Cosmology, Chronology and Crises: trauma and the evolution of the universe in the nineteenth century.

By HOWARD CARLTON

A thesis submitted to the University of Birmingham for the degree of DOCTOR OF PHILOSOPHY

Department of History
School of History and Cultures
College of Arts and Law
University of Birmingham
July 2019

UNIVERSITY OF
BIRMINGHAM

University of Birmingham Research Archive

e-theses repository

This unpublished thesis/dissertation is copyright of the author and/or third parties. The intellectual property rights of the author or third parties in respect of this work are as defined by The Copyright Designs and Patents Act 1988 or as modified by any successor legislation.

Any use made of information contained in this thesis/dissertation must be in accordance with that legislation and must be properly acknowledged. Further distribution or reproduction in any format is prohibited without the permission of the copyright holder.

Contents

ABSTRACT 3

ACKNOWLEDGEMENTS 5

Chapter 1. Cosmology, Chronology and Crises: trauma and the evolution of the universe in the nineteenth century. 7

Chapter 2. “Tho’ world on world in myriad myriads roll”: how many revelations are required to redeem the entire universe? 37

Chapter 3. “And eddied into suns, that wheeling cast / The Planets”: the nebular hypothesis and progressive cosmogony. 110

Chapter 4. “And murmurs from the dying sun”: thermodynamics, theology and the North Britons. 179

Epilogue: Charles Darwin and the subtle interactions of psyche and soma. 233

Bibliography of Primary Sources 240

Bibliography of Secondary Sources 249

ABSTRACT

This thesis will argue that whilst the historiography of the development of scientific ideas in the nineteenth century has for some time acknowledged the important influences of social, cultural and material factors, and the recent turn to the history of emotions has further reinforced the influences of psychology and physiology on subjectivities, the significant impact of existential trauma, life threatening illness or bereavement on apparently objective intellectual thought processes may not have been fully recognised. The ideas of selected subjects with respect to the nature of the universe and the interlinked epistemologies of science, religion, metaphysics and ideology were sometimes materially altered by emotionally affective life-events as evidenced by their subsequent productions and their performances of altered selves.

Given that the historiography of geology and biology during this period is relatively voluminous, this work will focus on the somewhat less-studied views of people who opined on the structure, size and composition of the universe. The approach taken will be to explore three topics of great interest to nineteenth-century astronomers and physicists; the question of the possible existence of life on other planets, the deployment of the nebular hypothesis as a theory of cosmogony and the religiously charged debates about the ages of the earth and sun.

Evidence has arisen as a result of a close reading of the comments and narratives of the subjects and their biographers for the sometimes subtle and complex influences which influenced their thinking on these questions. In the course of studying such primary sources it became clear that they frequently referred to significant life crises which preceded important changes in their theological, metaphysical and scientific worldviews. A few notable cases of this ilk have already been clearly signposted by historians, but the case histories discussed below will provide a significant set of new examples of such affects and effects. We will uncover the stories of several such perspective-altering events and will further interrogate the available documents in order to study the relationships between psyche and soma thus revealed. Applying this suggested mode of interpretation to the broader field of nineteenth-

century scientific developments in general, we shall achieve a greater understanding of the underlying motivations which drove the intellectual history of that era and which are still relevant to today's knowledge-making processes.

ACKNOWLEDGEMENTS

I would like to record my gratitude to the people and institutions who provided generous advice and assistance during the development of this thesis.

Firstly I must thank my two supervisors, Dr. David Gange and Dr. Sadiah Qureshi, for their constant encouragement and their very welcome suggestions, corrections and thought-provoking interventions which have guided me through what was a lengthy but enjoyable gestation.

My thanks are also due to several people who have provided informed commentary in the form of occasional conversations, via email in some instances, or perhaps over a cup of coffee or glass of wine during a conference:

Simon Briercliffe

Dr. Nichola Campion

Professor Michael J Crowe

Professor Gowan Dawson

Dr. Eleanor Dobson

Dr. Michael Hoskin

Ruth Lindley

Dr. Lee MacDonald

Professor Matt Houlbrook

Professor Rosemary Mitchell

Dr. Joshua Nall

Dr. James Pugh

Professor Crosbie Smith

Professor Robert Smith

Professor Bennett Zon

I also want to acknowledge the assistance of the staff of the following institutions who facilitated the use of their respective archives:

- Clodd correspondence, Brotherton Library Special Collections, Leeds University.
- The Herschel correspondence in the library of The Royal Society.
- The archives of Birr Castle, Birr, Co. Offaly, Republic of Ireland.

Finally, I would like to record my special thanks to friends and family for their encouragement and interest and in particular to my wife Penny who has supported me in every way throughout the project.

Chapter 1. Cosmology, Chronology and Crises: trauma and the evolution of the universe in the nineteenth century.

> This world was once a fluid haze of light,
> Till toward the centre set the starry tides,
> And eddied into suns, that wheeling cast
> The Planets:
>
> Alfred Lord Tennyson, '*The Princess*'[1]

On a cold but unusually clear night in December 1845 a Scottish Professor of Astronomy positioned himself more than fifty feet above the ground at the mouth of a giant telescope in the midlands of Ireland. From his precarious perch John Pringle Nichol (1804 - 1859) peered through "the unsteadiness in the air" at a large nebula in the constellation of Orion in an attempt to determine whether it consisted mainly of gas or was totally composed of stars. "It was – owing to the incompleteness of the instrument and unfavourable weather – the first time that the grand telescope had been directed towards the mysterious object; […] I went in breathless interest to its inspection. Not yet the veriest trace of a star!"[2] What was the significance of this stellar absence? In Nichol's view it was an important proof of his conviction that the nebula, like the rest of the universe, was, is, and would in the future be in a state of evolution; a process which might well extend to infinite depths in both space and time.

This form of cosmology was opposed by conservative theologians who believed, on the contrary, that God had set the cosmos in place in its current state by means of a singular act of creation and quite possibly adhering to a Mosaic timescale. They "saw fit to launch" at developmental cosmogonists like Nichol; "the charge of impiety, and to regard all such speculations, in sober seriousness, as rebellion against the attributes and activity of God."[3] So was Nichol in fact a denier of religion, guilty as charged? Nichol had previously been ordained as a minister, but resigned from clerical

---

[1] A. L. Tennyson, 'The Princess' in K. Hodder (ed.), *The Works of Alfred Lord Tennyson* (London, 1994), pp. 227 – 303, p. 241. Also quoted by R. A. Proctor, *Saturn and its System* (London, 1865), p. 201.
[2] J. P. Nichol, *The Architecture of the Heavens* (London, 1850), p. 113.
[3] J. P. Nichol, 'Art. VI. State of Discovery and Speculation Concerning the Nebulae', *London and Westminster Review*, Apr. 1836-Mar. 1840; Jul 1836; 3, 2; pp. 390 – 409, p. 406.

orders following a period of serious health issues which prompted parallel changes of direction in his faith and his career choices:

> The same illness, and circumstances connected with it, brought about a change in his religious views; his mind was turned away from the Church of Scotland, after he had been for some years a licentiate and preached several sermons, and became more and more exclusively directed into the paths of Literature and Science. [4]

We can conclude, therefore, that Nichol suffered a severe somatic crisis prior to his divorce from the established church. He subsequently became first a professional and then a popular astronomer as well as maintaining, at least for a while, his existing interests in progressive politics, journalism and economics.[5] Nichol never returned to orthodox Christianity; a belief system to which he, in fact, may never have had a strong adherence. As we shall see in due course his religious views were more closely aligned to Unitarianism or possibly a form of panentheism. His resignation from the post of "Rector in Montrose" and subsequent separation from the Church of Scotland not only allowed him to exercise his private judgement with respect to religion but also to pursue his interest in evolutionary cosmology which would potentially have been at odds with the creationary conservatism of the Presbyterian establishment.[6]

Nichol's comments on his night of observing and the nature of the deity were published in 1850 at a time when he was about to be admitted to a hydrotherapy clinic in Yorkshire where his opiate

---

[4] W. A. Knight, *Memoir of John Nichol, Professor of English Literature in the University of Glasgow* (Glasgow, 1896) p. 9. Professor Knight was the literary executor of John Nichol, the son of John Pringle Nichol. Knight had access to a large amount of correspondence including a collection of letters from John Nichol to his wife which he collated in 1861 in the form of 'Leaves from my Life'. The first chapter of the *Memoir* consists of this journal and it includes the comments on John Pringle Nichol quoted above.

[5] S. Schaffer, 'The nebular hypothesis and the science of progress' in J. R. Moore (ed.) *History, Humanity and Evolution: Essays for John C. Greene* (Cambridge, 1989), pp. 131 – 164.

[6] Knight, '*Memoir*', p. 8. There has in the past been somewhat of an overstretched dichotomy in the historiography of Victorian science and religion in the form of the 'conflict thesis' and narratives which focused on an overall loss of faith. More recently, historians like John Hedley Brooke have endeavoured to bridge this gap by pointing out the interconnections between theology and other epistemologies in the minds of nineteenth-century subjects. See the discussion of John Hedley Brooke and related historiography which can be found in: T. Dixon, 'Introduction' in T. Dixon, G. Cantor and S. Pumfrey (eds.), *Science and Religion: New Historical Perspectives* (Cambridge, 2010) pp 1 – 19. Also see J. H. Brooke, *Science and religion: Some historical perspectives* (Cambridge, 1991) and J. H. Brooke and G. Cantor, *Reconstructing nature; the engagement of science and religion* (Oxford, 2000). Timothy Larsen has similarly re-evaluated the apparent prevalence of Victorian 'loss of faith' narrative and found many instances of reconversion to traditional theologies during this period. See: T. Larsen, *Crisis of doubt: honest faith in nineteenth-century England* (Oxford, 2006).

dependency was to be treated.[7] His thoughts were expressed in a popular publication, one of several produced during his career, in which he clearly saw the science of astronomy and his personal concept of religion not as 'non-overlapping magisteria' but as synergistic components of his intellectual and emotional life. Nichol had reacted to a life-threatening medical event with a significant shift in his espoused views on religion and an enhanced enthusiasm for a cosmogony no longer constrained by traditional Trinitarianism. It can also be inferred that Nichol may have begun his ultimately addictive relationship with opiates during this serious illness; a connection which may have provided an additional stimulus or source of inspiration for some of the epistemic shifts which he and other subjects of this thesis experienced.

Reformed constructions based on entangled epistemologies produced by subjects whose work was consumed by wider publics constitute the main source material for this thesis. Whilst scholarly attention since the 1980s has increasingly focused on the mutual interaction of fields of knowledge (most broadly, science and religion, or literature and science) the key intervention to be made here is to demonstrate that these important intersections still imply far too limited a vision of how individuals create their cosmologies. The ideas of selected subjects with respect to these interlinked spheres were sometimes significantly altered by emotionally affective life-events as well as by the specific cultural contexts in which they had been immersed, as evidenced by the multiple selves which they subsequently performed.

Given that the historiography of geology and biology and the ways in which they were interpreted in order to support or oppose formation processes which could be deemed to be consistent with a particular theological worldview is relatively voluminous, this thesis will focus instead on the somewhat less-studied views of those natural philosophers who opined on the structure, size and composition of the universe itself. It will also identify some of the ways in which astronomy both paved the way for deep time and also provided some empirical evidence thereof which could be set

[7] J. P. Nichol, *Memorials from Ben Rhydding: concerning the place, its people, its cures.* (London, 1852).

alongside the speculations of geologists.[8] Whilst most of the ensuing discussions will be concerned with objects and concepts which operate at cosmic scales, the discussion of the emerging role of energetics will introduce some parallel discussions of the nature of matter at very small scales.

By the early nineteenth century the telescopic investigations of, amongst others, William Herschel (1738 - 1822) had determined that the sun may only be an average star which is itself in motion across a vast amorphous sea of stars.[9] The divinely-ordained clockwork cosmos of Isaac Newton (1643 - 1727) had become worryingly irregular and much less anthropocentric. To a natural theologian like William Paley (1743 - 1805) the challenging implications of a disorderly and potentially metastable universe seemed to be inconsistent with his vision of a stable and well-ordered creation underlying a similarly static polity. Paley decided that astronomy, in his opinion, was "not the best medium through which to prove the agency of an intelligent Creator."[10]

Most nineteenth-century people continued to believe that the current state of the universe was the result of the working out of a divine plan, whether that was a one-time activity or an ongoing intervention, and that an understanding of the process required a combination of theological and philosophical inputs. It was thus reasonable to expect that the reaction of the subject to the cosmos would be both emotional and intellectual.[11] For a significant portion of the twentieth century, however, our understanding of nineteenth-century people was conditioned by the revisionism which began shortly after the close of the period in question. Taking their lead from the distancing of the Victorian other initiated by Giles Lytton Strachey (1880 - 1932) many commentators asserted that the middle-classes, in particular, were socially respectable, emotionally repressed and politically

---

[8] See, for example, C. C. Gillispie, *Genesis and Geology: the impact of scientific discoveries upon religious beliefs in the decades before Darwin* (New York, 1959) esp. pp. 41 – 72.
[9] M. A. Hoskin, 'William Herschel and the Construction of the Heavens', *Proceedings of the American Philosophical Society*, 133, 3 (Sep., 1989) pp. 427 – 433.
[10] W. Paley, *Natural Theology or Evidences of the Existence and Attributes of the Deity collected from the appearances of nature.* (Philadelphia PA, 1802), p. 215.
[11] See, for example, F. M. Turner, 'The late Victorian conflict of science and religion as an event in in nineteenth-century intellectual and cultural history', in T. Dixon, G. Cantor and S. Pumfrey (eds.), *Science and Religion: New Historical Perspectives* (Cambridge, 2010) pp. 87 – 110. The argument for an ontological turn in history in which we endeavour to better situate subjects in their contemporary cultural context has been recently argued by Greg Anderson. See G. Anderson, 'Retrieving the Lost Worlds of the Past: The Case for an Ontological Turn', *American Historical Review*, June 2015, 120, 3, pp. 786 – 810.

conservative to the point of dullness, with a strong belief in 'family values' which has led in due course to retrospective comparisons with the policies of Margaret Hilda Thatcher (1925 - 2013) in the 1980s.[12]

In the second half of the twentieth century, notwithstanding the Thatcher period, understandings of nineteenth-century society shifted in parallel with the contemporary liberalisation of social *mores*, leading to an increasing interest in the newly discovered richness and complexity of Victorian lives. The recent turn to the history of emotions has added to this impetus by helping us to understand the subtlety with which emotions can be moulded by society and experienced by the individual.

Early biographers of those Victorians who pursued the fundamental questions of the nature of the universe tended to characterise them as dispassionate and objective individuals who either cleaved to a single point of view throughout their careers or that any changes which did occur were as the result of the ebb and flow of rational thought and intellectual debate. From the 1960s onwards, however, historiography has increasingly focussed on the significant influences of social, psychological, cultural and material factors on the processes of scientific 'discovery'.[13] Thus, for example, Lorraine Daston has suggested that the 'doing of science' should always be understood as taking place within a 'moral economy':

---

[12] For brief summaries of the evolution of our ideas about Victorians see: D. Gange, *The Victorians: A Beginner's Guide* (London, 2016) pp. 5 – 12 and M. Sweet, *Inventing the Victorians* (London, 2001) pp. ix – xxiii. A more detailed discussion of the Victorian attributes of Thatcherism can be found in: S. Evans, 'Thatcher and the Victorians: A Suitable Case for Comparison?', *History*, October 1997, 82, 268, pp. 601 – 620.

[13] There is a wide range of available historiography which covers this field from Thomas Kuhn's concept of paradigm shifts onwards. A. S. Pang, *Empire and the Sun: Victorian Solar Eclipse Expeditions*, (Stanford, 2002) pp 4- 6, provides a brief overview of the post 1960s revisions of the history of science and the idea of 'social construction'. For more detailed discussions of the development of this topic see: T. Kuhn, *The structure of scientific revolutions* (Chicago, 1962), P. Medawar, *The art of the soluble: Creativity and originality in science* (London, 1967), B. Latour and S. Woolgar, *Laboratory Life: the Social Construction of Scientific Facts* (Princeton, 1979), K. Knorr-Cetina, *The manufacture of knowledge: an essay on the constructivist and contextual nature of science*. (Oxford, 1981), J. S. Rudwick, *The Great Controversy: the shaping of scientific knowledge among Gentlemanly specialists* (Chicago, 1985), S. Shapin and S. Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life* (Princeton NJ, 1985), W. E. Bijker, T. P. Hughes, T. Pinch, *The social construction of technological systems: new directions in the sociology and history of technology*. (Cambridge MA, 1987), B. Latour, 'On recalling ANT' in J. Law and J. Hassard (eds.) *Actor Network Theory and After* (Oxford, 1999) and L. Daston and P. Galison, *Objectivity* (New York, 2007).

> By examining in a new light just those ways of knowing once thought to exempt science from the realm of emotions and values, a study of moral economies may illuminate the nature of the rationality that seemed to exclude them.[14]

This thesis extends this emerging understanding by showing how developments in astronomy and the physical sciences during the nineteenth century were also closely entangled with the psychosocial, organic and physical contexts in which their progenitors were immersed. Whilst the emergence of significant new ideas did sometimes take the form of a relatively slow movement towards a new paradigm, there were other occasions when a subject underwent a rapid change of perspective which was in some ways analogous to the epiphanies found in preceding and contemporaneous religious tracts. Such conversion stories provided the narrative tropes which permitted people to relate their personal journey to a known archetype.

Examination of the contexts of these intellectual 'conversions' suggests that in many cases they were associated with a recent or concurrent crisis such as an episode of serious illness or injury. Whether illness and personal tragedy shaped changing theologies and cosmologies, or whether individuals drew on culturally available narrative formulae to explain their altered views, it is clear that the intellectual lives of nineteenth-century astronomers and physicists had a far more significant emotional component than had formerly been recognised.

