The Big Bang and the Birth of Tragedy

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The Birth of Tragedy

I first encountered Friedrich Nietzsche's (1844-1900) *Birth of Tragedy from the Spirit of Music* (1872) while researching an essay about software development processes while studying for a Masters degree in Computing. Many years earlier, while taking my MBA, I had come across Schumpeter's (1883-1950) notion of *Creative Destruction* to capture the progress of the business life-cycle but I felt that Nietzsche's assertion that tragedy is born from the tension between order, in the form of the sun god Apollo, and the unpredictability of the god of wine and fertility, Dionysis, captured the idea that creative destruction is not just a framework for understanding the dynamics of markets but it can be used to understand phenomena, such as the rise and fall of empires, as well as the universe in general.

In addition, with the use of Greek mythology and the Athenian theatre of Aeschylus (525-456 BC) and Sophocles (487-406 BC), Nietzsche was asserting that human nature has not really changed since early antiquity and that humans have lived through many cycles of creative destruction stretching over millennea. Linking the past with his present, Nietzche related the balance of the Apollian and Dionysian of the early Greeks to his contempory, Richard Wagner (1813-1883), claiming Wagner's operas were a rebirth of tragedy.

Nietzsche thought that our nature has not just changed since the earliest of recorded times but is related to the intractable universe itself. Using the structure of the Cosmic Microwave Background (CMB) as evidence, this essay takes Neitzche's insight further and suggests that the universal burden of creative destruction can be traced all the way back to the Big Bang and is fundamental to understanding, not only ourselves, but the cosmos as a whole.

The essay starts with an outline of the history of astronomical thought, especially that of Copernicus, Newton and Einstein, framed in the historical context of the power politics of the day, all within the Apollonian and Dionysian embrace. The essay concludes with how the Big Bang may have given birth to tragedy on a universal and human scale.

From Antiquity to the Renaissance

Upon watching the cross of St. George and the star and crescent of the respective England and Tunisia flags unfurled on the pitch prior to a 2018 World Cup match and noting that Simon Schma thought it all "a bit medieval", I was struck how historical relics from our cultural background could appear in such a modern entity as the World Cup. Since the age of Mohammad (630) and the Quran (written in Arabic), the battle between Christain forces and Islam had raged for centuries, with the Crusades (1095-1272) being the most prominent in the Western mind, but with the fall of Constantinople to the Ottomans (1458 – technically the end of the Medieval period) and the completion of the Reconquista (1492) on the Iberian penninsula the old Roman Empire was firmly divided between Islam and Christianity. The Mediterranean, once the centre of the Empire, was now a sea border between two rival religions that had not even existed when Rome first came to dominance. With Emperor Justinian's magnificent Hagia Sophia (537), of "Solomon, I have out done thee" fame, now a mosque the Orthodox Church was in ruins and the Roman Church was, in Renissance Europe, unquestionably the 'One Holy, Catholic, and Apostolic Church'.

Over time the Church had absorbed the story of creation and the prophets from the Old Testament (written in Hebrew and Aramaic), the story of Jesus Christ and his followers and the pending Apocalypse from the New Testament (written mostly in common Greek) to culminate in the Vulgate Bible, a Latin translation of the Old and New Testaments by St. Jerome (382-405). After the East-West Schism (1054) that divided the Greek and Latin Churches the doctrine of the Roman Church had been forged over the coming centuries by scholastic philosophers, also known as the schoolmen, such as Anselm of Canterbury (1033-1109), Thomas Acquinas (1225-1274) and William of Ockham (1285-1347), who attemped to harmonise the various authorities of the differing Christian traditions, and to reconcile Christian theology with classical and late antiquity thinkers, such as Plato (428-348 BC), Aristotle (384-322 BC) and Ptolmy (100-170 AD), to explain the beginning, the coming end and the workings of the entire universe in between. A visual representation of their Apollian view is projected in St. Peter's Basilica (1506-1626) and the Apostolic Palace (1471-1605) in the Vatican where, in the Room of the Segnatura, Raphael's frescoes The Disputation of the Holy Sacrament, The School of Athens and The Parnassus (1510), an image centred on Apollo, can be seen. Else where in the palace can be seen Michaelangelo's Sistine Chapel (1483-1508).

