of science in the early Jewish faith (Reed 461).

Although not a work of *modern* science, the *Ma'aseh Bereshit* consists of the theological significance and understanding of both cosmology and astronomy.

Whether the early Jewish cultural environment encouraged scientific intrigue or not remains an open debate, but either answer offers a description of early Christian values with regard to science. Neuser, a theologian, argues that the early Jewish culture (of the dual Torah) lead to a hindered scientific understanding for believers. He argues that the canonical texts "inculcated a cognitive mode that is essentially incompatible with scientific and philosophical inquiry" (Reed 465). Clearly meant to scathe, Neuser's words led to recent debate on the topic. Research and analysis upon the relative importance of cultural exchanges, foreign influence, and definitions, ultimately leads to a multicultural context. Only from this context, can anyone compare the relative contributions of Jewish science to modern scientific advancement. Judaism's relative contribution to science is a reasonable metric to understand the scientific ethos within the culture. Development of complex and distinct astronomical tools took place within Jewish culture; therefore, actual scientific contribution is not in doubt, but the extent of the cultural hindrance or promotion is in question.

Within many early rabbinic texts, references to *special* knowledge occur. These references, called *baraita*, are particular texts which only temple officials would have been allowed to read and study. Most prominent among the *baraita* were astronomical resources for astrological purposes. Two early texts describe the "proper limits of inquiry" and the danger of "cosmological speculation" of the *Ma'aseh Bereshit* (Reed 459). These embodied the majority of ancient scientific text within Judaism. Unfortunately the nature of these *baraita* forbid them from being "translated in public" (Reed 479), and thus a body of censored text existed disjoint from

the public. This censorship of text is perhaps the most significant evidence for a mild suppression of scientific thought under Judaism.

Renaissance development in the relationship

Admittedly, there is a shortage of scientific progress during the middle ages up until the Italian and the later European Renaissance, but the reasons are multivalent and misperceived. The period from the fall of the Western Roman Empire, 5th century CE, up until the Renaissance was a period of economic stagnation and slow recovery. The turmoil throughout Europe naturally led to a minimum of funding open to the arts, including science. With little money invested in the sciences, it is no surprise that intellectual progress was depressed throughout the period. Besides affecting the economy of scientific investment, there was a related shift in Catholicism. Primarily driven by the depressed economic state of Europe as well as subsequent outbreaks of plague, both religious adherence and the cultural sphere grew during these 'middle ages'. While anti-secularism was never as high as modern television would suggest, a sentiment of social collectivism did spring up leading to a stifled scientific atmosphere where progress faltered.

An iconic case of a heated Catholic-Science clash has become a popular story in modern culture: the trial of Galileo. Contrary to popular belief, Galileo was not a crusader of science hell-bent against the church; in fact, quite the opposite is true. Although it is true that Galileo was "first and foremost a scientist" (Hodgson, 28), Galileo was also an "enthusiastic promoter and defender of the Catholic Church" (Hodgson, 29). During this period of European history, the Catholic Church taught the Aristotelian theory of the solar system wherein the Earth steadfast as

the center of the universe. This ancient model was well established in the minds of the people and, more importantly, in the Holy Scripture.

Nevertheless, the scientific data and observations taken by Galileo lead him to become convinced in the correctness of a heliocentric model of the solar system instead. Galileo believed, along with his predecessor, Copernicus, that the Sun remained fixed while the Earth revolved around it. Unfortunate for Galileo, the Church's disproportionate power to decree truths lead to clear obstacles for scientific progress. Throughout this period of history, the Catholic teachings yielded no fertile ground upon which science could rest, and therefore science was directly hindered.

Reformation and Science

The extent to which the catholic tradition of Christianity has affected the development of the modern sciences can be best analyzed through a comparative study of science during the reformation. Between the years of 1517 and the 1560s, Europe partook in a 'revolution of religion'. This evangelical and tumultuous time provided an atmosphere of "new and creative thought" which presented an opportunity for scientific development independent of Catholicism. In particular, consider the exemplar case of Strasbourg, a typical European city that witnessed a particularly dramatic shift from Catholicism to Protestantism.