One key result of exposure to such potent forces is the creation of a changed understanding of the universe wherein the existential concerns which arose when the individual contemplated the fate of the soul were often assuaged by the imagining of a divinely ordered cosmos capable of sustaining eternal human souls. Historical actors who had previously given significant thought to the nature of the universe maintained their post-traumatic physiological and psychological stasis by modifying their pre-existing epistemological set-points, especially their understanding of cosmogony. They were often motivated by their experiences to constitute a theistic universe in which the hoped-for fate of the soul could be seen to be consistent with the wider environment in which the subject understood that it existed. If such a paradigm shift subsequently led to increased performance of the 'outer forms' of

[14] L. Daston, 'The Moral Economy of Science', *Osiris*, (01/1995), 10, pp. 2 – 24, p 24.

their chosen church they would, as Daniel Lord Smail has argued, also be enabled to experience the psychotropic effects of "religion and ritual as sources of dopamine and other chemical messengers," [15]

One of the cases to be discussed, for example, is that of William Whewell (1794 - 1866). To date historians have attributed Whewell's shift to a newly minted denial of extraterrestrial biological plenitude in the early 1850s either to a distaste for a certain type of teleological argument or a dislike of the evolutionary views recently advanced in a popular publication. In Chapter 2 a new argument will be advanced that the heightened state of anxiety stimulated by the anticipated death of his spouse, which he experienced vicariously through the course of her worsening illness, was a primary motivating force for the reconsideration of his earlier views on pluralism.[16] At a time when he reasonably assumed that his wife, with whom he had a very close relationship, was destined to die shortly, Whewell wrote a book which was so at odds with his previous views and prevailing orthodoxy that he published it anonymously.

Chapter 4 will note that Crosbie Smith and Norton Wise, in their comprehensive 1989 treatise on the development of nineteenth-century ideas about energy, which included several re-evaluations of the ages of the sun and earth, have eloquently demonstrated the associations between the theologies of their chosen subjects and their thermodynamical theories.[17] This thesis will build on their work by identifying several significant life events which affected the same group of physicists and, it will be argued, were at times instrumental in producing contingent shifts in their subsequent choices of research topics and publications.

In the process of developing these case studies we will uncover further evidence that the construction of the self involves the integration of the overlapping domains of psyche and soma. Subjects can and do respond, sometimes unpredictably, to external and internal stimuli by drawing on the resources

---

[15] D. L. Smail, *On Deep History and the Brain* (Berkeley CA, 2008) pp. 184 – 185.
[16] See the discussion in Chapter 2 on the arguments advanced by John Hedley Brooke and Frederik Burnham to explain Whewell's evident change of mind on the subject of pluralism.
[17] C. Smith and M. Norton Wise, *Energy and Empire: A biographical study of Lord Kelvin* (Cambridge, 1989). C. Smith, *The Science of Energy: a cultural history of energy physics in Victorian Britain* (London, 1998).

available to them as they seek to perform coherent selves.[18] Thoughts and emotions do not arise in a vacuum but are influenced, sometimes strongly, by the physical and temporal environment of the thinker, resulting in the construction of a reflexive understanding of the working of the world. For convenience we shall label this holistic picture with the signifier *Weltbild*, a term which represents a more volatile and inclusive understanding of interiority than the alternative *Weltanschauung* (worldview) which might be understood to encompass only impersonal and rational perspectives.[19]

It is clearly useful to consider 'what else is going on' when attempting to decode the written or spoken productions of scientists and their interpreters in both the past and the present. Their apparently empirical pronouncements are evidently influenced by the state of their *Weltbilder*. This is not to say, of course, that the totality of the environmental factors which have been absorbed by, and will weigh upon, a twenty-first century person is not substantially different than that which would have impacted on a Victorian astronomer. Or, for that matter, to suggest that there is such a thing as a homogenous nineteenth-century 'mind', or even a predictable set of responses to the multiple factors at play.[20] As will become clear from the cases to be studied below, perceptions of a variety of philosophical and theological topics, including the origins of the universe and the nature of the deity, underwent significant shifts during this period as well as being differently interpreted by individual subjects.

The sources which inform a subject's *Weltbild* are many and varied but some common threads in the process of belief formation can be identified. Historians of emotion, such as William Reddy, Barbara Rosenwein, Jan Plamper and Rob Boddice have pointed out that there are hermeneutic feedback loops involved in the engagement of subjects with their social networks which lead to them evolving a

[18] S. Gunn, *History and Cultural Theory* (Harlow, 2006) pp. 133 – 136. Gunn presents the views of a variety of commentators including Anthony Giddens and Erving Goffman who, respectively, see identity as being a life-long project based on dramaturgical performances enacted by individuals and their associated social groups.
[19] Literally 'world picture' or conception of the world (German). See: M. E. Blum, *Continuity, Quantum, Continuum and Dialectic: the foundational logics of western historical thinking* (New York, 2006) p. 147: "The linguistic lexicon of the Weltbild, both in its nonverbal and verbal expression, is derived from culture, but in a more personally congruent sense than the more formal concepts of systems of thought which realize one's Weltanschauung."
[20] It remains, of course, an open question as to how similar or otherwise nineteenth-century selves were to our twenty-first century equivalents. See, for example, R. Hayward, *Resisting History: Religious Transcendence and the Invention of the Unconscious* (Manchester, 2008) pp. 3 – 4.

repertoire of selves with which to respond to the external environment and a shared vocabulary with which to describe their feelings.[21]

Some scholars have in addition suggested that emotional responses are developed via a process of 'psychological construction'.[22] It is becoming apparent that the developmental changes which occur during interactions between the individual and their psychosocial milieu are the third element in a triad of 'constructions' which combine to form our emotions and to allow the mind/body system to predict which emotion we are to experience next:

> The theory of constructed emotion incorporates elements of all three flavors of construction. From social construction, it acknowledges the importance of culture and concepts. From psychological construction, it considers emotions to be constructed by core systems in the brain and body. And from neuroconstruction, it adopts the idea that experience wires the brain.
>
> Body-budget predictions laden with affect, not logic and reason, are the main drivers of your experience and behaviour. [23]

Recent work in the field of neuroscience has demonstrated that the experience of consciousness and our sense of the existence of an embodied self are by-products of this allostasis maintenance system and are derived from the combination of the sensing of body state (interoception) and the unstable memories which inform a frequently unreliable personal history:

> The mind is a computational moment in a brain that creates a temporally continuous trajectory of neural activity, tasked with regulating a body in the world. [24]

---

[21] A brief introduction to this subject can be found in: J. Plamper, 'The History of Emotions: An Interview with William Reddy, Barbara Rosenwein, and Peter Stearns', *History and Theory* 49 (May 2010), pp. 237 - 265. Lengthier texts which provide a general survey of this field include: W. Reddy, *The navigation of feeling: a framework for the history of emotions* (Cambridge, 2001), R. Boddice, *The History of Emotions* (Manchester, 2018) and B. H. Rosenwein and R. Cristiani, *What is the History of Emotions?* (Cambridge, 2018).

[22] Boddice, *Emotions,* pp. 132 – 167.

[23] L. Feldman Barrett *How Emotions Are Made: The Secret Life of the Brain* (London, 2018) pp. 35, 285. For a meta-analysis of a range of studies which provides empirical support for the psychological construction hypothesis see: K. A. Lindquist, T. D. Wager, H. Kober, E. Bliss-Moreau, and L. Feldman Barrett, 'The brain basis of emotion: A meta-analytic review.', *Behavioral and Brain Sciences*, 35, 3, June 2012, pp. 121 – 143.

[24] J. Benjamin Hutchinson and L. Feldman Barrett, 'The Power of Predictions: An Emerging Paradigm for Psychological Research', *Current Directions in Psychological Science,* (June 2019) 28, 3, pp. 280 – 291, p. 287. For a more recent summary see: A. K. Seth and M. Tsakiris, 'Being a Beast Machine: The Somatic Basis of Selfhood', *Trends in Cognitive Sciences,* November 2018, 22, 11, pp. 969 – 981.

Another key finding is that the mind/body system constantly runs a heuristic model which simulates the expected behaviour of both the exterior and interior worlds, even when external stimuli are minimal, using actual outcomes to improve its predictive power. "Emotions are constructions of the world, not reactions to it." This prediction process is used to anticipate future emotional states and their associated physiological needs and thus to mediate the combination of affect and cognition which has recently been associated with the signifier 'cogmotion'.[25] The cognitive component generates a retrospective narrative of the way in which events appeared to unfold, supplying a veneer of rationality and morality which overlays our private intentions.[26]

This emerging explanation of the ways in which the prediction of emotions also drives mentation can be understood as the biological correlate of what we have here labelled *Weltbild*. There is a further implication that the *Weltbild* does not represent a unitary coherent self, there are instead multiple partial selves. This statement actually has two different interpretations, both of which are valid. On the one hand we have the functional (or vertical) set of interacting components studied by psychologists; "the self is not a single, unified entity. Rather, it is a set of interrelated, functionally independent systems."[27] On the other hand we also acknowledge the multiple (horizontal) partial selves which underpin what cultural historian interpret as "constructions of identity" interpolated from "the public narrative forms and social practices through which personal accounts are composed".[28]

The process of forming these selves is informed by a variety of external sources of apparently stable, but in practice malleable, information about the environment in which the subject finds itself. In Thomas Dixon's comprehensive history of the study of emotions in the nineteenth century he noted that there are three important components of an individual's construction of the world:

---

[25] L. Feldman Barrett, 'The theory of constructed emotion: an active inference account of interoception and categorization', *Social Cognitive and Affective Neuroscience*, 2017, pp. 1 – 23, p. 16. A. K. Seth, 'Interoceptive inference, emotion, and the embodied self.', *Trends in Cognitive Sciences*, 17, 11 (2013) pp. 565 – 573. Boddice, *Emotions*, p. 96.

[26] M. Roper, 'Splitting in unsent letters: writing as a social practice and a psychological activity', *Social History*, 26, 3, October 2001, pp. 318 – 339, pp. 319, 323 - 324.

[27] S. B. Klein and C. E. Gangi., 'The multiplicity of self: neuropsychological evidence and its implications for the self as a construct in psychological research', *Ann. N.Y. Acad. Sci.* 1191 (2010) pp. 1–15, p. 1. doi:10.1111/j.1749-6632.2010.05441.x.

[28] Roper, 'Splitting', p. 319.

> … assumptions about the nature of reality (ontological commitments), assumptions about how best to acquire knowledge about reality (epistemological commitments) and commitments to particular textual and metaphorical resources as the best way to articulate knowledge of reality (narrative and explanatory commitments).[29]

Clearly there are multiple choices which can be made at all three levels, but it would seem *a priori* reasonable to suppose that individual subjects will seek some level of consistency between these three elements. The selection of sources to be employed and selves to be performed is, however, clearly impacted by the affect of a significant life event and it is also evident that for most of our subjects a change in one axis of Dixon's triad sooner or later produced consequent effects in other domains. Whewell, for example, when influenced by the distressing circumstances of his wife's illness undertook a metaphysical shift to a position in which the salvation of Man was the primary purpose of the creation. In order to accommodate this view of final causes he was quite willing to alter previously held views on such cosmological topics as pluralism and the nebular hypothesis as well as performing a more overtly religious self in his private conversations and writings.

Although Dixon's categorisation of "commitments" focusses on science and religion, it should not be overlooked that there are other epistemological elements which should come into consideration. Political views, for example, would generally be expected to be related to the other elements of the subject's overall *Weltbild* in the same way as the broad alignment of theology and cosmology.[30] There are, however, no hard and fast rules which can be applied in this context. As Larsen has observed with respect to doubters who felt that their faith had been incompatible with their politics; "reconverts often reassessed their assumption that the cause of radical politics and the working classes naturally led on to opposition to Christianity. An encounter with a figure such as F. D. Maurice, for example, could do much to dissolve such an assumption."[31]

---

[29] T. Dixon, *From Passions to Emotions: The Creation of a Secular Psychological Category* (Cambridge, 2003) pp. 239 - 240.

[30] The role of affect in driving ideology has recently been discussed by several scholars, including the social theorist Brian Massumi and the historians Daniel Lord Smail and Lynn Avery Hunt. See, for example, R. Leys, *The Ascent of Affect: Genealogy and Critique* (Chicago, 2017) pp. 308 – 309, 335 – 342.

[31] Larsen, *Crisis*, p. 243.

The subject's ideological stance may, of course, undergo rapid transitions particularly in times of societal crisis such as war and famine, or of personal stressors including incarceration and physical maltreatment. Such rapid shifts, however, should be read against a background in which changes in political thinking are usually slow running processes. Recent studies in social psychology have shown that two of the key factors which need to be considered in this context are the combinatory effects of age and peer group behaviour.[32]

In a process which we might term 'social dialectic' most of our horizontal selves are both informed by and performed in contexts in which the individual subject interacts with others, often in the context of what Rosenwein has defined as 'emotional communities'.[33] Such loose coalitions provide the vocabulary, the repertoire of actions and the expected emotions from which the subject consciously or unconsciously selects a self or selves to be played out. Even a solo subject, such as a letter or sermon writer, performs against a background of anticipated outcomes and may move between multiple selves whilst composing a single communication.

The written sources which are available for our examination were almost all produced with one or more specific audiences in mind and those audiences, in turn, possessed pre-existing concepts of how a variety of document types should unfold.[34] A personal memoir or diary, for example, records a set of moments of time which have been selected, re-ordered, expanded or contracted to suit the author's purposes. Reading across from such heterogenous texts, as Kali Israel has pointed out, is like peeling apart a piece of fruit, exposing many segments which complement rather than negate each other; a process which "cannot end in reassembly. […] Resisting false closure offers more, not less, knowledge and pleasure."[35] All of the available sources have undergone such a process of selection,

[32] For a comprehensive discussion of the effects of peer groups and chronology on political views see: D. F. Alwin, R. L. Cohen and T. M. Newcomb, *Political Attitudes over the Lifespan: The Bennington Women after Fifty Years* (Madison WI, 1991).
[33] Plamper, 'Interview', pp. 249 – 261. Rosenwein and Cristiani, *Emotions*, pp. 39 – 45.
[34] Roper, 'Splitting', pp. 329 – 330.
[35] K. Israel, *Names and Stories: Emilia Dilke and Victorian Culture* (Oxford, 2002) p. 18.

both in terms of recall and in the editing of the material. They should therefore be examined in terms of what is missing just as much as what is present.[36]

In a similar vein, Beverley Southgate has used his analysis of the work of Virginia Woolf (1882 - 1941) to demonstrate that Woolf argued for "a new type of history – a history that is admittedly fictive, and that readily accepts the inevitability of imaginative inputs from authors imposing their own coherence." Southgate asserts that Woolf anticipated Hayden White (1928 – 2018) by half a century in pointing out that, like other authors, historians edit the past by picking out the key moments which they feel best outline a storyline which suits their purposes:

> … historians do not find their stories in the past, but need to invent a story in order to make any sense of that past and give it the form of a narrative with a beginning and middle and end.

Woolf also expressed her frustration that our understanding of interiority is constrained by both the limitations of available language and by the palette of ideas and emotions to which the reader has access. Many of the possible selves, which Woolf in *Orlando* numbered in the thousands, can be considered as being as indeterminate as a quantum wave function prior to interaction with an observation. Some nascent forms of the self may only materialise in unusual or especially formalised contexts such as the "highly mannered performances of identity" outlined in Matt Houlbrook's account of interwar libel trials.[37]

One highly relevant type of self which was accessed by the subjects of this thesis was that associated with terminal illness; a common phenomenon in Victorian life. This was an era in which even middle and upper class British families experienced higher rates of infant mortality and early adult death,

---

[36] C. Steedman, *An Everyday Life of the English Working Class: Work, Self, and Sociability in the Early Nineteenth Century* (Cambridge, 2013) pp. 10 – 11.

[37] B. Southgate, '*A new type of history': fictional proposals for dealing with the past* (London, 2015) pp. 88, 77, 82 – 86. M. Houlbrook, 'Commodifying the Self Within: Ghosts, Libels, and the Crook Life Story in Interwar Britain', *The Journal of Modern History*, 85 (June 2013) pp. 321 – 363, p. 358. Both Southgate (p. 88) and Houlbrook (pp. 325 – 326, 362) argue that the advent of psychoanalysis in the 20th century uncovered further possible forms of the self and the proliferation of 'modern' personal narratives based on probing examinations of interiority.

primarily due to infectious disease, than is the case for more recent populations in the global north.[38] As a consequence the expected emotional responses of the soon-to-be departed and the bereaved were well documented and understood by ”the educated English reader”:

> Conventions associated with *ars moriendi* (art of dying), familiar to the educated English reader from Jeremy Taylor's Holy Dying (1651), were deeply rooted in the corporate memory of the faithful, and provided nineteenth-century novelists with excellent material on which to work.[39]

One widely-read novelist who imagined a variety of sentimental deaths and affective death-bed scenes for his readers was Charles Dickens (1812 – 1870) whose own traumatic brush with death will be re-evoked in Chapter 4. Depending on the religious beliefs of the bereaved, the passing of a loved one, such as the demise of Little Nell in *The Old Curiosity Shop*, could be seen to be an almost welcome event, bringing relief to their suffering whilst holding out the promise of a passage to a higher plane of existence and a future joyful reunion.[40]

Responses to bereavement have been identified by Patricia Jalland and Dixon as having played into available discourses of religious conversion or unconversion which provided templates for the individual's performance of grief and resolution. Both historians have pointed to, amongst other exemplars, the experiences of Archbishop Archibald Campbell Tait (1811 - 1882) and his wife Catherine (1819 - 1878, née Spooner) who responded to the deaths of their children with abundant evidence of grieving but at the same time with a level of stoic acceptance; seeing in these events the mysterious working out of God's plan and assuming that they would in due course be reunited with the departed.[41] This is a theodicy which can be seen to parallel the emotional journey undertaken by William Whewell who, as noted above, evinced a strengthening of the performance of his religious self in the early 1850s, a few years before the tragedy which befell the Tait family.

---

[38] T. Dixon, *Weeping Britannia: Portrait of a Nation in Tears* (Oxford, 2015) pp. 158 – 159. For a discussion of mortality rates see: T. McKeown and R. G. Record, 'Reasons for the decline of mortality in England and Wales during the nineteenth century', *Population Studies*, (1962) 16, 2, pp. 94 - 122.
[39] M. Wheeler, *Heaven, Hell, & the Victorians* (Cambridge, 1994) p. 32. Dixon, *Weeping*, pp. 153 – 154.
[40] Wheeler, *Heaven*, pp. 31 – 50.
[41] P. Jalland, *Death in the Victorian Family* (Oxford, 1996) pp. 127 – 139, Dixon, *Weeping*, pp. 159 – 162 and Wheeler, *Heaven*, pp. 48 – 50.