As custodians of the one truth, the Latin Church was dominant. Art and architecture were used to proclaim the glory of God and his agents on earth; monarchs were defenders of the faith; churches and cathedrals, such as those in Seville, Cologne and Vienna, conveyed the message to the faithful; universities, such as Bologna, Cambridge and Paris, taught the Church's doctrine to the next generation of leaders and any new thinking was policed by an inquistion. Although there was an abundance of evidence to the contrary, the vast majority of people in Chistendom, from the Pope and monarchs down to lowly serfs, absolutely and without doubt believed the doctrine of the Church and the Apollian view that their world and the universe was created and ordered according to God's command as outlined in the Bible and would continue to do so until judgement day.

The Baroque, the Copernican Revolution and Newton

In reaction to paid for indulgences to fund the building of St. Peter's Basilica in Rome, little did Martin Luther know that the publication in Wittenberg of his Ninty-Five Theses (1517), the act that initiated the Protestent reformation and in turn the reactionary Catholic Counter-Reforation, would mean that by the end of the Baroque period (~1700) Europe was a very different place than that of the Renaissance which Rome dominated.

Unfortunately for many milions in Europe the process of change was horrific, but by the end of the 17th century a new order had emerged. The peace of Westphalia (1648), that favoured tolerance over religious conflict, had ended the religious hostilities in large parts of the Holy Roman Empire. The ending of the 80 year's war in favour of the Dutch Republics over Catholic Spain propelled the Dutch into their golden period and the 30 year's war ended with Kings and Princes of the Holy Roman Empire being able to decide the religion of their own kingdoms and principilities, the south being prodominantly Cathlolic, lead by the Austrian Habsbergs, with Prussia and most of the north choosing Protestentism.

England had a separate journey. Henry VIII's break from Rome (~1530), due to failing to have his marriage to Catherine of Aragon annulled, ended the power of the Pope in English state affairs. Elizabeth I's defeat of Philip II's Spanish armada in (1588) started the reverse of the Spanish Empire's power. The English civil war (1642 – 1651) and the execution of Charles I (1649) followed by the Glorious Revolution (1688) and the Act of Settlement / Succession (1701) meant that a Catholic could never sit on the English throne again with the added consequence that now parlimentary power preceded that of the crown, democracy in England was born. With the Act of

Union in 1707 England and Scotland became Great Britain, a country free of Catholic influence and a force to be reckoned with on the high seas and relatively free to chart its own course.

In continental Europe, with the successful defence of Vienna during the seige of 1683, the Austrian Habsburgs, as Emperors of the Holy Roman Empire, were the dominant force in South East Europe and the Ottoman threat to Christendom had basically been extinguished although their empire still extended well into the Balkans.

Outside the religious divide the most profound difference between the Protestant and Catholic states was their mechanisms for change. Their approaches are best summed up in the lifes of Galileo Galilei (1564-1642) and Issac Newton (1643-1727). Newton, building on the work of Copernicus (*De revolutionibus* 1543), Kepler (*Astronomia nova* 1609) and Galilleo (*Dialogo sopra I due massimi sistemi del mondo* 1632) at Trinity College Cambridge, was knighted and elected president of the Royal Society (founded in 1660) for the publication of his *Principia* (1687) which stated his laws of motion, his law of universal gravitation and a new mathematical technique, calculus. Galileo (1564-1642), on the other hand, died under house arrest, imposed on him by the Roman Inquistion, for his championing of heliocentrism and Copernicanism. His *Dialogo sopra I due massimi sistemi del mondo* ,which compared the Copernican system (sun centric) with the traditional Ptolmaic system (earth centric), was not taken off the prohibitive book list until 1758.

