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ASTRONOMY AND CULTURE IN THE EIGHTEENTH CENTURY: ISAAC NEWTON'S INFLUENCE ON THE ENLIGHTENMENT AND POLITICS

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ABSTRACT

This paper explores the influence of Isaac Newton's astronomy on European culture. More than any other astronomer, Isaac Newton gave the 18th century its cosmology of unity, predictability and order. Newton's discovery of the law of gravity, published in 1687 in his *Principia*, provided a single universal 'rule' for the entire universe (Cassirer, 1951 [1979]: 9). The application of Newton's theories to wider culture is known as Newtonianism (Schaffer, 1996: 610-26). Newtonianism emphasised order, stability, regularity and the rule of a law under which all men were equal. It held out the possibility that the current state of political disharmony could be replaced by peace, freedom and harmony. This paper will explore three consequences of Newtonianism. The first is Natural Rights theory: the argument that just as one single law governs the entire universe, so human society must also be governed by the same single law (Becker, 1958). The second is progress theory: the idea that history moves in an ordered pattern, gradually improving until it reaches a final, benign, end point (Condorcet, 1955). The third is sociology, which originated in the attempt to find evidence for the operation of Newtonian law in human society (Comte, 1875). The paper will conclude that an understanding of important cultural developments at the beginning of the modern world requires an understanding of developments in astronomy.

KEYWORDS: Enlightenment, Politics, Isaac Newton, Astronomy, Culture, Natural Rights, Progress Theory, Sociology.

1. INTRODUCTION

The Enlightenment of the 18th century has assumed a mythical status as the foundation of modern European civilisation. As a historical phenomenon, the term Enlightenment has a double meaning. One is as a historical period, in which sense it appears to have been first used in English in 1894 (Schmidt, 2003: 428). The other is as a worldview, a set of opinions about the way that people should behave and society should operate which represent a qualitative improvement on all previous worldviews. The identification of the Enlightenment as a single benign movement promoting human betterment through progress, universal rights and political freedom has led to the notion of 'Enlightenment Values' as a coherent set of principles that provide the foundation for modern western civilisation, as well as a road map for the ideal direction of non-western culture (Stern-Weiner, 2011; Taylor, 2013). This idea is embodied in the recent notion of an 'Enlightenment Project'.

The simplest definition of the Enlightenment is that of Immanuel Kant, written in 1784. 'Enlightenment', Kant wrote, 'is man's emergence from his self-incurred immaturity. Immaturity is the inability to use one's own understanding without the guidance of another' (Kant, 1996: 58). Most historians identify Enlightenment with intellectual revolution. For example, Roy Porter (2000b: 3) identified in the Enlightenment 'a ferment of new thinking amongst the reading public at large... [a] living language, a revolution in mood, a blaze of slogans, delivering the shock of the new'. However, as far as the history of science is concerned Charles Webster (1982) demonstrated that the scientific revolution was not a sudden break with old ideas, but an evolution in which ideas about the nature of the world developed gradually, not by rejecting the past but by building on it.

2. NEWTON

Isaac Newton was the single most important inspiration for most of the Enlightenment philosophers. As the poet Alexander Pope (1903) wrote, 'Nature and Nature's Laws lay hid in Night; God said "Let Newton be!" and All was Light'. It was in 1728, just one year after Newton's death, that the natural philosopher John Theophilus Desaguliers wrote the earliest known manifesto of Newtonian-inspired political theory, applying the new astronomy to the management of the state in a work whose title could not have set out his intention more clearly, *The Newtonian System of the World: the Best Model of Government, an Allegorical Poem* (1728):

What made the Planets in such Order move,

He said, was Harmony and mutual Love
(Porter, 2000: 137).

In particular, Newton's discovery of gravity encouraged the idea that a single, benign order governed the whole world. Precisely because the law of gravitation was universal, there was, in principle, no sphere of human behaviour which was free from its influence.