Victorian performances of illness in general included a variety of syndromes which a later reader may struggle to identify due to differences in the medicalisation of ambiguous conditions and changes in diagnoses, treatments and terminology. We shall encounter in due course two instances of women who suffered from unnamed, debilitating, and ultimately fatal illnesses; Cordelia Whewell (1803 – 1855, née Marshall) and Margaret Thomson (1827 – 1870, née Crum).[42] They may well represent just two instances of the many nineteenth-century people who suffered from tuberculosis, generally referred to as 'consumption', a frequent cause of death at this time and assumed, incorrectly, to be more prevalent amongst 'frail' women.[43]

Tuberculosis, also known as phthisis or the 'white death', had complex effects not all of which were viewed negatively by contemporary society. It often produced an ethereal and attractive paleness in its victims; an attribute which had been considered desirable by Romantic poets and was a probable cause of the "pale, fragile beauty" of the pre-Raphaelite model and laudanum user Elizabeth Eleanor Siddall (1829 - 1862). The patient, especially if "more affluent and genteel", could survive for many years during which the disease peaked and declined until it either proved fatal or went into remission. "But neither virtue nor wealth guaranteed protection against tuberculosis, so the disease acquired one of its most persistent attributes: an aura of sacrifice and atonement." In a nineteenth-century context this attitude of resignation could easily be read as religious affect, a noticeable aspect of the story of Cordelia Whewell.[44]

An important resource which was also available to the seriously ill subject was the stock of conversion stories. These had been popularised by late eighteenth-century religious groups including the Methodists, evangelical Anglicans and Scottish Calvinists. They generally contained a narrative arc in which a trigger event or reception of a narrative (such as a sermon or an 'improving' book) was

[42] There is a significant historiography of attitudes to women's health and treatment methods in the nineteenth century. See, for example: B. Meyer, 'Till Death Do Us Part: The Consumptive Victorian Heroine in Popular Romantic Fiction', *The Journal of Popular Culture*, 37, 2, 2003, pp. 287 – 308, A. Wood, '"The Fashionable Diseases": Women's Complaints and Their Treatment in Nineteenth-Century America', *The Journal of Interdisciplinary History*, 4, 1, The Historian and the Arts (Summer, 1973), pp. 25 - 52 and E. L. Bassuk, 'The Rest Cure: Repetition or Resolution of Victorian Women's Conflicts?', *Poetics Today*, vol 6, no 1/2, *The Female Body in Western Culture: Semiotic Perspectives* (1985) pp. 245 – 257.
[43] K. Byrne, *Tuberculosis and the Victorian literary imagination* (Cambridge, 2011) pp. 30 – 38.
[44] T. Dormandy, *The White Death: a history of tuberculosis* (London, 1999) pp. 85 – 100, 51, 61 – 62.

followed by a lengthy period of reflection leading to a declaration of new or renewed faith. The interiority of the subject at the moment of conversion was usually not examined; "Surprisingly, however, the moment of conversion is often unrepresented in the text. Conversion takes place offstage, constituting a narrative gap or silence."[45]

Unconversion narratives, on the other hand, were relatively unknown at the beginning of the century but began to be popularised later in the period. They tended to detail a similar lengthy soul-searching process in which a tortured individual eventually comes down on the side of doubt. Notable examples of this genre included *The Nemesis of Doubt* (1849) and *Robert Elsmere* (1888).[46] Timothy Larsen has argued that the increasing number of 'loss of faith' narratives in the latter part of the period may be more of a reflection of the concerns of contemporary Christians who had similarly undergone or were undergoing a personal crisis of belief. There was in fact a significant number, less noticed in recent literature, of reconversions in the same period.[47]

This thesis supports the argument that the performance of a conversion or unconversion trope was often prompted by physiological and emotional stimuli, but builds on this paradigm by providing further support for the idea of an accompanying reformation of the *Weltbild* into a new picture of the wider environment often leading to paradigm shifts in more than one epistemology. Perhaps the currently best known and most frequently quoted instance of such a change is the case of Darwin who, following the death of his daughter 'Annie' (Anne Elizabeth Darwin, 1841 – 1851), seems to have experienced a significant loss of religious faith.[48] This unconversion process is claimed by some writers to have motivated his desire to document his hypothesis that biological evolution proceeds via a process of natural selection and does not require divine intervention, although the progenitor of the 'Darwin and Annie' discourse was suitably cautious about the contingency implicit in this argument:

---

[45] B. Hilton, *The Age of Atonement: The Influence of Evangelicalism on Social and Economic Thought 1785-1865* (Oxford, 2001) pp. 8 – 10. E. Y. Koh, *The Victorian Religious Novel: Conversion, Confession, and the Marriage Plot*, PhD Thesis submitted to Rice University (Houston TX, 2011) pp. 35 – 40.
[46] N. Vance, *Bible and Novel: Narrative Authority and the Death of God* (Oxford, 2013) pp.135 - 160. B. Lightman, '*Robert Elsmere* and the Agnostic Crises of Faith.', in R. J. Helmstadter and B. Lightman (eds.) *Victorian Faith in Crisis*. (London, 1990) pp. 283 – 311.
[47] Larsen, *Crisis,* pp. 10 – 17.
[48] See, for example: Jalland, *Death,* pp. 343 – 349 and Dixon, *Britannia,* p. 197.

> Further research will show how far the events surrounding Darwin's loss of faith subsequently influenced his personal life and his science.[49]

Unlike the example of Darwin, the histories of the subjects in question will not turn critically on the actual loss of a close family member. In most instances discussed below the *Weltbild* shift which is to be considered is contingent upon a significant injury or illness which would have produced an existential crisis in the mind of the patient with a consequent impact on their perception of their own mortality.[50] As the earlier quotation from Michael Wheeler's work pointed out, terminal crises in which the reality of mortality and the proximity of death have become evident to the subject often created the *mise en scène* for a significant change of espoused opinion in matters theological in the form of a deathbed conversion.[51] If the individual died shortly thereafter it is evidently impossible to determine what other *Weltbild* shifts might have occurred in the aftermath of the crisis.

The stress brought about by emotions of this intensity will undoubtedly also have caused significant changes in their physiological environment, including the production or suppression of naturally occurring neurotransmitters and hormones, in such a way as to materially affect the emotion prediction processes discussed above. In addition to these internal biochemical changes, several cases will be discussed in which it will be shown that the subject's experience of a life-changing event was accompanied by the consumption of psychoactive drugs. It is worth noting at this point that the nature of the possible interactions between psychotropic stimulants and neuroplasticity has recently become

---

[49] J. R. Moore in 'Of Love and Death: why Darwin "gave up Christianity"' in Moore (ed.) *History*, pp. 195 – 229, p. 221. See also: J. H. Brooke, 'Darwin and Religion: Correcting the Caricatures', *Science & Education* (2010), 19, pp. 391 – 405, p. 396. doi:10.1007/s11191-009-9211-9. This discourse will be further discussed in the epilogue of this thesis.

[50] For a contemporary example of this type of reaction see: A. Gawande, *Being Mortal: Illness, Medicine, and what matters in the end* (London, 2014) p. 95 ff, "But [Laura L.] Carstensen [a psychologist who is perhaps best known for her work on socioemotional selectivity theory] had her own reason for thinking that one's personal perspective might be centrally important—a near-death experience that radically changed her viewpoint on her own life." A somewhat different example can be seen in computing pioneer John von Neumann (1903 - 1957), who sought to "synthesize computer science and neurobiology" at the same time as "his rediscovery of Roman Catholicism, shortly before his death of pancreatic cancer." A. Jasanoff, *The biological mind: how brain, body, and the environment collaborate to make us who we are* (New York, 2018) pp. 36 – 37.

[51] Such a deathbed conversion was claimed in the case of Darwin. It was denied by the family at the time and is not now seen as a convincing narrative. See S. J. Gould, *Darwin's island: The Galapagos in the garden of England.* (London, 2009) p. 2, quoted in Brooke, 'Darwin', p. 392.

a significant sub-project within the emotional turn to which Smail has made a major, but contested, contribution.[52]

This thesis will provide further evidence for the existence of epistemic responses to then available pharmaceutical compounds. As we shall see in subsequent chapters the use of opiates was widespread throughout the nineteenth century and even after Pharmacy Act of 1868 they continued to be widely prescribed as painkillers, being regarded as less hazardous than some of the other substances controlled by the legislation.[53] Opiates were used by significant sections of the working population as well as by Romantic authors including John Keats (1795 - 1821), Lord Byron (1788 – 1824), Sir Walter Scott (1771 - 1832), Branwell Brontë (1817 - 1848) and Thomas De Quincey (1785 - 1856).

In the case of Percy Bysshe Shelley (1792 - 1822) his usage might conceivably be classed, and was claimed by him, as therapeutic, whereas the consumption of quite prodigious quantities of laudanum by Brontë and De Quincey can only be seen as having been recreational and potentially inspirational in nature at a time when it and similar opiates were believed by some to be 'stimulants'. "Opium distorted perceptions of time and space and heightened emotional experience, something that strengthened its appeal to the Romantics."[54] In *Confessions of an English opium-eater*, for example, Thomas De Quincey noted that the effects of opium consumption included the opening up of a "theatre […] which presented nightly spectacles of more than earthly splendour.":

> Space swelled, and was amplified to an extent of unutterable infinity. This, however, did not disturb me so much as the vast expansion of time; I sometimes seemed to have lived for 70 or 100 years in one night; nay, sometimes had feelings representative of a millennium passed in that time, or, however, of a duration far beyond the limits of any human experience.[55]

---

[52] Daniel Smail made a significant intervention with his concept of neurohistory in: Smail, *Brain*. Other historians have expressed a concern that although Smail's work is potentially of great value, his references to a fixed palette of basic emotions is unappealing. For a summary of current views see: L. S. McGrath, 'History, Affect, and the Neurosciences', *History of Psychology*, (2017), 20, 2, pp. 129 – 147 and Boddice, *Emotions*, pp. 155 – 164.

[53] V. Berridge, *Opium and the People: Opiate Use and Drug Control Policy in Nineteenth and early Twentieth Century England* (London, 1999) pp. xviii – xxi, 64 – 66, 113 - 122. The main purpose of the 1868 Act seems to have been to develop a form of 'closed shop' for professional pharmacists.

[54] Ibid, pp. 21 – 37, 49 – 61. R. J. Evans, *The Pursuit of Power: Europe 1815 - 1914* (London, 2016) p. 449.

[55] T. De Quincey, *Confessions of an English opium-eater*, Second Edition (London, 1823) pp. 158 – 160.

It is evident therefore that a significant number of nineteenth-century artists and writers, in common with many others in the population, regularly resorted to opium in its various forms, for a mixture of medical, recreational and inspirational reasons. Like the "Lotos-Eaters" described by Alfred Lord Tennyson (1809 - 1892) they from time to time languished in states of lethargy whilst experiencing sybaritic visions infused with distorted perceptions of space and time accompanied by the dissolution of the self.[56]

One of the earliest academics who self-identified as a psychologist, William James (1842 - 1910), also noted a possible connection between such feelings of transcendentalism, which might be interpreted as religious experiences, and the use of "mind-altering drugs". In this discussion he included his own reaction to exposure to nitrous oxide, commenting that it had made Hegel's works at last appear to be accessible to him:

> What reader of Hegel can doubt that that sense of a perfected Being with all its otherness soaked up into itself, which dominates his whole philosophy, must have come from the prominence in his consciousness of mystical moods like this.[57]

James thus added an autobiographical flavour to the not entirely novel idea that psychotropic substances could act as a catalyst for feelings of religiosity and sublimity.[58]

The consequences of opiate use, whether deliberately sought out or occurring as a side-effect of its employment as an anaesthetic, can be retrospectively recognised as a causative agent in several of the *Weltbild* changes to be discussed in this thesis. Nichol, following his course of hydrotherapy, was quite open about the "muscular and intellectual" benefits of opium:

> And it endowed me with such strength besides, - power alike muscular and intellectual. Prostrate, as I might be, racked by pain, mind and body exhausted and prone - hand me

---

[56] A. L. Tennyson, 'The Lotos-Eaters' in Hodder (ed.), *Works*, pp. 93 – 97. There are reasonable grounds to suppose that the members of Odysseus' crew who sojourned in the land where "the poppy hangs in sleep" (l. 56) reflect Tennyson's concerns about the negative effects of opium eating which he had observed in his father and brother. See, for example, C. B. Stevenson, 'The Shade of Homer Exorcises the Ghost of De Quincey: Tennyson's "The Lotos-Eaters"', *Browning Institute Studies*, vol 10 (1982), pp. 117 - 141.

[57] W. James, *The varieties of Religious Experience: a study in human nature, being the Gifford lectures on natural religion delivered at Edinburgh in 1901-1902* (London, 1902) pp. 257 – 259.

[58] For a more extensive discussion of the connections between psychoactive drugs and religious experiences see, for example: S. Plant, *Writing on Drugs* (New York, 2001) pp. 93 – 118 and A. Huxley, *The doors of perception; and, Heaven and hell* (Harmondsworth, 1959).

> that draught, and in one quarter of an hour I could face any danger, and contend with all difficulty.[59]

We will also note in the case of William Thomson (1824 - 1907) that he was subjected to a mixture of psychotropic substances during a serious injury and at a time when we can reasonably assume that he came to understand his own body to be a site which demonstrated the inevitability of increasing entropy. This personal example of the cosmic dissipation implicit in his new thermodynamics was followed, perhaps unsurprisingly, by a deeper engagement with questions about the scale of time and the nature of the universe. Such a contingency cannot be absolutely proven retrospectively, but the circumstantial evidence for such a linkage will be shown to be worthy of further investigation.[60]

Through the course of this thesis there will be a number of opportunities to identify the key influences on some significant contributors to nineteenth-century astronomy and physics and to see how these inputs played out in the selection and presentation of their ideas. One of the key characteristics in the lives of our 'few' chosen individuals, however, is that unlike the 'many' who were their contemporaries and predecessors they had the opportunity to inhabit more than one emotional community, being in most cases engaged in overlapping disciplines which were at that time taken to be complementary rather than competing. A well-educated middle-class person was usually a member of several such groups simultaneously and thus would perform the multiple selves which were relevant to varying sites of social interaction.

Some of the key constructors which play out over the lifetime of most human beings are the systems of belief inculcated both deliberately and inadvertently by parents, other family members and educators. Ideas and language, if not actual new beliefs, come from the several sets of peers who were accumulated as a result of membership of one or more emotional communities. One important overlap which applied to most of our subjects was the intersection between religion and higher

---

[59] Nichol, *Ben Rhydding*, p. 4.
[60] Boddice, *Emotions,* pp. 39 - 40.

education. In the early nineteenth century many graduates with an interest in natural philosophy had also been ordained in one of the established churches. As Frank Turner put it:

> Since the seventeenth century the parson-naturalist and the academic clergyman-scientist had played a major and by no means inglorious role in British science, as the names of John Ray, Joseph Priestley, John Stevens Henslow, Adam Sedgwick, and William Whewell attest.[61]

Many university graduates retained a close link with the church, often acting as ordained ministers in addition to their 'primary' vocation. Clerics, because of their role as gatekeepers to a higher power, held a privileged status, regardless of their class background. "Socially, by their University education, and their relations with the gentry, the clergy as a body stood a class apart".[62] This ongoing relationship also constituted an instance of what Reddy has called an 'emotional refuge'; a group of people and a set of rituals which provided "safe release from prevailing emotional norms and allows relaxation of emotional effort,"; a concept which is physiologically reflected in Smail's idea of the psychotropic effects of religion.[63]

An important cultural resource which may well have been derived from their experience of church-going and which was of great value to several subjects in staking a claim to authority and authenticity was that of public performance. We learn from secondary sources that some of our 'actors' were equipped with performative selves which were able to generate or simulate the external evidence of their emotions and thus provoke an empathic response in their audiences through a shared representation of the intended feeling.[64] That a rather inexperienced practical astronomer like Nichol was capable of attracting and holding the attention of large publics, both in person and in print, was clearly the result of an ability, established at an early age, to fascinate and inspire others by virtue of

---

[61] F. M. Turner, The Victorian Conflict between Science and Religion: A Professional Dimension, *Isis*, 69, 3 (Sep., 1978), pp. 356 - 376, p. 364. For a Scottish perspective see also: Smith, *Science*, p. 5.
[62] G. M. Young, *Victorian England: Portrait of an Age* (London, 1936) pp. 63 – 64.
[63] Reddy, *Navigation*, p. 129, quoted in Boddice, *Emotions*, p. 76.
[64] C. D. Drinko, *Theatrical Improvisation, Consciousness, and Cognition* (New York, 2013). B. C. Bernhardt, and T. Singer, 'The neural basis of empathy', *Annual review of neuroscience*, 35 (2012) pp. 1 – 23.

the affective verbal and non-verbal grace notes which accompanied his expansive explanations of the 'new astronomy'.[65]

Another topic which has attracted much historiography and to which this thesis is endeavouring to make a useful contribution is the relationship between Victorian science and religion. As the century progressed the polychromatic nature of the roles of 'amateur' scientists began to diminish whilst their specific disciplines began to be more clearly recognised by the creation of funded posts in academia or industry. Turner's thesis is that the evolving separation between the profession of science, driven in part by the development of state education, and some of the more evangelical members of the clergy was one of the primary drivers underlying the late nineteenth-century narrative of a 'war' between science and religion in the mid-to-late Victorian period.[66]

Historiography has now moved far from the reductive characterisation of this supposed conflict and towards a relatively complex account of the political, metaphysical and religious contexts in which many books, papers and lectures which we would now broadly term 'scientific' were constructed. In due course it will be further demonstrated that the subtly shifting relationship between science and religion, including their relative epistemic authorities, acted as important social and psychological constructors which coloured the responses of various subjects to emotionally freighted stimuli.

In the context of the subject's response to existential crises, religion was of course a primary source of emotionally charged narratives which provided causal explanations for the divine origins of misfortune as well as reasons to be hopeful, or in some cases doubtful, about the future wellbeing of body and soul. Such theodicies have been examined from the latter part of the twentieth century onwards by psychologists who are attempting to understand the subtle interactions of psyche and soma i.e. the relationship between the interior processing of subjects and their external, more visible, selves who exhibited symptoms of illness, distress and adjustment to crises. This work has uncovered several possible correlations, usually positive but sometimes negative, between religious faith and

[65] See discussion of Nichol's success as a popular astronomer in Chapter 3.
[66] Turner, 'Victorian Conflict'.

welfare. A typical such study, in this case into recovery periods following bereavement, provides some evidence of a positive correlation:

> People reporting no spiritual belief had not resolved their grief by 14 months after the death. Participants with strong spiritual beliefs resolved their grief progressively over the same period. People with low levels of belief showed little change in the first nine months but thereafter resolved their grief.[67]

Other recent findings in social psychology underscore the salience of religious coping as a resource for people who, like our nineteenth-century subjects, were struggling with illness and other critical life events. Summarising the results of several such field studies Richard Tedeschi and his co-workers concluded that:

> The experience of having a life-threatening illness can help patients put their life in perspective, stimulate a new appreciation of and closer relationships with family and friends, renew patients' religious faith, and foster a greater appreciation of nature.[68]

Psychologists and historians are not the only scholars who have endeavoured to understand these nuances of faith and response. The question of how a major trauma may impact religiosity has been studied as much for the potential practical and beneficial, or otherwise, effects of faith on healthcare outcomes. Such research is clearly of great interest to medical practitioners, including clinical psychologists and palliative medicine specialists.[69] But it is also of great value when considering the narrative arcs of the subjects of this thesis.