The Catholic south, with its counter reformation forces, such as the Jesuits (founded in 1540) and Inquistions, was stubbornly sticking to the doctrine of the Church while the Protestant north, although fiercely religious and still dedicated to an Apollian and biblical explaination of the universe, not only had a mechaism for change for when Dionysis came calling, but actively encouraged scientific endevours. This approach to science and their parlimentary democracy, albeit with severly limited suffrage, was to bear considerable fruit for the British Isles over the coming centuries. The French, although still a Catholic and absolutist monarchy, saw the advantage of such an approach to science and founded the French Society of Sciences in 1666 of which Fourier was to become a member during the time of Napoleon. The Holy Roman Empire, also absolutist, founded their Academy of Sciences Leopoldina in 1652 of which Einstein was to become a member, albeit after the state of Germany was formed in 1871, and was excluded in 1933 for being Jewish. Although an academy of mathematics was created in 1582 by Philip II (1527-1598) in Madrid, mainly to improve the craft of war, the Spanish Royal Academy of Sciences was not founded until 1847.

Hand in hand with the new sciences and mathematics came a fresh, non scholastic, approach to philosophy. In the Baroque era the first of these thinkers were known as rationalists and amidst their ranks included Descartes (1596-1650), Spinoza (1632-1677) and Liebnitz (1646-1716). Art also flourished in the Baroque, creating such masters as Caravaggio (1571-1610), Velasquez (1599-1660) and, of course, Rembrandt (1606-1669), the Dutch master.

Although Catholic Europe had seen off the Ottoman treat, with King William of Orange’s success in Ireland against James II (1633-1701), the last of the Stuart kings, and the supporting French forces of the Bourbon ‘sun king’, Louis XIV, (1638-1715) in 1690, the balance of power in Western Europe had shifted from the Catholic states of France and Spain to the Protestant states of England and Holland, a shift in power that would have profound effects on Europe, the colonies of the new world and further afield.

At the end of the Baroque period it is helpful to be aware of the following: Russia, from humble beginnings but now under Peter the Great (1672-1725), was beginning to expand into a Christian,

but Orthodox, European empire; what is now know as the United States of America was a combination of English, French and Spanish colonies with considerable land mass still controlled by indiginous peoples; the African slave trade was a highly profitable, but clearly morally and ethically repugnant, trans-Atlantic business activity; the Indian sub-continent was a well known source of spices and other exotic produce that was now reachable by sea rather than via the Silk road and the inscrutable ancient eastern civilisations of Japan and China had limited contact with Europe.

The power and influence of Renaissance Rome may have been on the wane but at the end of the Baroque era its children, some of them unruly, governed from London, Paris, the Hague, Berlin, and Vienna were mostly in rude health, with Lisbon and Madrid the exceptions. In addition, Orthodox Moscow and Belgrade, picking up the mantle of the fallen Constantinople, were making claims to be the true heirs of Constantin's Roman Empire while the conquerors of the Eastern Empire and a child of Mohammed, the Ottoman Empire, was in steep decline.

The Enlightenment

By the Congress of Vienna in 1815 Europe had significantly changed again. Great Britain, now the United Kingdom of Great Britain and Ireland due to the Act of Union of 1800, had been drawn back to continental Europe to deal with the havoc unleashed by the French Revolution (1789) and Napoleon (1769-1821), finally concluding at the battle of Waterloo of 1815 and Napoleon's permanent exile on St. Helena. The big powers of Europe, now Russia, Great Britain, Prussia and Austria attempted to lay to rest the enlightenment inspired French Revolution and its desire for 'Liberté, Équalité, Fraternité' with the restoration of a Bourbon, Louis XVIII, to the French throne. It appeared that continental Christian - Orthodox, Catholic and Protestant - absolutism had prevailed but the chorus of the people was not to be denied and tragedy was sure to follow.