Voltaire (1694-1778) argued in similar fashion that the lessons of astronomy should be applied to politics. He revered astronomers such as Galileo and Johannes Kepler, but saved his greatest praise for Newton, whom he elevated to a semi-divine status. His praise was ecstatic: 'if true Greatness consists in having receiv'd from Heaven a mighty Genius, and in having employed it to enlighten our Minds and that of others; a Man like Sir Isaac Newton, whose equal is hastily found in a thousand Years, is the truly great Man' (Voltaire, 1726: 65).

And it was Newton, Anne-Robert-Jacques Turgot insisted, who had shown the way:

One man, Newton, has subjected the infinite to the calculus, has revealed the properties of light which in illuminating everything seemed to conceal itself, and has put into balance the stars, the earth and all the forces of nature (Turgot, 1991: 59).

For many years Newton worked on a system of chronology in which major historical events could be matched against the movement of the stars in order to illustrate the unfolding of God's mathematical plan in history, work he published in 1724. Newton was fascinated by number as the manifestation of God's law, which was revealed astronomically in the shift of the stars in relation to the sun's location on the spring equinox - 21st March - of one degree every 72 years. The complete cycle takes slightly less than 26,000 years. As an example of his method, Newton placed the construction of the ship *Argo*, in which the hero Jason set out to search for the Golden Fleece, in 939 BCE. This was when, according to his reckoning, the sun's location was 15 degrees of Aries, the sign of the Ram. So, according to Newton (1728 [1988]: 25), the Ram's position in the sky equated to the appearance of the ram in one of the most famous events in classical history. Newton's historical theory was widely noticed at the time. In particular it was greeted enthusiastically by Voltaire (1726: 120-2) for what he judged to be the advance it represented on previous efforts to understand historical time. Newton's mathematical system was not perfect, and he believed that, from time to time, God in the shape of Providence had to step in and recalibrate the mechanics in order to prevent a collapse in

the entire system (Hoskin, 1999: 143-4). This was precisely why it was so important to understand exactly how the universe operated, history included.

Newton created a new astronomy but also drew on ancient concepts to provide the basis for the idea of light as either representing divinity or providing a means to access divinity. He was deeply familiar with classical concepts of the sun as the transmitter of the divine light of heaven as well as the physical light of the world. Salvation from the ignorance of the material world therefore lay in enlightenment: 'for in you too', the *Corpus Hermeticum* asserted, 'the word is son, and the mind is father of the word... Now fix your thought upon the Light... and learn to know it' (Hermes Trimegistus, *Libellus I.6*: 117). Further, 'He who has recognised himself', that is, acknowledged the divinity within, then 'enters into the Good' (Hermes Trimegistus, *Libellus I.18*: 125). The idea of the divine sun had featured in the opening lines of Nicolaus Copernicus' *De Revolutionibus* (1543) the work which began the astronomical revolution by arguing that the sun was the centre of the universe, rather than the Earth, as had been previously thought (Copernicus, 1543 [1995]: Vol I.10, 24-5).

Newton himself made his own translation of one of the most famous Hermetic texts, the *Tabula Smaragdina*, or Emerald Tablet. We now know that this was written in Arabic around the 8th century, but in Newton's time it was thought to be one of the foundations of ancient wisdom. His translation expresses with great clarity his belief in the unity of heaven and earth, with the sun and moon, metaphorically speaking, in parental roles.

That wch is below is like that wch is above & that wch is above is like yt wch is below to do ye miracles of one only thing
And as all things have been & arose from one by ye mediation of one: so all things have their birth from this one thing by adaptation.
The Sun is its father, the moon its mother.
(Newton, no date: lines 3-4)

The standard English translation of the entire *Corpus Hermeticum* at the time was John Everard's, published in 1650, which included the following lines equating the mind with God and the light of the sun:

The Mind therefore is not cut off, or divided from the essentiality of God, but united as the light of the sun.
And this mind in men, is God, and therefore are some men Divine, and their Humanity is near Divinity.
(Everard, 1650: lines 3-4)

And from the King James version of the New Testament, the standard English translation of the

time, Newton knew that 'And the light shineth in darkness; and the darkness comprehended it not' (John I: 5). Newton may have provided the framework by which God was dethroned as lord of all in favour of science, but his own faith was deep. Along with every devout Christian, he knew one of the best known verses in John's Gospel, in which Christ declares that 'I am the light of the world: he that followeth me shall not walk in darkness, but shall have the light of life' (John 8: 12).