A common nineteenth-century trope, which is still very much present as a coping mechanism today, was to take a more optimistic view of God's plans and of the probability of the soul's survival beyond death thus enabling the bereaved to rendezvous with their lost partners or relatives in a presumed

---

[67] K. Walsh, M. King, L. Jones, A. Tookman, R. Blizard, 'Spiritual beliefs may affect outcome of bereavement: prospective study', *British Medical Journal,* 324, 29 June 2002, pp. 1 – 5, p. 1.
[68] R. G. Tedeschi, C. L. Park and L. G. Calhoun, *Posttraumatic Growth: Positive Changes in the Aftermath of Crisis* (Mahwah NJ, 1998) p. 103.
[69] M. O. Harrison, H. G. Koenig, J. C. Hays, A. G. Eme-Akwari and K. I. Pargament, 'The epidemiology of religious coping: a review of recent literature', *International Review of Psychiatry,* (2007) 13, 2, pp. 86 - 93, p. 90. See also: H. G. Koenig, D. B. Larson, and S. S. Larson, 'Religion and Coping with Serious Medical Illness', *The Annals of Pharmacotherapy,* 2001 March, 35, pp. 352 – 359.

future life.[70] This was not a universal reaction, however, and we shall in due course further examine the case of Nichol and also take a brief look at the life of Thomas Paine (1737 – 1809), both of whom reacted to existential challenges by evincing increased scepticism and doubt. The latter type of response, which has also been observed in contemporary subjects, is usually based on a pessimistic theodicy in which, consciously or unconsciously, the individual blames God for the 'bad thing' which has happened.[71]

There was a slow shift during the nineteenth century from public to private religion which can be glimpsed in the changing responses of Chalmers, a corporate Calvinist, through the initially semi-detached Anglicanism of Whewell which *in extremis* elided into a profession of private faith, to the prevaricating Richard Anthony Proctor (1837 - 1888) who defined his personal position as much by what he was opposed to as to what he advocated. A similar timescale applied to claims of authority in the interpretation of natural law which ranged from the creationist certainty of clerics like Paley and Thomas Dick (1774 - 1857) to later assertions of scientific rationality made by agnostics, pantheists and other holders of heterodox views.[72] Chapter 4 will, however, point out that there were nonetheless some theologically nuanced responses to nascent materialism which emanated from professional scientists whose 'religious' selves had absorbed elements of early exposure to protestant enthusiasm.[73]

In the process of examining of nineteenth-century understandings of the universe this thesis will provide further evidence that astronomy provided significant input to the developing understanding of

---

[70] J. C. Jackson, J. Jong, M. Bluemke, P. Poulter, L. Morgenroth and J. Halberstadt, 'Testing the causal relationship between religious belief and death anxiety', *Religion, Brain & Behavior*, March 2017. doi:10.1080/2153599X.2016.1238842. (accessed 3 April 2017). K. Burgess, 'Sick Britons find religion in God's waiting room', *The Times*, 17 September 2018, p. 3.

[71] K. I. Pargament, B. W. Smith, H. G. Koenig and L. Perez, 'Patterns of Positive and Negative Religious Coping with Major Life Stressors', *Journal for the Scientific Study of Religion*, 37, 4 (Dec., 1998), pp. 710 - 724, p. 717.

[72] For a brief general overview of nineteenth-century religious trends see J. Melnyk, *Victorian Religion: Faith and Life in Britain*, (Westport CT, 2008). O. Chadwick, *The Victorian Church*, 2 vols (London, 1966 and 1971) provides a much more comprehensive account as does: G. Parsons (ed.) *Religion in Victorian Britain*, 4 vols (Manchester, 1988). The rise of heterodox religious beliefs in the latter part of the century is discussed at length in: A. Owen, *Place of Enchantment: British Occultism and the Culture of the Modern* (Chicago, 2004).

[73] F. Gregory, 'Intersections of Physical Science and Western Religion in the Nineteenth and Twentieth Centuries' in M. J. Nye (ed.) *Cambridge History of Science*, vol 5, chapter 2 (Cambridge, 2008). Smith and Wise, *Energy*. B. V. Lightman, 'Victorian Sciences and Religions: Discordant Harmonies', *Osiris*, 2nd Series, 16, Science in Theistic Contexts: Cognitive Dimensions (2001), pp. 343 – 366.

the expanding scales of space and time. An emergent collective view of astronomers was that the universe is either very old and very large or even possibly infinite in duration and extent. The Victorian cosmos was in the process of becoming "not only queerer than we suppose, but queerer than we can suppose."[74]

Of evident concern to many people was the potential conflict arising between such a new understanding of the universe and the cosmogonies outlined by the main monotheistic religions in their respective sacred volumes. This provoked, in the minds of many Victorians, feelings of isolation and "existential emptiness":

> Time and space, geology and astronomy, combined to open up dizzying perspectives which seemed to dwarf mankind and its history, calling in question the consolations of religion and the optimism inherited from the Romantics.[75]

To what extent was a deity responsible for either the original structure or the ongoing management of the universe as it now stood? How many sentient beings does the cosmos contain and what are their soteriological needs? It had become difficult to envision the existence of an omnipotent theistic deity who somehow continued to care individually for potentially billions of souls.

As was concurrently the case with discussions of the nature and duration of geological formation processes, it had become evident that God was either able to pre-ordain complex chains of events which unfolded over long periods of time or that a minimally interventionist deity was operating via developmental processes which were stochastic, possibly even catastrophic at times.[76] There was a distinct risk that readers of secular science might conclude that such a deity does not possess the capability or intention to intervene in the life of an individual human being. The potential doubts

---

[74] J. B. S. Haldane, *Possible Worlds and Other Papers* (London, 1927), p. 286.
[75] R. Gilmour, *The Victorian period: the intellectual and cultural context of English literature, 1830-1890* (London, 1993) pp. 25 – 26.
[76] For a brief review of various geological theories put forward by catastrophist and uniformitarian geologists see: S. Toulmin and J. Goodfield, *The Discovery of Time* (Chicago, 1977) pp. 141 – 170. R. O'Connor, *The Earth on View* (Chicago, 2007) pp. 1 – 187 provides a more extensive discussion of this topic.

arising from dissonant responses to questions of origin had important consequences for such ultimate questions as the purposes of human life and the possibility of immortality.[77]

Natural theologians, seeking to achieve an accommodation between "genteel establishment science" and the "social status quo" espoused relatively static models of both the universe and human society.[78] Theists like Chalmers, on the other hand, needed there to be an eschatological 'end time' for a "transitory and finite" Nature "cursed by depravity, imperfect in its parts and destined for inevitable decay." Thus, for example, the Scottish stonemason Hugh Miller (1802 – 1856) read the record of the rocks as prophetic evidence for God's progressive master plan.[79]

Further support for a finite terrestrial timescale and the inevitable dissolution of nature, which were seen to be in conflict with both the uniformitarian geology of Lyell and the timescales required for Darwinian evolution, in which as Thomas Henry Huxley (1825 - 1895) later put it; "The abyss of time began to loom as large as the abyss of space.", came in the second half of the century from the energetic limitations invoked by some of Miller's fellow countrymen.[80]

Astronomers, physicists and other scholars embraced and extended Kant's concept of time as a subjective 'intuition' and attempted to understand its variability when considered by a human or divine subject as opposed to the observed chronometric predictability of celestial time-pieces; thus the passing of time as perceived by God may be such that the "lifetime of the entire Human Race [is] but as the moment which dies with the tick of the clock that marks it – which is heard and passes."[81]

---

[77] J. R. Topham, 'Natural theology and the sciences' in P. Harrison (ed.), The Cambridge Companion to Science and Religion (Cambridge, 2010) pp. 59 – 79, p. 71. J. A. Secord, *Victorian Sensation: The Extraordinary Publication, Reception, and Secret Authorship of Vestiges of the Natural History of Creation* (Chicago, 2000) p. 260.

[78] Turner, 'Victorian conflict', pp. 94 – 99.

[79] Smith, *Science*, pp. 18 – 19. E. Richards, "'Metaphorical mystifications': the Romantic gestation of nature in British biology" in A. Cunningham and N. Jardine (eds.*), Romanticism and the sciences* (Cambridge, 1990) pp. 130 – 143, pp. 136 – 139. See Chapter 2 for a more detailed discussion of the geological origin narratives of Chalmers and Miller.

[80] Smith, *Science*, pp. 308 – 312. See also, J. A. Secord, *Visions of Science: books and readers at the dawn of the Victorian age* (Oxford, 2014) pp. 138 - 172. T. H. Huxley, 'Science' in T. H. Ward (ed.), *The reign of Queen Victoria: a survey of fifty years of progress*, vol 2 (London, 1887) p. 363.

[81] B. Russell, *History of Western Philosophy and its Connection with Political and Social Circumstances from the Earliest Times to the Present Day* (London, 1946) pp. 734 – 735. Russell pointed out that the actual word used by Kant was *Anschauung* which does not precisely translate to "intuition" – it could also be read as

The increasing scale and potential complexity of time which were suggested by the physical and biological sciences posed a set of questions for nineteenth-century audiences. How was an older universe to be populated? How could traditional religions account for the required span of control such that the almost countless souls of humans (and possibly non-humans) could still individually and theistically cared for? To what extent could man usurp the previously divine attributes of being the owners and controllers of time or would natural laws eventually consign the human species to oblivion; as described by Herbert George Wells (1866 - 1946)?[82] All of these questions, informed by the findings and speculations of scientists, philosophers and theologians, were debated during the nineteenth century foreshadowing the subsequent development of new ideas of the nature of reality.[83]

Chapter 2 will focus on the first of these questions; the population of the universe. Proponents and opponents of pluralism engaged with the question of the possible existence of life, especially where that life consists of intelligent beings, on other planets in the solar system and elsewhere. For Trinitarian theologians such potential additions to God's flock raised many interesting questions, such as whether extraterrestrial beings have souls and whether they had been redeemed by a single Incarnation on earth, or were multiple redemptive acts required? Did the existence of other beings increase or decrease the evidence for the existence of a deity and what did it mean for the veracity of the Christian religion? Since much of this debate revolved around imaginative interpretations of limited observational evidence, the participants were

---

"looking at" or "view". J. P. Nichol, *Views of the Architecture of the Heavens. In a series of letters to a lady* (Edinburgh, 1837) p. 144.

[82] H. G. Wells, *The Time Machine: An Invention* (New York, 1895).

[83] The concept of time as an element of four-dimensional spacetime developed from ideas first discussed in the nineteenth century. One of the more intriguing attempts to reconcile astronomical scales with an omnipotent deity and which to some extent foreshadows theoretical concepts which were to be expanded in due course can be found in: F. Eberty, *The Stars and the Earth; or, Thoughts upon Space, Time and Eternity*, which was first published in English in 1846 and was studied by, amongst others, William Whewell. The two theories of relativity are documented in: A. Einstein, (tr. R. W. Lawson), *Relativity: The Special and General Theory.* (New York, 1920). The idea that Einstein may have been influenced in his thinking by his knowledge of the challenges of timekeeping for railway networks is described in: P. Galison 'Einstein's Clocks: The Place of Time', *Critical Inquiry*, 26, 2 (Winter, 2000) pp. 355 - 389. J. Canales, *The Physicist and the Philosopher: Einstein, Bergson, and the Debate That Changed Our Understanding of Time* (Princeton NJ, 2015) discusses the differing views of Einstein and Henri Bergson on the nature of time.

relatively free to elaborate their hypotheses and to project their ideas in such a way as to support their personal preferences.

Evidence of extraterrestrial life was variously seen as an argument either for or against such concepts as theistic religion, hierarchies of creation, societal evolution and even as a pattern for imperial conquest and colonisation. Pluralist concepts could be interpreted as metaphors for ideas of racial difference which had inspired a parallel debate between proponents of Christian universalism, albeit harbouring strong paternalistic overtones, and the supporters of human evolutionary hierarchies "with white Anglo-Saxons at the apex,".[84] Three of the participants in the pluralism debate were the Scottish theologian and political economist Thomas Chalmers, the Cambridge polymath William Whewell and, later in the century, the popular astronomer Richard Proctor. In each case it will be shown that there was an identifiable relationship between changes in their interpretation of the likelihood of the existence of extraterrestrial life and preceding or parallel episodes of emotional distress and the heightened prominence or reformation of their religious selves.

Chapter 3 will examine the stories of several subjects who were engaged in a debate about the origins of the universe in the form of the two cosmogonic hypotheses which had been articulated by Pierre-Simon Laplace (1749 - 1827) and William Herschel at the end of the eighteenth century. This discussion was given fresh impetus and a wider audience by some of Nichol's post-breakdown writings in the 1830s and by the publication of the notorious pot-boiler *Vestiges of the Natural History of Creation* in 1844.[85] When viewed alongside preceding and contemporary debates in the field of geology, these nebular hypotheses provided additional support for longer chronologies and a developmental history of the universe.

---

[84] S. J. Dick, 'Cosmic Evolution: History, Culture, and Human Destiny' in S. J. Dick and M. L. Lupisellsa (eds.), *Cosmos & Culture; Cultural Evolution in a Cosmic Context* (Washington DC, 2009) pp 29 – 59. C. Hall, *Civilising Subjects: metropole and colony in the English imagination 1830-1867* (Cambridge, 2002) p. 17.
[85] J. Eisberg, 'Solar Science and Astrophysics' in M. J. Nye (ed.) *Cambridge History of Science,* vol 5, chapter 26 (Cambridge, 2008) pp. 505 - 521, p. 514. S. Schaffer, 'Herschel in Bedlam: Natural History and Stellar Astronomy', *British Journal for the History of Science*, 13, 3 (1980) pp. 211- 239. R. Chambers, *Vestiges of the Natural History of Creation* (London, 1844).

Recent historiography has examined the underlying ideological motivations which drove this cosmogonic discourse.[86] They key events in this history include the claimed refutation of the nebular hypothesis based on observations made with a giant telescope; the 'Leviathan of Parsonstown'. Nichol's subsequent output endeavoured to subtly undermine this negation of nebulosity and to lay a strong foundation for the use of astronomy as a tool to support theories of cosmic development which were extensions of his earlier support for radical ideas of the political evolution of human society.[87]

The fourth chapter will examine some the of ideas about the age of the solar system which emerged in the second half of the nineteenth century. Following the controversies which had been provoked by the emerging trope of biological evolution by natural selection, a new debate arose as a result of the application of the newly discovered laws of thermodynamics to the questions of the ages of the sun and the earth. This interchange of views added fuel to existing arguments about the reliability or otherwise of geological and biological chronologies. The sub-text of such debates was, as noted by Niamh Brown, a form of existential angst; "one of the key factors connecting thermodynamics and astronomy is that they raise similar questions and anxieties about the role of humanity in the universe, and humankind's eventual place in the afterlife."[88]

The main proponents of a low chronology were the 'North British' physicists. They have previously been shown to have persisted in holding a belief in a potentially theistic cosmos which was clearly a factor in their advocacy of a young sun and earth.[89] Probably the most well-known member of this group was William Thomson, subsequently ennobled as Lord Kelvin. He received significant support from several colleagues with similar backgrounds, including James Clerk Maxwell (1831 - 1879), Peter Guthrie Tait (1831 - 1901) and Balfour Stewart (1828 - 1887). An additional point to be developed in this chapter, however, is that to treat them as a homogenous group of likeminded

---

[86] P. J. Bowler and I. R. Morus, *Making modern science: a historical survey* (Chicago, 2005), pp. 280 – 281.
[87] Schaffer, 'nebular'. Elements of Chapter 3, specifically the narrative of Nichol's response to the claimed refutation of the nebular hypothesis, have previously been published as: H. Carlton, 'Condensing from a Fluid Haze: John Pringle Nichol, the Nebular Hypothesis and Nineteenth-Century Cosmogony' in N. Campion and C. Impey (eds.) *Imagining Other Worlds: Explorations in Astronomy and Culture* (Ceredigion, 2018) pp. 87 – 94.
[88] N. Brown, 'Devotional Cosmology: Poetry, Thermodynamics and Popular Astronomy, 1839-1889', PhD thesis submitted to the University of Glasgow (2016), p. 47.
[89] C. Smith, 'Force, Energy, and Thermodynamics' in M. J. Nye (ed.) *Cambridge History of Science*, vol 5, chapter 15 (Cambridge, 2008) pp. 289 - 310, pp. 301 - 302.

thinkers is to oversimplify the situation; they were perhaps more united by geography and institutional affiliation than they were by confessional alignment or extent of religiosity.

Some of the North British group also opposed purely mechanistic explanations of the phenomena associated with life, such as free will and consciousness, by advancing dualist arguments of the kind proposed earlier by René Descartes (1596 - 1650).[90] Their novel contributions included the speculative idea of 'zero energy' physiological interactions which might underly the ephemeral concept of the mind and the hypothesized existence of parallel universes as repositories for the soul as an independent and possibly eternal entity.

To reiterate the major argument outlined above, the novel viewpoint presented here is that significant changes in the development of the physical sciences and in overlapping epistemologies were, as demonstrated in the case histories examined here, sometimes contingent on preceding instances of psychotropic trauma. It should of course be acknowledged that recent historiography has already pointed out the close connections between religious beliefs, political aims and cultural contexts which have influenced various subjects' proclivities for particular ways of knowing. What does not seem to have been as strongly noted to date, however, is the extent to which significant emotional crises have led to marked changes of previously espoused positions in one or more components of an individual's construction of the world. We cannot presume to interpolate ourselves into nineteenth-century minds or bodies, nor can we necessarily read forward from such relatively distant *Weltbilder* to contemporary mind-sets, but it does seem clear that we should add to the armoury of the historian of science a further component of the formation of ideas; the connection between existentially freighted life-events, often accompanied by somatic shock or emotional affect, and significant alterations in the subject's selection of espoused theories, performed selves and observed behaviours.

[90] M. A. Gillespie, *The theological origins of modernity* (Chicago, 2008) pp. 170 – 206.

Chapter 2. "Tho' world on world in myriad myriads roll": how many revelations are required to redeem the entire universe?

Tho' world on world in myriad myriads roll,
Round us each with different powers,
And other forms of life than ours,
What know we greater than the soul?