It is important to stress that the age of empire was in full swing with Great Britain now controlling vast territories, even with the loss of the American colonies after 1776. Although other European powers had empires Britain's, with its success over the French in the Seven Years' War (1756-1763), was by far the largest and most powerful. This age of empire greatly changed the UK and made it even more culturally distinct from the rest of Europe. Not only is this imperial cultural relic reflected in the Commonwealth, it is most apparent in sporting events such as the Cricket and Rugby world cups, with countries as diverse as India, Australia, Pakistan, Zimbabwe, Ireland, Canada, the West Indies, Bangladesh, South Africa, Sri Lanka as well as England and Scotland competing to be crowned world champions. Although there was euphoria in England when they beat New Zealand in the cricket world cup final in 2019 it probably didn't even get a mention in the evening news on the continent.

On the other side of the Atlantic a free United States of America was expanding rapidly and, by roughly 1850, it had been extended to the west coast of the North American continent, expanding further in 1867 with the Alaska purchase from Russia and then far into the Pacific Ocean with the annixation of the islands of Hawaii in 1900, making Hawaii the 50th state of the United States. In addition, huge migration flows, mostly from Europe, saw the population of the United States explode during this time.

As for the Far East, China had weaken militarily and had left itself exposed to European colonisation and exploitation, ceding control of Hong Kong to the United Kingdom in 1842, the same year it lost the first Opium war while Japan, after a lengthly period of self-imposed isolation, was slowly opening itself up to the West, especially after the Mejii restoration of 1868.

The unescapable conclusion of the Congress of Vienna was that the estranged son of Rome, London, was now the capital of a vast global empire with the addition of holding the balance of power in continental Europe; Moscow, a child of Constantinople, had the mightest army on the continent; the German speaking forces of the former Holy Roman Empire, if united, had the potential to be the mightest of all while the power of Rome, still influencial in Vienna and Paris, was definitely on the wane. In North America, the city of Washington, the estranged son of London, was growing stronger on freedom and equality but, paradoxically and shamefully, fuelled by slavery. Another sign of the continued decline of the Ottoman Empire was Greek independence in 1829; Greece had been an integral part of the empire since the fall of Constantinople in 1453. Finally, the Oriental empires of Japan and China were realising, maybe too late, that they had technologically fallen behind the West and their independence was under threat.

Modernity, Einstein and the Big Bang

The European powers continued to grow in strength mainly due to industrialisation, commerce and their expanding empires but, although a violent act, it would have been difficult to predict how the assassination of Archduke Ferdinand (1863-1914) in Sarejavo by Serbian nationalists would lead to the Bolshevik Revolution (1917) and the execution of Tsar Nicoals II (1868-1918) and his family at Yekaterinberg in 1918; the dissolution of the Austro-Hungarian empire in 1918 and the abdication of Welhilm II (1859-1941) also in the same year. At the end of World War I (1914-1918) Christain alsolutism, once mighty, hardly existed on the continent but its legacy was a Europe in ruins.

Although the folly of the Treaty of Versailles (1919) was known to many at the time it would have almost been impossible to predict the rise of Hitler (1889-1945) and Stalin (1878-1953) and the start of World War II (1939-1945), leaving in its aftermath, not only total destruction on a global scale, but the Holocaust and the atomic bombing of Nagasaki and Hiroshima, indelible scars on the soul of humanity.

When Albert Einstein first published his theory of special relativity in his paper *On the Electrodynamics of Moving Bodies* in 1905 Europe was enjoying the Belle Époch and was the thriving centre of the world. As well as being the capital cities of vast empires, Vienna was the music capital of the world; Paris the artistic and cultural; London the commercial and Berlin had a world wide repuation for mathematics and science. By the time Einstein published his *General Theory of Relativity* in 1915 Europe was at war and Einstein, like all Germans, had to endure the German blockade (1914-1919). It was during this time that Eddington (1882-1944) of Trinity College Cambridge provided the first empirical evidence that space-time is bent by gravity when he photographed the bending of sun light during a solar eclipse in 1919. Ironically, Eddington had been sent to disprove Einstein's theory and so win a propaganda victory for Britain over Germany as well as maintain the pre-eminence of Netwon's law of gravity. Eddington, a consciensious objector and scientist, followed the evidence and published his work regardless of national loyalities.