By the beginning of the 18th century, light had become a metaphor for the triumph of the west, then represented by the beginnings of the English, Dutch and French colonial empires, the expansion of global trade, and the technical innovations which were laying the foundations of the Industrial Revolution. In 1706 the Earl of Shaftsbury wrote, 'There is a mighty Light which spreads itself over the world, especially in those two free Nations of England and Holland' (Porter, 2000a: 3). But what exactly was this light? In 1750 Turgot published *A Philosophical Review of the Successive Advances of the Human Mind*, one of the foundations of the theory of progress, and a seminal work on cultural and intellectual evolution. Turgot (1750 [1991]: 53) spoke of 'the enlightenment of man on the subject of the Divinity', and of the Christian faith which saved Europe from barbarism after the end of the Roman Empire. Enlightenment, for Turgot, was synonymous with the triumph of Christian, that is, European civilisation.

The whole world was a model of the rotation of stars; and Newton, who had explained one of the supreme mysteries of God's creation, was raised in the eyes of his admirers, to a kind of divine status. It was reasonable for Turgot, then, to conclude that all events, both social and political, move inexorably towards the same ends as do the stars:

Different events take place in different countries of the world and all of them, as if by so many separate paths, at length come together to contribute to the same end, to raise up once again the ruins of the human spirit. Thus, in the night, we see the stars rise one after the other; they move forward, each in its own orbit; they seem in their common revolution to bear along with them the whole celestial sphere and to bring in for us the day which follows them.
(Turgot, 1750 [1991]: 56)

Newtonianism replaced one God with another – Nature (Becker, 1932: 62-3). And if, as John Locke argued in his *Essay Concerning Human Understanding* (1689 [1997], 59), all knowledge was derived from sense perceptions (completely rejecting the Platonic belief in innate Ideas) then the highest aspiration was to harmonise one's self with nature, a concept

which then provides the basis for the Heavenly City of the Enlightenment philosophers.

Between Galileo's publication of his telescopic observations in 1610 and Newton's formulation of gravity in 1687 (which confirmed that the planets could move without any need to be pushed by divine beings) in his *Philosophiae naturalis principia mathematica*, the cosmos was stripped of its personality (Cassirer, 1951 [1979]: 9). One of the most substantial features of the changes brought about by the intellectual revolution of the 17th and 18th centuries was the depersonalisation of nature, or 'disenchantment' to use Max Weber's phrase (Weber, 1947: 139). The movements of planets like Venus and Mars across the night sky still offered visible evidence of an underlying order, but Venus was no longer the goddess of love and Mars lost its role as the bringer of war. Only mathematical formulae were left. God survived, but now he spoke through the laws of physics.

Newton's *Principia* was widely read. In fact, it was essential reading for all educated people and was to exert a particularly powerful impact on the European world view. The application of Newton's astronomy to the service of an atheist, mechanical, determinist, universe governed by one single law has been termed Newtonianism (Schaffer, 1996: 610-626; Hoskin, 1999: 130-167). The emerging idea of universal rights was embedded in the logic of what I call 'Political Newtonianism' (Campion, 2011: 599). The core principle held that, just as one single law governs the entire universe, so human society must also be governed by the same single law: no king should be above the law any more than any commoner, and the arbitrary exercise of political power was condemned as contrary to natural law. The political implications were profoundly radical and were articulated in what came to be known as Natural Rights philosophy: life, liberty and the pursuit of happiness were to be proclaimed natural, tyranny unnatural. This was the version of universal truth which inspired the founding fathers of the USA, providing a scientific framework for their quest for political equality (Becker, 1958: 59-60). For Thomas Paine, who did so much to persuade the Americans to break with Britain in 1776, the perfect order of the planets was a profound demonstration of the truth of God's natural creation, and, quoting the radical French aristocrat, the Marquis de Lafayette, he wrote how the truths which Nature had engraved on the heart of every citizen carried an innate love of liberty (Paine, 2003a: 191-2; Paine, 2003b: 207). Natural rights belong to people through the fact of existence and freedom is the default position of the Newtonian universe (Paine, 2003b: 217). And the force which manages society for the best, Paine said in 1776,

paraphrasing Newton in the very year that American independence was declared, is like a 'gravitating power' (Paine, 1986: 66). It is irresistible: it must succeed.