Alfred Lord Tennyson, 'Ode on the Death of the Duke of Wellington'[91]

During the first few months of 1809 a young Church of Scotland minister was confined to bed in his isolated rural home whilst suffering from what he had good reason to believe was a fatal illness. The exact nature of this malady was uncertain, given the vagaries of contemporary medical diagnoses, described by his family as "consumption" and by his doctor as "an affection of the liver". The prognosis must have seemed almost inevitable to him as he had recently lost several relatives and close friends, including a sister, a brother and a surrogate father, to "the same fatal malady." His son-in-law reported that "For days and weeks he gazed upon the death brought thus so near;" [92] It is hardly surprising, therefore, that in this period of suffering and morbid expectation his thoughts turned to a contemplation of what might lie beyond; "The undiscover'd country from whose bourn / No traveller returns,"[93]

During this illness he was treated with powerful pharmaceuticals some of which, as noted by De Quincey, stimulate altered perceptions of time and space. It may not be a coincidence, therefore, that Thomas Chalmers' thoughts during this period clearly turned to the "insignificance of time". His stream of consciousness evidently included some reflections on the insubstantiality and transience of human existence when compared with "the magnitude of eternity" and thus on the potential futility of a life which perhaps has no continuation into an afterlife. As he wrote to his friend and colleague the Reverend Mr. Carstairs who lived in nearby Anstruther:

---

[91] A. L. Tennyson, 'Ode on the Death of the Duke of Wellington' in Hodder (ed.), *Works*, pp. 400 – 407, p. 406.
[92] S. J. Brown, *Thomas Chalmers and the Godly Commonwealth in Scotland* (Oxford, 1982) p. 53. W. Hanna, *Memoirs of the Life and Writings of Thomas Chalmers D.D., LL. D.*, vol I, (Edinburgh, 1849) p. 152.
[93] W. Shakespeare, 'Hamlet, Prince of Denmark', *The Complete Works of William Shakespeare* (London, 1978) pp. 846 – 882, Act 3, Scene 1, p. 862.

> My confinement […] has fixed on my heart a very strong impression of the insignificance of time – an impression which I trust will not abandon me though I again reach the heyday of health and vigour. This should be the first step to another impression still more salutary – the magnitude of eternity. Strip human life of its connexion with a higher scene of existence, and it is the illusion of an instant, an unmeaning farce, a series of visions and projects, and convulsive efforts, which terminate in nothing.[94]

Following this near-fatal illness, which lingered on for almost two years, it became clear that Chalmers had also undergone a significant shift in his attitude to, and enthusiasm for, revealed religion. As we shall discover shortly, his previous approach to his clerical career had not been particularly diligent. After the traumatic episode outlined above, however, he pursued a far more evidently evangelical approach to religion. He succeeded, by dint of the quality of his sermon-giving self's performances, in drawing large crowds to hear him preach in Kilmany and in due course he was elected to the position of pastor for a much larger congregation in central Glasgow. Following his promotion he not only used this expanded platform to proselytize his personal version of religion but also to evince a notable interest in the meaning of the existence of extraterrestrial life and the contentious question of the age of the earth. At the same time he proceeded to explore practical solutions for alleviating poverty based broadly on Malthusian political economics.

In due course we shall demonstrate that the views of several subjects with respect to the idea of pluralism were malleable and *Weltbild* dependent. Such opinions were shaped, sometimes significantly, by the ebb and flow of emotions which are in turn the result of interactions between longer term cultural inputs and shorter term psychological and physiological affects. The exposition of this topic will necessarily entail a parallel discussion of why, particularly in the nineteenth century, the question of whether or not aliens existed, and their hypothesized states of redemption or 'grace', were topics of great interest and emotional impact for both clerics and astronomers, despite the comparative lack of either relevant scriptural sources or observational evidence.

Unlike some other philosophical controversies aired in this period, such as the debates surrounding the various ages of the Earth suggested by Mosaic chronology, as opposed to the contending theses of

[94] T. Chalmers to Rev. Carstairs 19 February 1809 quoted in Hanna, *Memoirs*, vol I, pp. 151 - 152.

geologists, belief or otherwise in the existence of extraterrestrial life did not have a clear-cut connection to personal positions in other epistemologies including religion and metaphysics. This disconnect occurred because the various hypothesized alien 'states of being' were easily capable of being adjusted to fit each subject's endeavour to create a narrative of how the universe is ordered from both a theological and a cosmological perspective.

After reviewing the views of several commentators who raised awareness of the questions of pluralism and its possible theological corollaries around the turn of the nineteenth century, we will consider in greater detail the emotional journeys, as far as we can reasonably interpolate them, which were undertaken by several key protagonists; Thomas Chalmers, William Whewell and Richard Proctor.

In the case of Chalmers, the traumatic life event which preceded the emergence of novel views on several topics was first documented by his relative and near contemporary William Hanna (1808 - 1882). The importance of this seminal event has subsequently been to some extent glossed over, so it is now necessary to reinstate the centrality of the physical and psychological causes of Chalmers' conversion. This crisis produced, as noted above, at least three contingent changes in his *Weltbild*.

It will similarly be argued that the key trigger for the changes experienced by Whewell has not previously been clearly identified and has instead been assumed to be a rational response to the ebb and flow of debate. Evidence will be advanced that he was significantly influenced by an emotive change in his subjectivity which in turn altered his pluralist perspective. Whewell, unlike Chalmers, had had plenty to say on the probability of life on other planets prior to experiencing a personal crisis which led him to reverse his earlier views and to conclude that the earth is the only planet occupied by intelligent life forms possessed of immortal souls. Current explanations of Whewell's change of mind are based on intellectual arguments which revolve around his version of metaphysics or his aversion to a specific text. Later in this chapter, however, a closer reading of his personal correspondence will be used to show that a significant, or even the primary, cause of his rejection of pluralism was the need to achieve personal consolation for the impending loss of his wife Cordelia.

Proctor's journey followed a reversed trajectory. He was already in the process of adopting a thoroughly evolutionary genesis for the universe at all scales when contemporary events conspired to force him to choose between his previous tacit support for the Catholic church, which had apparently arisen as the result of a bereavement, and his emergent career as a populariser of science. A re-reading of his public utterances and publications will be used to demonstrate that it was primarily his reading of the more febrile responses of supporters of traditional religion to a provocative and apparently materialist speech given in Belfast by John Tyndall (1820 - 1893), which prompted his adoption of a more agnostic persona.

These theological challenges to his chosen profession occurred at a time when he was already entertaining serious doubts about the compatibility of the previously overlapping emotional communities and discourses of the Catholic church and of his fellow scientists. It was 'the straw which broke the camel's back' in terms of completing a severance from Trinitarianism which had probably been some time in the making. A parallel change which occurred at this time was that he began to significantly play down the possible existence of extraterrestrial life; an idea which he also associated with the more enthusiastic proponents of religion.

Proctor's dilemma suggests a further strand of thought which will be reviewed in the specific context of the extraterrestrial debate. It will be useful to examine how the models which were available to individual subjects for contemplation of the relationship between various epistemologies were, of course, culturally dependent. To Chalmers, for example, it seemed obvious that the only appropriate way in which to interpret questions of geology, astronomy or even political economics was via the lens of religion; the intellectual and emotional environment in which he was immersed for most of his career. His theological context led him to assume that God was ultimately responsible for the definition and regulation of all things and that it would be inauthentic to deny divine authority in both spiritual matters and more secular affairs.

Whewell, a liberal Anglican immersed for most of his life in the intellectual atmosphere of Cambridge University, adopted a somewhat more atheological approach to academia and administration from

which we also infer that the politics of wider society did not for him have such a strong dependency on the divine. He nonetheless, at a time of crisis, constructed a strong link between his scientific beliefs and personal salvation which forced him into a re-consideration of the relative weights which should be given to the competing selves which co-existed in his *Weltbild*.

By the time, however, that Proctor was attempting to resolve his interior conflict between an acquired allegiance to Catholicism and the evident naturalist tendencies then developing within the physical sciences, he ultimately concluded that he had to make a clear-cut choice between the two increasingly divergent emotional communities to which he had previously owed fealty.

It is interesting to note in passing that self-proclaimed membership of a religious faith can in practice lead to problematic questions of identity. During this and subsequent chapters it will become clear that subjects who claimed allegiance to a particular 'church', and who adopted at least the appropriate signifier, were frequently at variance with at least some elements of its central dogma. In other words, they were performing the language, outward forms and social duties of the religious refuge to which they claimed allegiance, but at the same time their private judgement included significant doubts about buying in to the complete theological package which was supposedly the cohering element binding the whole communion together. A perhaps unexpected symptom of this dysmorphia was that, as we shall see, the most convincing advocates of orthodoxy were sometimes also those most at variance with the 'core values' of their chosen in-group.

During the period under review the possible abundance of extraterrestrial life was examined by proponents of natural theology and found to justify several metaphysical viewpoints which in some, but not all, cases accorded with their pre-existing religious positions. The two key arguments applied *in extenso* to the emerging abundance of stellar systems were those of analogy and plenitude; the argument from analogy suggested that other stars would be accompanied by solar systems which

resemble our own and the principal of plenitude suggested that a deity would not have bothered to create these additional worlds if there had not also been an intention to extensively populate them.[95]

A general corollary of these conclusions, therefore, at least for an evangelizing Scottish Presbyterian like Chalmers (post 1809), was that God would not have failed to create many other beings who could and would become "the worshippers of His glory":

> But there is no end of conjecture; and to the men of other times we leave the full assurance of what we can assert with the highest probability, that yon planetary orbs are so many worlds, that they teem with life, and that the mighty Being who presides in high authority over this scene of grandeur and astonishment, has there planted the worshippers of His glory.
>
> Did the discoveries of science stop here, we have enough to justify the exclamation of the Psalmist, "What is man, that thou art mindful of him; or the son of man, that thou shouldest deign to visit him?[96]

Although Chalmers asserted in this passage that God has a vast number of worshippers spread across "so many worlds", there is also at least a hint of a doubt, subsequently shared by Whewell amongst others, about the capability of the deity to take an interest in, and make propitiation for, an individual human being. The Psalmist clearly assumed a positive response to this question. Chalmers similarly employed the biblical text as a rhetorical device to be subsequently answered in the affirmative with an assurance of God's theistic care and attention.

Confidence in cosmic plenitude seemed to arise as an automatic corollary of natural theology; if one believes that the universe is a product of divine design then the additional habitats which it was now assumed to contain must also be inhabited as a result of the same creative objectives and processes. This putative population represented, in the minds of its proponents, further convincing evidence of the omnipotence of a deity whose almost inexhaustible ability to produce or reform *terra firma* was

---

[95] See S. J. Dick, 'The Origins of the Extraterrestrial Life Debate and its Relation to the Scientific Revolution', *Journal of the History of Ideas*, 41, 1 (Jan - Mar, 1980), pp. 3 - 27 and W. C. Hefferman, 'The Singularity of our Inhabited World: William Whewell and A. R. Wallace in Dissent', *Journal of the History of Ideas*, 39, 1 (Jan - Mar, 1978), pp. 81-100, pp 84 - 86.

[96] T. Chalmers, *A Series of Discourses on the Christian Revelation viewed in connection with the Modern Astronomy* (Glasgow, 1817) pp. 32 - 33. The embedded quotation is from Psalm 8 verse 4.

being proposed in parallel by those geologists who credited God with having produced multiple waves of living things.[97]

For some natural theologians it was also axiomatic that the hypothesized extraterrestrials must be members, or at least potential members, of an expanding congregation of worshippers. The alternative idea of a single redemption was put forward by those commentators who sought to demonstrate the uniqueness of Man and to preserve a special revelation which only applied to the planet earth. This point of view had the virtue of being consistent with scripture and did not require the imagination of additional divine missions which might be seen as analogies of the tour of the Americas envisioned by Joseph Smith (1805 - 1844), the founder of Mormonism.[98] The idea of a single Incarnation was echoed and expanded in a tract published by William Whewell in the 1850s which we shall examine in more detail shortly.[99]

Whewell's 1853 book also represented, in part, a version of the second, and generally later, perspective which, with the benefit of hindsight, historians have generically labelled 'scientific naturalism'. If the genesis of the universe is the work of a deistic creator, or no creator at all, then its current state must have arisen as a result of a set of secondary laws or even stochastic and uncontrolled evolutionary processes. This viewpoint implied the corollary that intelligent life-forms might be quite rare entities.

Such a dichotomy still exists in current debates about the prevalence or otherwise of extraterrestrial life. There is an ongoing exchange of arguments between those who take the view that life will have arisen nearly everywhere that suitable conditions exist for its sustenance and the supporters of the 'rare earth' hypothesis who feel that our galaxy, sun and planet are unusually or even uniquely suited to act as cradles of life. Religion no longer plays an overt role in this debate, but one might

[97] O'Connor, *Earth*, p. 63.
[98] J. Smith, *The Book of Mormon* (Palmyra NY, 1830).
[99] W. Whewell, *Of the Plurality of Worlds: an Essay* (London, 1853).

nevertheless not have to dig too hard to identify underlying metaphysical and even pseudo-theological beliefs which inform these opposing points of view.[100]

A significant challenge to revealed religion which depended in part on the concept of pluralism had occurred towards the end of the eighteenth century, when the potential superfluity of worlds and beings came to the attention of the political radical Thomas Paine. He employed the idea of cosmic plenitude, which was subsequently to be such an inspiration for Chalmers, as a significant plank in one of his radical tracts. This work, based to some extent on his own interest in astronomy, argued against the literal truth of many elements of Christianity and thereby sought to reduce the (in his view) malign influence of the established Church with its strong links to the ruling classes. Historians remain divided on the question of to what extent Paine was in fact a "filthy little atheist" or a convinced deist or whether, as now seems more likely to some scholars, he was pursuing a theistic, possibly Quaker, line of argument which sought to rescue the most important moral teachings of traditional religion from contemporary attacks.

He began writing the book in question, entitled *The Age of Reason,* in 1793 "just before he was imprisoned for ten months by the French revolutionaries, whom he had supported in his *Rights of Man*."[101] Perhaps the most remarkable aspect of this pejorative work is that it was written at a time when Paine had not only narrowly escaped being guillotined (his survival was due to a fortunate error by one of the guards) but he was also so ill that he was "expecting to die hourly,". A fellow prisoner reported that he was; "expecting not to see Paine alive in the morning, he [Paine] always expressed his firm belief in the principles of the book, and begged Mr. Bond should tell the world such were his dying sentiments." This account has to be read alongside several such exemplary deaths described in a hagiographic biography written by Moncure Daniel Conway (1832 – 1907) almost a hundred years later. It included, for example, Paine's report of the final words of Georges Jacques Danton (1759 -

[100] For a discussion of more recent debates surrounding cosmic plenitude see Dick, 'Cosmic'. As an example of a the 'rare earth' view of the probability of extraterrestrial life see J. Gribbin, *The Reason Why: The Miracle of Life on Earth* (London, 2011).
[101] R. Porter, *Enlightenment: Britain and the Creation of the Modern World* (London, 2000) pp. 452 – 453. M. J. Crowe, *The extraterrestrial life debate 1750 – 1900: the idea of plurality of worlds from Kant to Lowell* (Mineola NY, 1999) pp. 162 – 164.

1794); '"They will send me to the scaffold; very well, my friends, I shall go gaily." Even so did Danton meet his doom.'[102] These 'dying bravely' narratives seem curiously Christ-like, given the biographer's overall theme of Paine's success as a rationalist disposer of received religion.

The temporal association between impending death and Paine's insistence on revealing his innermost thoughts on Trinitarian religion, bolstered by his use of pluralism as a logical absurdity in the form which came to be known as the "astronomical objection", can hardly be coincidental.[103] In making such a vigorous case against traditional theology during his illness and imprisonment he was, in effect, administering an alternative and intentionally perverse sacrament in which he confessed to the truth as he then understood it, as well as performing a form of defiant, even arrogant, stoicism which, again according to Conway, was typical of his co-prisoners and which he may well have feared could have everlasting negative consequences if he turned out to be wrong.

Paine was one of the earliest authors to have argued that the existence of multiple populated planets could undermine faith in the parochial belief system of Christianity. Like contemporary natural theologians he proceeded from an initial assumption that a beneficent "Creator" had put in place a "society of worlds" to "administer […] instruction to man." even if only "by their motion":

> Our ideas, not only of the almightiness of the Creator, but of his wisdom and his beneficence, become enlarged in proportion as we contemplate the extent and the structure of the universe. The solitary idea of a solitary world rolling, or at rest, in the immense ocean of space, gives place to the cheerful idea of a society of worlds, so happily contrived as to administer, even by their motion, instruction to man.[104]

The idea of multiple worlds also gave rise to genuine doubts, however, in the same way as it did for some later thinkers. It created a sense of existential angst as the individual human subject attempted to contemplate the implications for the capabilities and span of control of a single governing entity. Why would the supposed ruler of the universe expend such care and attention (and great self-sacrifice in Trinitarian theology) on a single insignificant planet such as Earth? Can a supreme being truly

---

[102] M. D. Conway, *The Life of Thomas Paine*, vol II (New York, 1892) pp. 128 – 130.
[103] Chalmers, *Discourses*, p. v.
[104] T. Paine, *The Age of Reason* (1794 repr. London, 1880) p. 44.

multitask to the extent of undertaking the 'cure of souls' on millions of worlds whilst also personally engaging in one redemption at a time. How would the Almighty or a component thereof (to Paine, a Quaker, this was an irreverent concept) find time, and perhaps more importantly the penitential empathy, to undertake "an endless succession of deaths,"?

> From whence then could arise the solitary and strange conceit that the Almighty, who had millions of worlds equally dependent on his protection, should quit the care of all the rest, and come to die in our world, because, they say, one man and one woman had eaten an apple. […] In this case, the person who is irreverently called the Son of God, and sometimes God himself, would have nothing else to do than to travel from world to world in an endless succession of deaths, with scarcely a momentary interval of life.[105]

In addition to using the recently expanded scale of the universe as an argument against some of the core precepts of Christianity, Paine was here exploring a line of thought which was to become prevalent during the early part of the nineteenth century; was there a single act of divine self-sacrifice which took place on our home planet or is there a requirement for this immolation to take place on every populated body in the universe? Would the received discourses of revelation and redemption need to be repeated across myriads of societies? Responses to these questions were, of course, determined by the subject's malleable psychological construction and current religious influences.