In 1922 Alexander Freidmann (1888-1925) solved Einstein's field equations of gravitation. Friedmann's solution is a set of equations that govern the expansion of space of the universe within the context of general relativity.

In 1927 Georges Lemaître (1894-1966) took Friedmann's solution and proposed the 'Big Bang Theory' of the creation of the universe in his paper *A homogeneous Universe of constant mass and growing radius accounting for the radial velocity of extragalactic nebulae* which included the first observational estimate of, what was to be known as, the Hubble constant.

Two years later in 1929 Edwin Hubble observed that the distances to galaxies were strongly correlated to their redshifts suggesting that all galaxies were receding away from us at a velocity proportional to their distance, now known as Hubble's law.

Although a revelation the 1964 discovery of the CMB was crude and since then a number of American and Europen satellites, carrying sensitive radio telescopes, were launched to refine the measurements with the latest and most accurate observations recorded by the Planck surveyor which operated from 2009 to 2013, with the most data release in 2018.

The CMB is the relic electromagnetic radiation from the early universe, created approximately 300,000 years after the Big Bang, which can be almost perfectly modeled by black body radiation. However, the spectral radiance contains small irregularities; it is this variation which has been measured so accurately by the Planck surveyor and matches what would be expected if small thermal variations, generated by quantum fluctations of matter in an extremely small space, i.e. a patch, had expanded to the size of the observable universe as it is today. The black body spectrum and thermal variations are shown in Illustration 1 below.

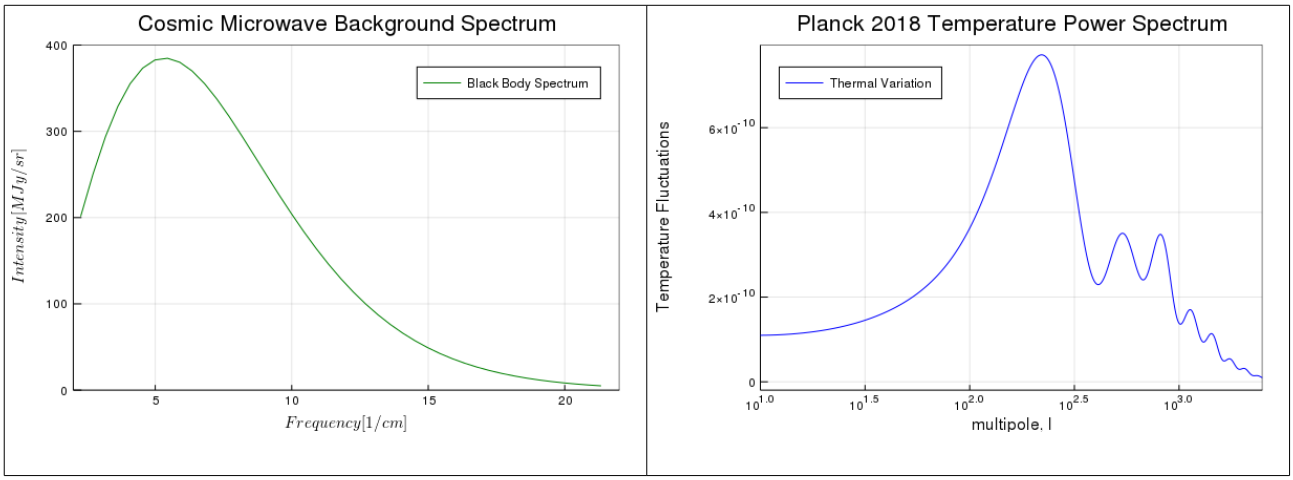

Illustration 1: Black Body Spectrum and Thermal Variations

By the time Arno Penzias (1933-present) and Robert Wilson (1936-present) stumbled across the Cosmic Microwave Background (CMB) in 1964 power and influence had radically shifted from Europe to America. Not only was America the global centre for commerce, science and technology it was also the 'go to' destination for European artists and musicians, e,g. Piet Mondrain (1872-1944), Willem de Kooning (1904-1997), Igor Stravinsky (1882-1971) and Arnold Schoenberg (1874-1951). Influenced by emigre European talent the United States created masters such as Jackson Pollock (1912-1956) and Mark Rothko (1903-1970) as well as Leonard Bernstein (1918-1990) and Philip Glass (1937-present).