Kenneth Thibodeau developed an ingenious method to characterize, and to some extent quantify, the impact of the reformation on the production of scientific literature and academic progress, specifically in the city of Strasbourg. Based on a compilation of printing records, college entrance data, and other records (Thidobeau 35), Thibodeau managed to plumb the change in culture which developed in tandem to the shift away from Catholicism. Not only was

there a “phenomenal rise in scientific publications,” but the “tone and character” of the works became different (Thibodeau 38). With this sort of evidence, it appears that Catholicism had been inhibiting scientific progress around the time of the reformation, but there is more to the story.

Although a causal connection between the displacement of Catholicism and scientific proliferation is indicated and supported, most connections of this sort are more complicated. It is possible that Catholicism was not detrimental to scientific advancement, but that the boon seen during, and after, the reformation is conditional with any revolution. Perhaps the instigator for this new and dynamic scientific work was the new possibilities unleashed by the dramatic shifts of the reformation. A publication that presents and quantifies this viewpoint would be an asset in drawing conclusions here.

This period of history presents a mixed case of whether Catholic ideology promoted or hindered scientific intrigue. The stability offered by the Catholic Church limited diverse thinking, as demonstrated by Thibodeau in his study of Strasberg, but with stability came the development of colleges and freedom to pursue knowledge for the sake of knowledge. Based on the evidence presented, the Catholic Church did not actively retard scientific progress and understanding, but also provided only limited opportunity for truly excellent or original work through its disproportionate power to proscribe truths based on papal decree (see the Galileo case above).

Recent relation to science

One of the most notable changes within the catholic relationship with modern science has been the Council Vatican II of 1962. Issued by Pope John IV in order to “remedy the serious

mismatch between the advances in the world of science and technology and in that of religion and morality" (Kozhamthadam 611), this council established a strengthened relationship between the Catholic Church and modern scientific thought. The events of recent history had led to a displacement of religion in favor of modern industry and technology, a trend best summarized by the drop in attendance for Catholic Mass. Preliminarily there was very little different between this clash of the Catholic Church and science and the historical analogs. For throughout history the church has felt itself threatened by the authority it would relinquish due to advances in science (Hodgson 30). In fact, Pope John IV stated that "contemporary developments in science challenge theology far more deeply than did the introduction of Aristotle into Western Europe in the thirteenth century" (Kozhamthadam 613). The feelings of the Church were the same, but its reaction was completely new and unprecedented. This time the Catholic Church professed a desire to be "brought up-to-date" and to "adapt itself to meet the challenges of modern times" (Kozhamthadam 612), rather than hinder the progress of science. This historically significant shift within church sentiment and behavior best exemplifies the relatively recent promotion of the sciences inside the Catholic environment.

A mutual boon for both Catholicism and science stemmed directly from the Vatican 2 council. Throughout the conference, a respect for both "non-Catholics" and "non-Christians" issued forth from a spirit of "openness to new possibilities" (Kozhamthadam 615). These 'new possibilities' eventually lead to an official statement of apology in the church's handling of the Galileo case (Hodgson 50; Kozhamthadam 616) in addition to a more inclusive official doctrine.

Historically speaking, the Catholic Church has professed an open, scientific atmosphere, or at least their desire for one, but the actions of the Vatican 2 council is the first major action in accordance with this desire since at least the Council of Vienna. Although only demonstrating an

open atmosphere by the 1960's, the positive relationship with science may stretch back significantly further, hidden by a lack of a public example akin to the Vat 2 meeting. Regardless, by the ladder half of the 20th century Catholic theology had allied pleasantly with scientific progress.

Future of Christianity and science

While limited to only general speculation, the future of the Catholic-Science dynamic will still certainly have critical impacts due to the ever-developing integration of global societies. One aspect to consider is the impact of Catholic methodology upon the worldwide energy and pollution crises. Especially Due to the dynamic and ever-sensitive international and interreligious sensitivities, only the direct connection between recent "green" policies and Catholic doctrine will be discussed.