One of Paine's more enthusiastic supporters was Shelley who had explicitly stated in his 1811 pamphlet *The Necessity of Atheism* that "the mind cannot believe the existence of a creative God."[106] It seems probable that Shelley and Paine were the key opponents whom Chalmers later included within the impersonal categories of "the Treatises of the Infidel" and "Freethinkers".[107] Shelley, like his predecessor, was inclined to see the immensity of the universe as supporting evidence for his challenge to revealed religion. In the lines which describe the multiple stellar systems through which Queen Mab's magical chariot can roam, for example, Shelley stated his views on the dissonance

[105] Paine, *Reason*, pp. 44 – 45.
[106] P. B. Shelley, 'The Necessity of Atheism' in P. B. Shelley, (foreword by H. S. Salt), *Selected Prose Works of Shelley* (London, 1915) pp. 1 – 15, p. 5.
[107] Chalmers, *Discourses*, pp. 5 – 12.

between the findings of astronomy, the concept of pluralism and a belief in Trinitarian Christianity or "the childish mummeries of the God of the Jews,":

> The plurality of worlds, — the indefinite immensity of the universe is a most awful subject of contemplation. […] It is impossible to believe that the Spirit that pervades this infinite machine, begat a son upon the body of a Jewish woman; […] All that miserable tale of the Devil, and Eve, and an Intercessor, with the childish mummeries of the God of the Jews, is irreconcileable with the knowledge of the stars.[108]

As Michael Crowe has pointed out, Shelley's work appears to have been influenced by the astronomical lectures of Adam Walker (1731 – 1821) and the writings of Lucretius. Walker had argued that the geocentric cosmic order and the changing scale of the universe cast significant doubt on such topics as the existence of the devil and the location of hell, thus undermining some principal pillars of traditional punitive theologies. Shelley's personal preference was to remove the concept of "eternal punishments for disbelief". To this end, he subsequently quoted William Herschel's view that "the sun possesses a cool interior against such authors as Swinden, who had designated the sun as the location of hell". His distaste for eternal damnation was, of course, subsequently also a topic of concern for Charles Darwin whose grandfather Erasmus had been a source of inspiration for the pluralism of *Queen Mab*.[109]

We should also at least examine the idea that Shelley's heterodox musings on the religious implications of pluralism could in part be attributed to the results of his supposedly reluctant use of laudanum "at times of excessive physical and mental stress."[110] Shelley openly referred to his laudanum habit in private correspondence and there is also a report of an incident when, having been refused access by the Godwins to their daughter and his future wife Mary (1797 – 1851), he "burst into the house and ran up to Mary offering a bottle of laudanum, and declared, 'By this you can escape from tyranny.'" In his published poems references to drug use were somewhat more circumspect, but there is good reason to believe that the lines in *Prometheus Unbound* which evoked

---

[108] P. B. Shelley, *Queen Mab* (London, 1813) pp. 126 – 127.
[109] Crowe, *extraterrestrial*, pp. 170 – 171. Crowe references the prior work of Carl Grabo which demonstrated the close connection between *Queen Mab* and Erasmus Darwin's 1791 poem *The Botanic Garden*. Shelley, 'Necessity', p. 4.
[110] Berridge, *Opium*, pp. 56 – 57.

"oracular vapour" and the sleep-inducing "Nepenthe" produced by "folded Elysian flowers" represented respectively nitrous oxide and opium.[111]

One of the earliest rebuttals of Paine's thesis occupied most of the first part of a lengthy work delivered by the Baptist minister Andrew Fuller (1754 - 1815), who in 1799 cited scriptural support, or perhaps more accurately the lack of biblical opposition, for the very high value which God places on the salvation of a single soul:

> It is no exaggeration to fay that the falvation of one foul, according to the fcriptural account of things, is of inconceivably greater moment than the temporal falvation of a nation, or of all the nations in the world, for ten thoufand ages. […] THERE IS NOTHING IN THE SCRIPTURE DOCTRINE OF REDEMPTION WHICH IS INCONSISTENT WITH THE MODERN OPINION OF THE MAGNITUDE OF CREATION.[112]

Perhaps the single act of redemption which had taken place on Earth would, unlike the multiple events imagined by Paine, be sufficient to save all the inhabitants of the universe? This certainly seemed to have been Fuller's view, although his hesitant assertion was couched via the self-evidently weak argument that the care extended by "the whole camp of Ifrael" to one victim of leprosy during their exodus from Egypt should be read as an analogy for God's care of the human race:

> The leprofy of Miriam was an event that affected the whole camp of Ifrael, nor did they proceed on their journies till fhe was reftored to her fituation: and it is not unnatural to fuppofe, that fomething analogous to this would be the effect of the fall and recovery of man on the whole creation.[113]

Fuller was a follower of a radical strand within the Baptist church into which the historian Catherine Hall was subsequently to be born. They were "committed to a to a notion of a universal family of man … which stretched across the oceans, linking West Indians, Africans, Chinese and Indians in the

---

[111] K. Singer, 'Stoned Shelley: Revolutionary Tactics and Women Under the Influence', *Studies in Romanticism*, Winter 2009, 48, 4, pp. 687 – 707, p. 701. P. B. Shelley, *Prometheus Unbound: a lyrical drama in four acts with other poems* (London, 1820) pp. 77, 84. Nepenthe (νηπενθής) is an allusion to a "powerful anodyne" which induces forgetfulness and was assumed by the Greeks to have originated in Egypt. See: Homer, (Translated by E. V. Rieu), *The Odyssey* (London, 1987) p. 70, (Book 4, Line 221).

[112] A. Fuller, *The Gospel, its own witnefs: or the Holy Nature and Divine Harmony of the Christian Religion Contrafted with the Immorality and Absurdity of Deism* (New York, 1801), p. 189. First published in 1801 with a preface by the author dated 10th October 1799.

[113] Ibid., p. 202.

embrace of its mission. […] This was, in its own way, a transnational world."[114] Thus his personal theology was a significant motivation in his concerns for the redemption of extraterrestrial and terrestrial souls. From Fuller's perspective humanity is to be seen as a peculiarly recalcitrant species within a populous broader creation and thus in particular need of God's paternalistic care in a manner analogous to the evangelical proselytizing which he and his colleagues were concurrently carrying out amongst apparently unredeemed colonial cultures around the world.

The author of the classic mainstream text of natural theology, William Paley, a Church of England cleric and contemporary of Paine, was, perhaps surprisingly, remarkably reticent on the topic of pluralism. Paley's most popular book, which employed the apparent evidence of design in the universe as an argument for the existence of a deity whilst mostly ignoring the idea of extraterrestrial life, became required reading for Cambridge students for several decades after its publication.[115]

In an interesting parallel with Paine and foreshadowing the experiences as well as the thoughts of Chalmers, his teleological thesis was written at a time when he was suffering from "severe accessions of a painful disorder, under which he had long labored, and which has since proved fatal."[116] In the process of performing a stoic self, reminiscent of Paine's fortitude in the face of death, Paley claimed to have found some positive aspects which arose from his otherwise painful and debilitating illness. Speaking of the existence of occasional periods of relief from the pain that he experienced he claimed that; "It has the power of shedding a satisfaction over intervals of ease, which, I believe, few enjoyments exceed."[117]

Unlike Paine, however, Paley, being possibly a Socinian himself, chose to disguise any doubts he may have had at a time when he was seeking to demonstrate the underlying truth of the existence of a creative, and possibly theistic, deity as he contemplated his own mortality. He thus provided a key text for subsequent natural theology which he felt should be seen as the foundation stone on which his

---

[114] Hall, *Civilising*, pp. 1 - 2.
[115] Paley, *Evidences*. A. Fyfe, 'The Reception of William Paley's "Natural Theology" in the University of Cambridge', *The British Journal for the History of Science*, 30, 3, Student Papers (Sep., 1997), pp. 321 - 335.
[116] G. W. Meadley, *Memoirs of William Paley, D.D.* (Sunderland, 1809) p. 141.
[117] Paley, *Evidences*, p. 367.

earlier Christian constructions had been erected. "Over the course of the century, *Natural Theology* was read as a work of gentlemanly natural theology, as a work which could be used in a formal or informal education in science, and as a work of Christian apologetic."[118] It is therefore ironic that a book which was subsequently regarded as a foundational Trinitarian tract was written by an author who may well have been for much of his career a closet Unitarian. The uncertainty amongst his contemporaries about Paley's possible Sociniansim can perhaps best be explained by his apparent late adoption of evangelical views at the height of their popularity around the turn of the century and coinciding, perhaps predictably, with his terminal illness.[119]

Natural Theology represented Paley's defence against a perceived upsurge in Enlightenment rationalism, deism and atheism, which included the works of the Scottish philosopher David Hume (1711 - 1776) and the more recent attacks by Paine.[120] He declined to mention the targets of his tract by name, perhaps for fear of lending unintended weight to their utterances or inciting readers to examine their works in more detail, referring instead rather vaguely "to any scepticism concerning [natural theology] with which the present times are charged,". Acknowledging his ignorance "of the *sensitive* natures, by which other planets are inhabited" meant that he did not feel the need to attempt to address the question posed by Paine as to how such putative beings were to be reconciled with a Trinitarian schema.[121] This reluctance seems to reflect a disinclination to take on the task of refuting the 'astronomical objection' perhaps combined with a lingering tinge of empathy with Paine, a potential fellow-traveller in heterodoxy.

---

[118] A. Fyfe, 'Publishing and the classics: Paley's *Natural theology* and the nineteenth-century scientific canon', *Stud. Hist. Phil. Sci.* 33 (2002) pp. 729 – 751. Meadley, *Paley*, pp. 150 – 166.

[119] Hilton, *Atonement*, p. 179 traces this idea of a late 'conversion' to comments made by John Joseph Gurney (1788 - 1847), an evangelical Quaker, and the evidence from Paley's posthumous sermons as reported in J. D. Yule, 'The impact of science on British religious thought in the second quarter of the nineteenth century', PhD thesis submitted to Cambridge University (1976), p. 186.

[120] Hume's more sceptical writings on the topic of revealed religion include the discussion of miracles in D. Hume, *An Enquiry Concerning Human Understanding* (1748 repr. London, 1777) pp, 110 – 111 and the posthumously published discussion of natural theology in D. Hume, *Dialogues Concerning Natural Religion* (London, 1777). For a review of eighteenth-century deists and rationalist religion, see Porter, *Enlightenment*, pp. 96 – 129.

[121] Paley, *Evidences*, pp. iv, 288.

Paley's general view of astronomy in terms of its usefulness as evidence of natural theology was ambiguous. He understood that no method was then available which would allow close inspection of heavenly bodies which appear as only "bright points, luminous circles" and therefore little could be directly known about their potential complexity of form, content or inhabitants. He was thus able to ignore such nominally unanswerable questions as whether other solar systems were analogous to our own and whether they posed similar challenges in terms of the possibility of geological, biological and theological evolution.

On the other hand, the abundance of local heavenly bodies and the utility of their having been conveniently arranged by God into suitably placed and stable orbits around a stationary sun, led him to the anthropocentric and teleological conclusion that the whole system was thus provided with convenient sources of light, heat and visual stimulation for human beings as well as demonstrating the wisdom of the author of the invariant laws of physics. This slightly uninspiring view of the benefits to natural theology provided by astronomy was later to become a significant point of disagreement between Paley and Chalmers, a similarly successful author and preacher.[122]

Thomas Chalmers was the most influential supporter and promoter of the concept of pluralism as Christian apology in the early nineteenth century.[123] He was born in 1780 and raised in Fife as the sixth child of a devout but increasingly financially straitened Presbyterian merchant. At a relatively early age he exhibited a precocious skill in the art of oratory and expressed an intention to be ordained as a minister.[124] Chalmers did, however, subsequently experience significant doubts about elements of Christian theology in his years as a mathematics student at St. Andrews, having a "scepticism […] which affected the foundations of all religion, whether natural or revealed." In due course, nonetheless, he was licensed as a preacher by the Church of Scotland, other forms of employment having fallen through, and was intellectually persuaded, or so he claimed, to a firmer conviction in the

[122] Paley, *Evidences*, pp. 287 – 305.
[123] Crowe, e*xtraterrestrial*, pp. 167 – 168.
[124] Hanna, *Memoirs*, vol I, pp. 3 – 9.

overall veracity of the scriptures "by reading Bishop Butler's Analogy of Natural and Revealed Religion, &c."[125]

During his early years in the ministry he remained distrustful of enthusiasts for Christianity and pronounced himself distinctly doubtful about the way in which the central tenets of atonement and redemption were interpreted by orthodox Calvinism, preferring instead the more sceptical conclusions reached by "free and rational inquirers":

> In what particular manner the death of our Redeemer effected the remission of our sins, or rather, why that death was made a condition of this remission, seems to be an unrevealed point in the Scriptures. […] The tenets of those whose gloomy and unenlarged minds are apt to imagine that the Author of Nature required the death of Jesus merely for the reparation of violated justice, are rejected by all free and rational inquirers.[126]

A relatively recent biographer, Stewart Brown, has asserted that Chalmers was at that time a member of that element of the Church of Scotland which "emphasized the themes of order, rationality, and social progress" and that "Chalmers had been essentially a Moderate in his religious views." Brown, moreover, noted his "antipathy to Calvinism and religious enthusiasm," as well as a lack of "commitment to his clerical profession." and a somewhat lacklustre approach to serving his parishioners:

> In his pursuit of university preferment and literary reputation, he exhibited the most irresponsible aspects of early nineteenth-century Scottish Moderatism. He used his parish for his own support while he pursued a career in mathematics or political economy. He wrote his sermons hastily, and frequently left his parish for weeks or even months at a time. He neglected household visitations, the religious instruction of the young, and the other responsibilities of a parish minister.[127]

Chalmers subsequently underwent a considerable shift in his attitude to Christianity, becoming a prominent member of the Popular party, which opposed the more relaxed and rationalist theology of

---

[125] Hanna, *Memoirs,* vol I, pp. 32 – 33, p. 146. On p. 146, Hanna is quoting the words of "Rev. Mr. Smith" who was a colleague and amanuensis of Chalmers during 1807 - 1810.
[126] Ibid., p. 147. Hanna states that this is an excerpt from a sermon given by Chalmers at Kilmany.
[127] Brown, *Chalmers,* pp. 44 – 49.

the Moderates. George Gilfillan (1813 – 1878), a near contemporary Scottish poet, ascribed this change to the experience of writing a specific text:

> Partly through the circumstance of being requested to write on the "Evidences of Christianity," for the Edinburgh Encyclopaedia, his mind was deeply and permanently impressed with a sense of religion. He felt that his preaching had hitherto been a "sham." With characteristic determination, he altered it from its foundation. Ceasing to be an "Ape of Epictetus," he became, for the first time a preacher of Christ crucified.[128]

Thus, in Gilfillan's view, the cause of Chalmers' noticeably altered *Weltbild* and his move from "sham" preaching to his being an advocate of "Christ crucified" was to be found in a commission which he had undertaken for the *Edinburgh Encyclopaedia*. It will be argued shortly that this was not the key driver of Chalmers' change, although the experience of developing arguments in favour of Presbyterian theology may well have provided the fertile intellectual soil into which the seeds of his subsequent conversion were sown. We can also presume that Gilfillan found this explanation satisfying because of the didactic benefits of a morally uplifting conversion story wherein the experience of working with a suitably 'improving' text led to an important and desirable change. This interpretation of Chalmers' story thus demonstrated the benefits of receiving and comprehending the right kind of written word; a category in which Gilfillan no doubt located his own literary efforts.

Brown has supplied further potential causes of Chalmers' altered *Weltbild*, such as his interactions with David Brewster (1781 - 1868) a prominent evangelical who was the editor of the encyclopaedia on which Chalmers had worked and an enthusiast for pluralism. An informal engagement which Chalmers entered into with "a spirited beauty" called Anne Rankine which was not successfully concluded, probably because of his "outbursts of temper" is also cited by Brown as a potential causal factor.

The key factor which seems to have triggered Chalmers' unexpected change of religious intensity, however, was the trauma associated with the almost terminal bout of "consumption" which occurred in 1809. Brown does indeed acknowledge that this was an important, indeed perhaps the most

[128] G. Gilfillan, *A Gallery of Literary Portraits* (Edinburgh, 1845) p. 121.

important, driver of the conversion process. Michael Crowe, in his well-researched and comprehensive survey of the extraterrestrial life debate, concurred that this significant life event happened "at the time of the deaths of some persons close to Chalmers and a serious illness he himself suffered,".[129]

The origin of these convergent views on Chalmers' Damascene conversion can be traced to Hanna's report, in the first volume of the biography of his father-in-law, of this significant turning point in Chalmers' life. Hanna's narrative is clearly structured as a deathbed conversion, foreshadowed by reports of several preceding deaths and illnesses; "But death was now to be no stranger: already had he borne away two of the family [his brother George and his sister Barbara] in his cold embrace; and two of his sisters were at this time threatened with the same fatal malady." Hanna particularly noted the stylistically pious and exemplary death of his neighbour Mr. Ballardie (Chalmers' uncle who "had been a kind of second father" to him) and who had "passed into eternity in a moment":

> She found him kneeling on a chair in the very attitude of prayer, but the spirit had fled – apparently without pain or struggle it had taken its departure; and from this lowly posture before the throne of grace on earth had passed into the presence of the throne of glory in the heavens. […] It seemed as if, once begun, the quick succession was to go on unbroken. A panic seized the family, as if one after another they were doomed to fall. Partaking fully of that panic, Mr. Chalmers believed that he was about to die.

One witness of Chalmers' illness was a Professor Duncan who, in passing, provided evidence of both the "application of the very strongest medicines" and of the dramatic changes in the patient's appearance, including a very evident loss of weight and vigour:

> His illness, which was an affection of the liver, was such as to require the application of the very strongest medicines. "I visited him," says Professor Duncan," at Fincraigs, [Chalmers' house at Kilmany in Fife] where he was under the medical treatment of Dr. Ramsay of Dundee, and I certainly never saw any person so much altered in the same space of time, being then greatly attenuated, while formerly he was corpulent. He was scarcely able to walk across the room. [...] It was a year or two before he recovered, and during that period he had much the appearance of an old man, of one who would never be able again for much exertion."[130]

---

[129] Brown, *Chalmers*, pp. 52 – 54. "Consumption" was a rather vague description which could imply several possible underlying maladies. See comments by Professor Duncan below. Crowe, *extraterrestrial*, p. 183.
[130] Hanna, *Memoirs*, vol I, pp. 150 - 152. Comments in parentheses are not in the original.