Having travelled to the United States in 1933 for a lecture tour Einstein, fearing for his life, decided not to return to Nazi Germany and died in Princeton in 1955. His predictions, based on his General Theory of Relativity, are still being shown to be correct, with the most recent, the discovery of gravational waves by the LIGO in 2015, making headlines all around the world.

From inauspicious beginnings, it would have been imperceivable to imagine that the United States of America, the estranged child of London, would become the dominant force on the globe, but with victory in Europe and Japan in 1945; the decline of the European imperial powers and the end of the Cold War (1947-1991), signalled by the fall of the Berlin wall and the collapse of the USSR in 1991, this is exacly what happened and we entered the era of Pax Americana, liberal democracy and

the ‘end of history’; an Apolloian delusion similar to that promoted by Renaissance Rome. Also surprisingly, from weak positions in the late 19th century, by the beginning of the 21st century China, now communist, and Japan had the 3rd and 4th largest global economies, respectively, after the United States and the European Union. Another surprise was after less than 100 years under communism Russia returned to its Orthodox and, it could be argued, absolutist roots. As for the Ottoman Empire, decline tuned to collapse in the aftermath of the first world war. In 1923 the Republic of Turkey emerged in Asia Minor but after French and British rule ended after World War II chaos has ensued in many parts of past Ottoman Arabian lands which has proved to be an environment suited to dictorships and violent extremism.

History was resuscitated on 11th September 2001 with the terrorist attack by Islamic fundamentalists on the World Trade Centre in New York. In the same year the US President, George W. Bush (1946-present), declared a “war on terror” which, unfortunately but necassarily, is still ongoing and with it, renewed tragedy and untold suffering.

The Big Bang as the Birth of Tragedy

Wherever we look we are surrounded by relics from our cultural background. They may be crosses, stars or cresents on national flags; mounments, statues and buildings in capital cities or even in languages, such as Latin used for the mottos of most western universities; Greek symbols in mathematics and Arabic and Hebrew still the national scripts of many countries.

The claim of this essay is that the largest and most emcompassing relic is the Cosmic Microwave Background left over from the Big Bang and that from Illustration 1 the black body spectrum is the source of our and the universe’s tendency towards order and the temperature variation is the source of what appears to be random, sometimes shattering, events. In short, the black body radiation is represented as the god Apollo and the temperature variation, Dionysis. From observations from the Gaia satellite the stars in our galaxy, the Milky Way, go through cycles of birth, life, death and regeneration; similar life cycles can be found here on earth. The natural conclusion is that the nature of the universe can be found within our trails and tribulations and the changing universe is not a drama played out in the heavens but we are part of its multi-layered drama. Within the CMB’s combination of a universal background radiation creased by temperature fluctuations we have the Apollonian and Dionysian embrace that neither we nor the universe, as a whole, can escape. With the Big Bang has come the Birth of Tragedy for the entire universe, us included.

Nietzsche understood that we live our lives within the turbulent dynamics of Apollo and Dionysis and believed that the ancient Greeks not only understood this intuitively but accepted and celebrated it in the medium of theatre. With the discovery and minute mapping of the Cosmic Microwave Background we can give our cultural ancestors empirical evidence that their intuition was probably right.

As an aside, this might explain why there are such elegant formulae to describe nature, such as the Theory of General Relativity and Quantum Mechanics on the one hand and cumbersome frameworks, the standard model comes to mind, on the other. The assumption that there is an elegant, Apollian theory to describe the entire universe in the form of a Grand Unifying Theory maybe a delusion. It might also explain why an all encompassing, peaceful and prosperous world order, no matter how noble an aspiration, may also be beyond the grasp of humanity.