The myth of Newton the divine scientist became such a familiar part of conventional wisdom that the Count de Saint-Simon (1760-1825), one of the first socialist theorists, spoke of universities in his ideal state in religious terms as 'temples of Newton' (Pollard, 1971: 98). Saint-Simon's secretary and disciple, Auguste Comte (1798-1857), the founder of sociology, was to elevate Kepler, Galileo and Newton together as a divine trinity, symbolising in their combined careers one manifestation of the universal 'law of three' in human society (Comte, 1851 [1875]: Vol. I, 399-400). Sociology, as an academic discipline, then originated as an attempt to identify the operation of the same mathematical laws that moved the planets in the movement of people. It remains the ultimate expression of Newtonianism in the micro-management of human society.

3. PROGRESS THEORY

Such confidence was provided by Turgot's theory of progress, which was elaborated by the Marquis de Condorcet in the 1790s (Israel, 2014: 77). Condorcet was Turgot's biographer, and was deeply familiar with his arguments in favour of the improvement of society. He was elected first to the Commune of Paris when the revolution broke out in 1789, then to the Legislative Assembly in 1791, eventually becoming its President, and serving on a sub-committee of the Committee of Public Safety along with Robespierre. While hiding from the authorities in Paris he had composed his great manifesto on progress, published in 1795. Like others who experienced the Revolution, Condorcet saw how the world could change in a few days. He was a Newtonian, convinced that the entire universe operated according to a single set of laws, as evident amongst people as in the movement of the planets. 'The sole foundation for belief in the natural sciences' Condorcet (1795 [1955]: 173) wrote, 'is this idea, that the general laws directing the phenomena of the universe, known or unknown, are necessary and constant. Why should this principle be any less true for the intellectual and moral faculties of men than for the other operations of nature?' Time was historical, social and ceremonial, and manipulation of its symbols educated the masses in the ideals of the revolution. But his assumption that the timing of political and intellectual progress is tied to the revolution of the planets, suggests that history must follow its own course, and can neither speed up nor slow down. Paradoxically, human action is therefore limited in what it can achieve, be-

yond assisting history on its way. In spite of his own personal situation – on the run from the Jacobins – Condorcet (1795 [1955]: 173) was an incurable optimist:

Our hopes for the future state of the human species may be summed up in three important points: the elimination of the inequality between nations; progress in equality within the same peoples; and finally the real perfection of mankind.

The new universe gripped the imagination of many of the 18th century's leading thinkers, for whom the laws of astronomy were thought to contain the clues to a true understanding of human society. 'The *philosophes*', Graeme Garrard (2003: 17) wrote, 'wished above all to extend the scientific and philosophical revolution inaugurated by Galileo... Newton... and [Francis] Bacon, into society and politics'. More than any other astronomer or natural philosopher, Isaac Newton gave the 18th century its new, reformed cosmology of unity, predictability

and order and his discovery of gravity provided a single universal rule for the entire universe, one formula according to which all existence might be understood (Cassirer, 1951 [1979]: 9).

Newtonianism emphasised order, stability, regularity and the rule of a law under which all men were, in theory, equal. The universe was, above all, organised, and God's withdrawal, promoted by the Deists, from an intimate relationship with every individual to a distant, impersonal, role meant that the universe now was essentially self-regulating. But Newton's philosophy also held out the possibility that the current state of political disharmony, embodied in the arbitrary exercise of monarchical power, could be replaced by peace, freedom and harmony. Humanity, with the benefit of knowledge of the true working of the universe, was now perfectible, a revelation which was to underpin both the theory of progress and the development of science.

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