From Hanna's account we learn that Chalmers spent a long period of time in close confinement; "For four months he never left his room;".[131] During this time, spent in an isolated farmhouse with limited human contact, it is little wonder that his thoughts turned to contemplation of his own mortality and an anticipation of impending death. Hanna continued his conversion narrative in the form of a reported interior dialogue which was supposed to represent the thoughts which had exercised Chalmers during his confinement. In the course of these meditations he had apparently reflected on "the feverish dream" of his past life when; "Blinded by the fascination of the things seen and temporal, he had neglected the things unseen and eternal." According to his son-in-law he then resolved that; "he would dedicate himself to the service of God, and live with the high aim and purpose of one who was in training for eternity."[132]

We don't know the nature of the medication prescribed by "Dr. Ramsay of Dundee" for Chalmers' treatment, but we do know that during the early nineteenth century opium was very widely utilised as a sedative and palliative, despite the contrary evidence of its potential role as a stimulant as has been noted in the case of some Romantic authors. "It would be almost easier to list those areas where it was never employed than to attempt to deal with every therapeutic possibility." There thus exists a strong possibility that a psychogenic substance played some part in the alterations to his affective and cognitive environment i.e. his *Weltbild* which prompted and sustained Chalmers' reveries and contemplations of eternity during this long period of illness and convalescence.[133]

The altered perspective which Chalmers adopted after his close call with death appears to have been particularly influenced by his reading of *Pensées sur la Religion,* a rambling set of notes, published posthumously, in which Blaise Pascal (1623 – 1662) attempted to expound the emotions and thought processes lying behind a similar change of avocation from mathematics to a Jansenist strain of Christianity. Pascal's 'journey' had been prompted by a near-fatal carriage accident which was similarly followed by a long period of recovery and a series of doom-laden visions; "He swooned

[131] Hanna, *Memoirs*, vol I, p. 151.
[132] Ibid., pp. 153 – 154.
[133] Berridge, *Opium*, p. 66.

away, and was only restored with difficulty, and his nerves were so shattered that long afterwards, during sleepless nights and during moments of weakness, he seemed to see a precipice at his bedside, over which he was on the point of falling."[134]

Chalmers expressed his admiration for the exemplary change of career direction and the promotion of an almost Calvinist theology effected by his predecessor who, he felt, was:

> … - a man of the richest talents and whose youth was signalized by his profound and original speculations in mathematical science, but who could stop short in the brilliant career of discovery, who could resign all the splendours of literary reputation, who could renounce without a sigh all the distinctions which are conferred upon genius, and resolve to devote every talent and every hour to the defence and illustration of the Gospel. This, my dear sir, is superior to all Greek and to all Roman fame.[135]

Following this traumatic period in his life Chalmers, inspired both by Pascal's ultimately successful bid for an alternative legacy and his own brush with death, took a much more active role in the life of the church. In 1814 he was adopted as the evangelical candidate for the important role of minister of the Tron Church in Glasgow, to which post he was in due course elected. During the selection process his enthusiastic and powerful preaching overcame the concerns of some evangelical elders who were in some doubt as to whether his conversion was real. Their caution probably reflects their memories of his earlier diffidence and irregularity in matters of religion and represents further evidence of the suddenness of his change of direction. They may also have entertained some genuine doubts about the authenticity of his espoused new position. He was indubitably motivated to disseminate evangelical Christianity; whether his particular soteriology cleaved closely to Presbyterian orthodoxy remains somewhat of an open question.[136]

The reflections on eternity which had occupied him during his length convalescence seem to have inspired a rethink by Chalmers on the interpretation of Mosaic chronology. This was a contentious

---

[134] N. Wilde, 'Scepticism and Faith in the Philosophy of Pascal', *The Harvard Theological Review*, 9, 1 (Jan., 1916), pp. 56-83, pp. 64 – 65, 70 - 71. The quotation is said to be from Jacques Benigne Bossuet's work but unfortunately Wilde does not give a precise reference to the source. Jansenism had strong similarities to evangelical Calvinism including redemptionist soteriology, justification by faith and predestination.
[135] Hanna, *Memoirs*, vol I, p. 152. The entire quotation is taken from a further section of the letter to Mr. Carstairs.
[136] Brown, *Chalmers*, pp. 91 – 92.

topic as the assumed elapse of time since the creation had continued to increase, albeit in an uneven fashion, from the late eighteenth century onwards based on arguments derived from astronomy as well as geology. In 1802, for example, William Herschel had proposed a minimum duration for the visible cosmos of around 1.9 million years.[137] The age of the earth was potentially further increased during the first decades of the nineteenth century by the bygone aeons which were adduced in ongoing debates about the meaning of the fossil record between progressive creationists like the Reverend William Buckland (1784 – 185) and the more nuanced, less directional evolution of Charles Lyell.[138]

Shortly before his appointment as the minister of the Tron church, Chalmers became one of the earliest members of a group, identified by John Yule as "scriptural hermeneutists", who attempted to find room for geological ages within the Genesis account.[139] Chalmers' hypothesis, first published in 1814, was that there is room for a considerable pause in activity between the initial creation of heaven and earth and the time when "the Spirit of God moved upon the waters." which he saw as the opening act of the traditional six days of creation (i.e. between the first and second sentences in the second verse of Genesis Chapter 1):

> Between the initial act and the details of Genesis, the world for aught we know might have been the theatre of many revolutions, the traces of which geology may still investigate, and to which she in fact has confidently appealed as the vestiges of so many successive continents that have now passed away. The whole speculation has ministered a vain triumph to infidelity – seeing first that the Historical Evidence of Scripture is quite untouched by those pretended discoveries of natural science; and that, even should they turn out to be substantial discoveries, they do not come into collision with the narrative of Moses.[140]

This 'middle way' concept, which allowed that the "pretended discoveries of natural science" might in the end turn out to be "substantial", is known as the 'gap theory' of creation. It was not originally

---

[137] W. Herschel, 'Catalogue of 500 new nebulae', *Philosophical Transactions of the Royal Society*, 1802, 92.2, pp. 477 – 528. Quoted in S. G. Brush, *The Nebulous Earth: The Origin of the Solar System and the Core of the Earth from Laplace to Jeffreys* (Cambridge, 1996) p. 35.
[138] J. H. Brooke, 'Science and the fortunes of Natural Theology: some historical perspectives', *Zygon*, 24, 1 (March 1989) pp. 3 – 22, p. 12.
[139] Yule, 'British', p. 328 quoted in Hilton, *Atonement*, p. 23.
[140] 'Dr. Chalmers' Posthumous works', *The Literary Gazette and Journal of the Belle Lettres, Arts, Sciences, etc.*, 20 November 1847, 1609, pp 810 – 811. T. Chalmers, *On Natural Theology*, vol 1 (New York, 1857), p. 251.

Chalmers' idea and was in fact one of several attempts which emerged during the eighteenth and nineteenth centuries to harmonise the narrative of Genesis 1 with the findings of geologists and palaeologists.[141]

As Boyd Hilton has observed, Chalmers' version of the concept provided a "theatre of many revolutions" which left room for several destructive and creative events of the kind which had been proposed by catastrophist geologists.[142] There is thus a deliberate ambiguity in his approach; he is allowing himself and his audience to defuse the "vain triumph to fidelity" and to hold to a literal reading of Genesis, in line with traditional theology, whilst simultaneously providing an opportunity for potential new scientific discoveries to fill the gap. Chalmers, like Paley, did not attempt to address the question of how alien geologies might operate; this is presumably an unconscious lacuna which owes its origin to earlier cosmologies in which the superlunary bodies and their orbits were all assumed to be perfectly formed.

Some theologically inclined geologists, including Hugh Miller, endeavoured to fill out the detail of Chalmers' gap. Miller reimagined scenes from *Paradise Lost* in the form of a "retrospective prophecy" based on the premise that Moses could not possibly have been alive at the time of the start of creation.[143] He also sought to explain the multiple extinction events found in the ground by envisioning a series of miraculous, rather than developmental, creations each of which, except the present one, had been followed by a gradual deterioration into degenerate states that God had ultimately decided to destroy. This somewhat pessimistic view of the operation of God's special providence was reflected in Miller's terminally depressive psychology. "[U]nder massive strain from lung disease and overwork," he "shot himself in the chest" with "the loaded revolver which lay by his bedside," to prevent potential violence against his own family.[144] This tragic example provides a further instance of the significant impact of somatic trauma on a subject's *Weltbild*, in this case resulting in suicidal ideation and death.

---

[141] O'Connor, *Earth*, pp. 64 – 66, 213 n. 84
[142] Hilton, *Atonement*, p. 150.
[143] O' Connor, *Earth*, pp. 411 – 414.
[144] Gillispie, *Geology*, pp. 171 – 181, O' Connor, *Earth*, pp. 424, 433.

Chalmers' legalistic reinterpretation of Genesis 1 was further promoted in the late nineteenth century by George Hawkins Pember (1837 - 1910) in a book entitled *Earth's Earliest Ages*, published in 1876, and subsequently by Cyrus Scofield (1843 - 1921) in *Scofield's Reference Bible* (1909).[145] In the 1917 version of this biblical commentary, Scofield somewhat confusingly also re-cycled the potentially incompatible 'day-age' theory which had been promoted by several scriptural geologists.[146] Arguments of this form had been in existence since at least the time of Augustine of Hippo (354 - 430), although Chalmers himself had somewhat loftily dismissed it in his collected essays on natural theology on the grounds that such a cosmogony appeared to reduce God's agency:

> But on the other hand we should not tamper with the record by allegorizing any of its passages or phrases. We should not for example protract the six days into so many geological periods – as if by means of a lengthened natural process to veil over the fiat of a God, that phenomenon, if we may so term it, which of all others seems the most offensive to the taste of some philosophers, and which they are most anxious to get rid of.[147]

Chalmers' tentative acceptance that deep time may well turn out to be a real phenomenon as opposed to the "allegorizing" proposed by scriptural geologists reflected his concern that no doubt should be cast on philosophical necessarianism and the creator's capacity to control all elements of time and space which also explains his strong insistence on the original collocation of created matter. These beliefs were particularly important to a Scottish Calvinist because of the further implication which they carried that God was responsible for and had knowledge of the predestined fate of every soul.[148]

Shortly after his arrival at his new post in Glasgow and two years after the publication of *Queen Mab* Chalmers chose to base his inaugural series of sermons on the findings of 'modern astronomy'. Many of Chalmers' subsequent writings were indeed initially structured and delivered as sermons. It would be consistent with the earlier discussion of multiple selfhood to suggest that Chalmers' reflexive and

---

[145] R. L. Numbers, *The Creationists: The Evolution of Scientific Creationism* (Berkeley CA, 1992) pp. 45, 362.
[146] R. T. Mangum and M. S. Sweetnam, *The Scofield Bible: Its History and Impact on the Evangelical Church* (Colorado Springs, 2009) p. 97.
[147] R. T. Pennock, *Tower of Babel: The Evidence against the New Creationism* (Cambridge MA, 2000) p. 19. Chalmers, *Theology*, p. 229.
[148] D. Fergusson, 'Predestination: A Scottish Perspective', *Scottish Journal of Theology*, 1993, 46, 4, pp. 457 – 478, 468 - 469.

rhetorical sermon-writing self was replaced by a more expressive sermon-giving self as he acted out his homilies, initially at his desk, and later in the physical setting of the Tron church. We infer from contemporary reports that the impact of his oratory included not only the "brilliant glow of a blazing eloquence", reported by a reviewer of his written work, but also a litany of non-verbal gestures and physical tropes recorded by a more immediate observer:

> Excitement, convulsion, are fit yet feeble terms for his appearance, either at the desk or the pulpit. And yet, what painter has ever ventured to draw his preaching? And hence the dullness and paltriness of almost all the prints; they show the sibyl off the stool, the eye dim and meaningless, not shot with excitement, and glaring at vacancy; the lion sleeping, not the mane-shaking, tail-tossing, and sand-spurning lord of the desert.[149]

Without this literary portrait provided by Gilfillan we would have little or no knowledge of the physicality of Chalmers' performances. The sermon-giving self, which had apparently not been much in evidence prior to his lengthy illness, was clearly quite dramatic. It was also a transient phenomenon which could be quickly replaced by the more contemplative persona which seemed to be more appropriate when sitting for a portrait.

In the series of astronomical sermons Chalmers enthusiastically subscribed to the extraterrestrial life hypothesis. In direct contrast with Paine and Shelley, however, he saw the idea of a populous universe as a positive indication of the power and creativity of a deity who operates in an expanded sphere in which "a higher scene of existence" could be located. Despite having to interact with an almost uncountable number of souls his idealised omnipresent God was able to connect with and care for every being in such a way as to alleviate his own recent brush with death. By choosing to use the performative format and theological language of a sermon, together with the mode of delivery from the authoritative elevation of his pulpit, Chalmers was, consciously or unconsciously, selecting a template plucked from the emotional community of the church which would assist his performance of

[149] W. Hanna, *Memoirs of the Life and Writings of Thomas Chalmers D.D., LL. D.*, vol II (Edinburgh, 1850) p. 88. Hanna is quoting from a review of Chalmers, *Discourses*, by the Baptist minister and essayist John Foster (1770 - 1843). The description of Chalmers' preaching can be found in: Gilfillan, *Gallery*, p. 110.

an elegiac and spiritually uplifting peroration. The effectiveness of his post-conversion sermon-giving self was clearly far greater than his former somewhat lacklustre delivery.

Chalmers' support for the pluralism hypothesis, subsequently published in book form as *A Series of Discourses on the Christian Revelation viewed in connection with the Modern Astronomy,* was couched in very positive language. In keeping with the rhythmic cadence of an originally oral presentation he asked a sequence of rhetorical questions as a means of first building up and then bringing down a generic adversary whom he labelled "the Infidel":

> Is it likely, says the Infidel, that God would send his eternal Son, to die for the puny occupiers of so insignificant a province in the mighty field of his creation? Are we the befitting objects of so great and so signal an interposition? Does not the largeness of that field which astronomy lays open to the view of modern science, throw a suspicion over the truth of the gospel history? and how shall we reconcile the greatness of that wonderful movement which was made in heaven for the redemption of fallen man, with the comparative meanness and obscurity of our species?[150]

Chalmers clearly understood that the "largeness of the field which astronomy lays open", i.e. the scale and duration of the universe, was potentially a weakness as well as a strength of his argument. It could not only be used by natural theologians as evidence of God's creative powers but also by opponents of revealed religion, like Paine, who wished to "throw a suspicion over the truth of gospel history?" Chalmers' solution was to argue that the potentially strong case made by "the Infidel" should be countered by contemplation of both the omnipotence of, and the personal grace afforded by, "the same God who sits in the highest heaven, and reigns over the glories of the firmament, is at my right hand, to give me every breath which I draw, and every comfort which I enjoy."[151]

The quantity of potential souls in the universe had expanded during the early nineteenth century as a result of the increasing age and scale of the cosmos and it was by no means clear that a single redemptive act would be sufficient to secure their salvation. His earlier meditations on the subjectivity of time, however, provided a potential solution to this problem for Chalmers. In response to the arguments of "the Infidel who urges the astronomical objection to the truth of Christianity" that

[150] Chalmers, *Discourses,* p. 54
[151] Ibid., p. 53.

the deity could not possibly have had time to arrange penitential processes on the potential infinity of other worlds, Chalmers, presumably also reflecting on his own gap theory, was able to retort that God, who can treat "a thousand years as one day" has "the mighty roll of innumerable ages" to work in.[152]

Of the various supporters of pluralism in the early to mid-nineteenth century, Chalmers was the most popular and widely read. His appearances at the Tron Church in Glasgow, according to Hanna, were attended by "congregated thousands" of Glasgow merchants, clerks and apprentices who, on the days when his sermons were to be given, left their desks early to attend Chalmers' evidently engaging performances. Chalmers' sermons stimulated the imaginations and "human sympathies" of his audience by pointing out "the vastness and variety of those unnumbered worlds which lie scattered over the immeasurable fields of space." He thus provided his audience with a glimpse of the altered perspective on the scale of the universe and the insignificance of a single human lifetime which he had himself experienced:

> The spectacle which presented itself in the Trongate upon the day of delivery of each new astronomical discourse, was a most singular one. Long ere the bell began to toll, a stream of people might be seen pouring through the passage which led to the Tron Church. [...] … heaven and its high economy and its human sympathies and eternal interests, engrossed the mind at least and the fancy of congregated thousands.[153]

Chalmers perhaps also saw these congregations as a small sample of the numerous populations of the universe which either had been, or needed to be, redeemed by an experience of personal salvation. His post-conversion evangelical theology promoted the idea that the salvationary offer arising from Christ's atonement was open to everyone, regardless of whether they yet had faith or not; an idea which he presumably extended to cover extraterrestrial species who had not yet heard 'the Word'. It is certainly clear that he pursued an interest in terrestrial missionary work and had studied the "theories and practices of the Moravians, Baptists, the London Missionary Society, and the Church Missionary Society". As a result of "his enthusiastic, experimental approach" many of his own students became missionaries:

---

[152] Chalmers, *Discourses*, pp. 155 -157.
[153] Hanna, *Memoirs*, vol II, p. 88.

> His holistic philosophy, as well as his enthusiastic, experimental approach to mission, was reproduced and expanded by his students who became missionaries, educators, and church leaders around the world.

Perhaps unexpectedly, given his partisan leadership of the Disruption in the 1840s, he retained a broadly ecumenical sense of mission throughout his life; "his commitments to mission and principle were stronger than his commitment to any particular church, national or free."[154]

Relatively few dramatic political changes can be observed in the narratives of the subjects of this thesis, presumably because the existential threats and emotional crises which they faced were not, as it happened, associated with situations in which a revised ideological stance could be expected to relieve their anxieties. Perhaps the clearest instance of a politically significant paradigm change, however, was that of Thomas Chalmers who, following his conversion to evangelism, espoused a stronger belief in a divinely ordered moral universe in which people would undertake 'right action' once they had been suitably educated.

A youthful Chalmers had been prone to occasional vituperation against class privilege; "in his anger with the gentry for ignoring his abilities and refusing to acknowledge his family's proper status in the hierarchy of social orders, his thought was beginning to move in a radical direction." Nonetheless, his anomie did not lead him to formulate a strong political ideology, indeed his thoughts were "more a function of thwarted ambition than any defined social ideal."[155] There does not appear to be any period in which he took up a truly radical point of view which would have been more congruent with the ideas of 'infidels' like Paine and Shelley or indeed the communitarian plans of socialists like Robert Owen (1771 - 1858).[156] He instead expressed support for an agrarian model of political economy, eschewing industrialisation, which he saw as a counter to Napoleon's Continental System and which would provide better support for the marginal subsistence experienced in his native Fife.[157]

---

[154] J. Roxborogh, 'The Legacy of Thomas Chalmers', *International Bulletin of Missionary Research*, (October 1999), pp. 173 – 176.
[155] Brown, *Chalmers*, p. 19.
[156] L. J. Snyder, *Reforming Philosophy: a Victorian Debate on Science and Society* (Chicago, 2006) pp. 293 – 294.
[157] Brown, *Chalmers*, pp. 35 – 42.