With the recent, albeit tragic, natural and man-made incidents such as tsunamis and the Fukushima nuclear plant, the Vatican has become much more aggressive with 'green' practice and the future of our planet (Radio). Consider the recent statement by Pope Benedict urging all to "adopt a lifestyle that respects the environment and [to] support research and the exploitation of clean energy sources, respectful of the heritage of creation" (Kerr). This outward promotion of environmental concerns extends inward as well: Vatican City installed numerous solar panels back in 2008. This sort of open embrace of an otherwise scientific topic is intriguing.

From the Pope to the resident priests the world over; the Catholic Church has made great strides in understanding and accepting the scientific basis for popular environmental concerns (Allen). The Church's rhetoric on this matter promotes a public acceptance and even a general

interest in science. Therefore, the future of the Catholic-Science relationship holds both promise and potential for a superior understanding of the natural world as well as our spiritual world.

Conclusion

The multifaceted and historical relationship between the development of Catholicism and simultaneous ascension of science has culminated in an acknowledged importance of scientific understanding by the Church. Through the lifetime of the Church, the connection between Catholicism (Christianity) and the scientific mindset has had time to both diverge and realign again in modern times. Contrary to the arguments of many anti-religious promoters, there is little evidence that Christianity has ever been against religion, even if it has been discouraging at times. Therefore, arguments that humanity would be colonizing the moon by now if only the Christians had not pulled us all into the dark ages are based on misinformed ignorance. Through the church's development, there has been a parallel development of scientific thought. It is only suiting that after over two thousand years of heritage that both Christianity and Science would find common ground when needed in the last century filled with world wars and major breakthroughs.

The Scientific Spirit: Lessons from interreligious studies.

Science is defined by some as referring "to the body of reliable knowledge itself, of the type that can be logically and rationally explained" (Wikipedia). While the common perception of what constitutes science readily aligns to the 'reliable knowledge' aspect, the clause about communication is a bit removed from most people's definition of science. On a philosophical level the pursuit of knowledge for personal understanding is right and proper; but on a practical level, understanding is virtually useless without collaboration and discussion. While whole essays can be written about this aspect of science alone, this

discussion will focus on a topic a bit peripheral to communication: religious and cultural collaboration in the modern world.

With countless religions and worldviews from cultures as far removed from one another as northern China and central Argentina, proper communication and exchange is integral in these times of globalization. Scientific collaboration clearly does not define the nature of all intercultural and intracultural communication, yet it is critical to the advancement of technology. In the realm of research both Christianity and Hinduism hold countries on the forefront of science. Therefore, it is imperative that communication is not hampered through interreligious confusion or cultural confusion. Perhaps a personal story would shed light on this global subject.

A colleague of mine, Dr. Robert Hazen, is a senior research scientist at the Carnegie Institute in Washington. While of European dissent, Bob is a Hindu through his mother and an active member of his local community. While in Boston for a conference, Bob guest lectured here at BC on his research in 'mineral evolution'. Naturally, we went out for dinner after the presentation, and being a local I was given the honor of selecting the restaurant. By the time I realized my mistake it was too late. I had brought Bob to Fleming's Prime Steakhouse by the commons: I brought a Hindu to a steak house for dinner. While Bob was quite all right with it, I felt awkward and unsure about the whole expedition.

While perhaps not the most dramatic or epic narrative, this event will stick with me. Although nothing serious, the situation does demonstrate how integral religious or cultural identities can become. It is only with proper understanding that collaboration can proceed unhindered and without unnecessary conflict and misconceptions.

For a modern example of where Hindu-Christian dialog occurs within science, look no further than the CERN initiative of Europe. As the single largest, and most expensive, scientific project to date, CERN operates as a joint venture for half a dozen countries with assistance from another dozen or so. India is an active member with 'observational' status, which means that they have active scientists and

researchers based at the facility. It is my belief that proper understanding of the scientific history of a religion is vital to understand the methodologies and connections utilized by its scientists. I hope that with our new perspective on the Hindu and Catholic relationships with science we can better forge understanding while minimizing the opportunities for misunderstandings.

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