Following his appointment to the Tron church, however, his personal experience of voluntary work amongst Glasgow's poorer citizens, combined with his reading of the works of Thomas Malthus (1766 - 1834), convinced him of the need to improve their lot by means of conversion to Christianity and an improved 'moral economy'. This led him to what might at first sight seem to be a perverse conclusion; that the provision of relief for the poor would fail to produce any improvement in their morality and hence their health and welfare but would instead have the opposite effect.[158]

Like his fellow Presbyterians and some, but not all, natural theologians he saw poverty as a sign of moral failure and irreligion. He therefore supported the abolition of the Poor Laws because he believed that there was an opportunity to improve the "economic comfort" and "physical comfort" of his fellow Glaswegians by enhancing their "moral worth" and "prudence":

> … inseparable connection between the moral worth and the economic comfort of a people ... political economy is but one grand exemplification of the alliance, which a god of righteousness hath established, between prudence on the one hand, and physical comfort on the other.[159]

It seems, then, that there was a slow but significant change in Chalmers' views on politics and political economy following his theological conversion event. It had become Chalmers' view that there is a very strong connection between religious observance and the well-being of the population. He underwent a gradual shift from advocacy for agrarian self-sufficiency towards a Malthusian approach to the urban poor which seemed to be related to the cultural and economic context of his parishioners as well as to his choice of reading matter Post-conversion Chalmers was, however, a quite complex character who exhibited multiple selves and who could, at different times, appear to be either compassionate or dispassionate in his interactions with his fellow human beings.[160]

Thomas Chalmers was a highly influential theologian and church leader. His thoughts on pluralism reached a wide audience and set the tone for subsequent debates on the topic. Significant

---

[158] Brown, *Chalmers*, pp. 117 – 129.
[159] T. Chalmers, *On the Power, Wisdom and Goodness of God, as manifested in the adaptation of external nature to the Moral and Intellectual Constitution of Man* (Glasgow, 1839) pp. 52 – 54.
[160] Brown, *Chalmers*, pp. 283 - 284.

components of his *Weltbild*, including the strength of his religious conviction and his views on the probable existence of alien life seem to have been very significantly altered by an unfortunate and adventitious series of events; the concurrence of the deaths of several close relatives and his own near-fatal illness during which he was treated with "the very strongest medicines".

It seems probable that there was a proselytizing intention which connected Chalmers' changed attitudes to the, in his view, convergent paradigms of evangelism and the existence of extraterrestrial life. Having converted from youthful scepticism to a newly found faith in the core message of his chosen form of Christianity he sought to spread the 'good news' to his fellow humans and potentially also to considerably expand the celestial congregation of God's worshippers. If even a minority of planets contained a population of unredeemed sinners then there would be ample future opportunity for evangelical missionary work amongst these putative interplanetary 'colonials'.

Following Chalmers' intervention in favour of evangelical pluralism, his ideas were enthusiastically adopted by several commentators. In 1829, for example, his fellow Scottish Presbyterian and amateur astronomer Thomas Dick (1774 - 1857) published a volume entitled *Philosophy of a Future State* in which he pursued a combination of natural theology and pluralism to its logical conclusions. He estimated that there are 80 million visible stars and since, by analogy with the solar system, each star should have thirty or more satellites then there could be 2.4 billion inhabited worlds in the visible universe.[161]

Dick had undergone, slightly earlier than had Chalmers, the experience of a conversion from a conventional but perhaps rather unenthusiastic career in the Church to a far more involved participation in religion, astronomy, education, pacifism and emancipation. The stimulus which led to his 'reformed' vocation was a series of episodes of adultery with a servant, followed shortly thereafter by the neonatal deaths of the two children whom he had fathered with his wife and the maid. This tragic sequence of events, which he saw as divine retribution for his sins, had led to his (subsequently revoked) excommunication from the Stirling Presbytery in 1805; "certainly, his call for the ministry

[161] T. Dick, *The Philosophy of a Future State* (New York, 1829) p. 213.

proved insufficiently strong to regulate his behaviour. His character besmirched, Dick now had to rehabilitate himself."[162]

In due course Dick re-calculated the number of souls (i.e. potential worshippers) in the solar system to be of the order of 22 trillion.[163] This highly speculative conjecture was accompanied by a further imaginative leap; that the centre of the galaxy is occupied by a vast body which in fact constitutes "THE THRONE OF GOD".[164] Dick's new hypothesis was his solution to an ancient predicament; where is the abode of the gods? In medieval versions of the geocentric Ptolemaic universe there was conceived to be a system of heavenly spheres which provided accommodation for the various fabulous creatures who occupied the higher rungs of the 'great chain of being' but this neat ordering had been ruled out by William Herschel's irregular and non-heliocentric Milky Way.[165]

By 1840, and in continuing pursuit of his objective of demonstrating the vast size of God's congregation, Dick expanded his earlier solar system population estimate to encompass other stellar systems and solid bodied comets (which he had latterly decided were also populated) and adduced a grand total for the visible universe of 60, 573 x 10^{18} inhabitants.[166] This huge number, which provided a suitably expansive counterpoint to the subsequent arguments of Whewell and Proctor, represented a high water mark in terms of speculation concerning the size of the population of the cosmos and the extent of God's kingdom. This vast congregation of potential worshippers, which was beginning to be apprehended well before the publication of Dick's grandiloquent calculations, exacerbated the dilemma for the advocates of pluralism which had been posed by Paine; in a vast and populous universe how could God have time to exhibit even the slightest fraction of concern for a single human being?

---

[162] W. J. Astore, *Observing God: Thomas Dick, Evangelicalism, and Popular Science in Victorian Britain and America* (London, 2001) pp. 1 - 2, 19 – 20.
[163] T. Dick, *Celestial Scenery, or the Wonders of the Planetary System Displayed* (New York, 1838), p. 306.
[164] Dick, *Philosophy,* pp. 249 – 250.
[165] A. O. Lovejoy, *The Great Chain of Being: A Study of the History of an Idea* (Cambridge MA, 2001).
[166] T. Dick, *The Sidereal Heaven and other subjects connected with Astronomy* (New York, 1840) pp. 317 – 318, 359 – 364.

A notable exception to the general tendency to pluralistic enthusiasm in the first half of the century, which contrasted with the evangelistic enthusiasm and expansive interstellar populations promoted by Chalmers and Dick, can be identified in the work of Samuel Taylor Coleridge (1772 – 1834), who has for a long time, and on his own admittance, been strongly associated with the consumption of opium, particularly during his poetic peak years. Thomas De Quincey's descriptions of his own visions under the influence of what Coleridge euphemistically called "an anodyne" have enabled one scholar to claim great specificity about which lines of the latter's *Kubla Khan* should be read as elements of an opium dream:

> Moreover, in the first part of "Kubla Khan" there are indications that Coleridge was experiencing the widening of the limits of space and time described by De Quincey. The caverns are "measureless to man," the forests are "ancient as the hills," and Kubla hears a message from the remote past, - " ancestral voices prophesying war."[167]

These earlier passages can be contrasted with the lines which represent the poet's failed attempt at recollection after the "person on business from Porlock" had departed, including the terminal lines:

> For he on honey-dew hath fed,
> And drank the milk of Paradise.[168]

In later life, and in a substantially revised edition of *Confessions*, De Quincey reacted strongly to Coleridge's accusation that he had "resorted to opium in the abominable character of an adventurous voluptuary,". Coleridge claimed by way of invidious comparison, that he himself had "fallen excusably (because unavoidably) into this habit of eating opium" due to medical necessity. His argument was strongly refuted by a dubious De Quincey; "[Coleridge] suffers himself to fall into a captivity to this same wicked opium, deadlier than was ever heard of, and under no coercion whatever that he has anywhere explained to us. A slave he was to this potent drug not less abject than Caliban

---

[167] S. T. Coleridge, 'of the fragment of Kubla Khan' in S. T. Coleridge, *Christabel, etc.* (London, 1816) pp. 51 – 54. N. B. Allen, 'A Note on Coleridge's "Kubla Khan"', *Modern Language Notes*, 57, 2 (Feb., 1942), pp. 108 – 113, 112.

[168] S. T. Coleridge, 'fragment'. S. T. Coleridge, 'Kubla Khan' in Coleridge, *Christabel*, pp. 55 – 58. "milk of Paradise" was a widely used euphemism for laudanum. It is a reference to the white liquid which is produced by scarifying opium poppy heads. See: L. Inglis, *Milk of Paradise: a history of opium* (London, 2018) pp. 12, 156 - 157.

to Prospero".[169] De Quincey's scepticism was well founded. As a young man Coleridge had associated with several 'Romantic scientists' including Thomas Beddoes (1760 – 1808), Humphrey Davy (1778 - 1829) and other 'Brunonians' who "were unusual in regarding opium as a stimulant," and had joined them in experiments with nitrous oxide, a gas which Robert Southey (1774 - 1843) lauded as "a pleasure for which language had no name."[170]

A more mature Coleridge was able apparently to curtail but not to eliminate his opium usage which, it transpired, was essential to his ability to write:

> While it is unlikely that he ever returned to the enormous doses of his earlier years, he did continue to take […] what he considered sufficient opium to keep him "tranquil and capable of literary labor."' '[171]

Coleridge had by this time returned to the fold of the liberal wing of the Anglican church after a youthful flirtation with being a "Unitarian, if not a Deist;".[172] It has to be presumed that it was the combined affect of these two influences which led him to express a very negative view of pluralism:

> I never could feel any force in the arguments for a plurality of worlds, in the common acceptation of that term. A lady once asked me - "What then could be the intention in creating so many great bodies, so apparently useless to us?" I said - I did not know, except perhaps to make dirt cheap. The vulgar inference is *in alio genere*. What in the eye of an intellectual and omnipotent Being is the whole sidereal system to the soul of one man for whom Christ died?[173]

This line of argument foregrounded his concern with the relative weight which the Deity would place on a single human soul. and this passage represented an external expression of his rediscovered Trinitarian convictions and perhaps an intimation, in the final year of his life, of his own mortality.

---

[169] T. De Quincey, *Confessions of an English opium-eater*, Volume one in a series of De Quincey's works, (Edinburgh, 1862) pp. 3, 8. This version had been substantially revised by the author in 1856.
[170] 'Brunonianism' was the name given to a Romantic medical theory "based on the excitability of the animal body" which had originated with Edinburgh physician John Brown (1735 – 1788). C. Lawrence, 'The power and the glory: Humphry Davy and Romanticism' in A. Cunningham and N. Jardine (eds.*), Romanticism and the sciences* (Cambridge, 1990) pp. 213 – 227, 215 – 219.
[171] E. L. Griggs and S. T. Porter, 'Samuel Taylor Coleridge and Opium', *Huntington Library Quarterly*, 17, 4 (Aug., 1954), pp. 357 – 378, 363.
[172] J. D. Campbell, *Samuel Taylor Coleridge: A Narrative of the Events of his Life* (London, 1894) pp. 33, 255 – 256.
[173] S. T. Coleridge, 'Table Talk' (February 1834) in W. G. T. Shedd (ed.), *The Complete Works of Samuel Taylor Coleridge*, vol VI (New York, 1884) pp. 502 – 503.

Taking, then, the thoughts of Paine, Chalmers, Shelley and Coleridge as examples we see that the concept of pluralism was not was always deployed to promote traditional religious beliefs, nor was an opposing view automatically a denial of conventional theology. A unique revelation applicable only to man could potentially be seen to sit much better within a sparely populated universe; an argument which was to be subsequently promoted by William Whewell, one of the many people who had studied Chalmers' *Discourses* with interest and appreciation.

Whewell was the son of a Cumbrian carpenter who had exhibited such academic promise at schools in Lancaster and Heversham that he won a scholarship to attend the University of Cambridge.[174] As a young Fellow at Trinity, the college of which he subsequently became Master, he had evidently followed a recommendation which he received from his sister Anne:

> I am glad you have been reading more of Chalmers's [sic] sermons; I have only read one or two of his astronomical ones, but I think they are all that you describe them.

In the same letter he also offered an invidious comparison with a preacher called Irving; "He is very far inferior to Chalmers, whose pupil and assistant he has been, and, as I think, to some others whom I have heard."[175]

More evidence of Whewell's early interest in, and potential support for, pluralism came in the form of a sermon which Whewell preached at Cambridge, shortly after his ordination into the Church of England, in which he clearly expressed his then firm belief in extraterrestrial "responsible beings" and an acceptance of the argument "founded upon analogies":

> That the earth which man inhabits is one among a multitude of worlds which roll on their appointed paths in the populous universe, at intervals which it exhausts the imagination to span […] these are not the reveries of idle dreamers or busy contrivers; - but for the main part, truths collected by wise and patient men on evidence indisputable, […], founded upon analogies which most will allow to reach at least some degree of probability. Now it may be natural that a believer […], upon thus learning as it were the population of the whole universe let in upon him as joint claimants of God's notice and objects of his care, feel, so to speak, alarmed and dispirited; as if it were too much to expect that his

---

[174] I. Todhunter, *William Whewell, D. D. Master of Trinity College, Cambridge. An account of his writings with selections from his literary and scientific correspondence,* vol 1 (London, 1876), pp. 1 – 2.
[175] Whewell to Anne Whewell, J. M. Stair Douglas, *The life and selections from the correspondence of William Whewell, D. D. late Master of Trinity College Cambridge* (London, 1881) p. 72. The letter is undated but was included by Stair Douglas with other correspondence from 1822, which is consistent with other information which it contains.

> preservation and redemption and satisfaction should occupy the mind which is charged with the care of ten thousand worlds and systems.[176]

Whewell went on to make use of the same excerpt from Psalm 8:4 ("What is man that thou art mindful of him?") which Chalmers had deployed in his *Discourses*. The primary thrust of this sermon can indeed be seen as having been derived with little deviation from Chalmers' original work. In reading this passage we therefore understand that Whewell in 1827 was inclined to accept the pluralist arguments then very much in vogue amongst natural theologians and, though he shared with others some theological doubts and a concern that the underlying basis of Christianity and the idea of a personal theistic deity could be undermined by this position, he accepted that an expanded universal population could nonetheless be seen as a positive indication of the omnipotence of the creator. It is, however, at least a little ironic that, despite his later erudite ruminations on inductive philosophy and Baconian science, Whewell at this stage was quite happy to accept as "evidence indisputable" some very speculative ideas to the effect that the universe is populated by numerous living and intelligent beings.

Whewell was subsequently invited to author a *Bridgewater Treatise* because of his previously displayed sympathy with the aims and arguments of natural theologians. It is unsurprising, given his enthusiasm for the work of Chalmers, that he chose *Astronomy and General Physics considered with Reference to Natural Theology* as the title and theme for his contribution to the series. Whewell dedicated one section of this book, first published in 1833, to a discussion of the argument from final causes in which he posited that considerable caution should be exercised by natural philosophers when investigating the origins of objects and phenomena in the universe. Whewell, unlike Chalmers, advised philosophers "not to assume that we know the objects of the Creator's design". He advocated instead the study of the secondary laws which generate many of the aspects of creation now visible to man:

> Final causes are to be excluded from physical inquiry; that is, we are not to assume that we know the objects of the Creator's design, and put this assumed purpose in the place of

[176] Sermon preached by Whewell on February 18, 1827. Todhunter, *Whewell*, vol 1, p. 326.

> a physical cause. We are not to think it a sufficient account of the clouds that they are for watering the earth, (to take Bacon's examples) or "that the solidness of the earth is for the station and mansion of living creatures." The physical philosopher has it for his business to trace clouds to the laws of evaporation and condensation; to determine the magnitude and mode of action of the forces of cohesion and crystallization by which the materials of the earth are made solid and firm.[177]

Here, Whewell seemed to be arguing for a method of scientific enquiry which favoured a process of discovering proximate materialist explanations for the phenomena of nature rather than trying to second guess the mind of God. This will turn out to be one of several points of view held by Whewell in the 1830s which were to be modified in the early 1850s at a time when Whewell appeared to be much more confident that he understood the purpose of creation.

The treatment of pluralism in his *Bridgewater Treatise* was not expansive but neither was it negative. Whewell devoted a few comments in a section entitled 'On the Vastness of the Universe' to a consideration of "these countless species of creatures;" who inhabit the known and as yet unknown universe, concluding with an encomium to the powers of the "Maker and Master of all;":

> On the contrary, those magnitudes and proportions which leave our powers of conception far behind; […] may reasonably serve, not to disturb, but to enlarge and elevate our conceptions of the Maker and Master of all; to feed an ever-growing admiration of His wonderful nature; and to excite a desire to be able to contemplate more steadily and conceive less inadequately the scheme of his government and the operation of his power.[178]

The effusive support for pluralism exhibited by Whewell in 1827, somewhat less energetically argued in 1833, can be clearly contrasted with the evident change of mind which reached its full flowering in *Of the Plurality of Worlds: an Essay*, published anonymously in 1853, and in which he sought to refute pluralism for reasons which will be discussed shortly. There are some indications that this change of mind began to take place in the late 1840s in the form of the following comments

[177] W. Whewell, *Astronomy and General Physics Considered with Reference to Natural Theology* (London, 1833) p. 264.
[178] Ibid., p. 212.

made by Cambridge mathematician and Whewell biographer Isaac Todhunter (1820 – 1884) with respect to a paper Whewell gave at that time:

> Dr Whewell there briefly contrasts two theories of the Universe, and while admitting that there are difficulties in both, considers that they are less in that theory which was in fact afterwards maintained in the *Essay*. Perhaps the opposition which this work encountered stimulated him to seek for arguments in its favour and increased his confidence in it.
>
> I have already said on page 188 that this memoir contains, in the form of a suggestion, an anticipation of the main position of the *Essay* on the Plurality of Worlds, namely, that man is the principal object of creation.[179]

The passage to which Todhunter referred was inserted as a worked example, rather than the main thesis, in a paper on metaphysics and methods. This discussion gives us a clearer insight into Whewell's views on both pluralism and the nebular hypothesis in 1848. It should be particularly noted that his examples of extraterrestrial organisms were now restricted to "vegetable and animal life", with no mention of intelligent beings:

> … the Idea, such as the motions of satellites, the relations of the elements of planets, the existence of vegetable and animal life upon their surfaces. But if all these Facts, when fully studied, should appear to be included in the general Idea of Nebular Condensation […] we are also to recollect that the Facts may be compared with another Idea, no less large and striking; […] The other Idea which I speak of is the Idea of Man as the principal Object in the Creation; to whose sustenance and development the other parts of the Universe are subservient as means to an end;[180]

The idea of the presence of living organisms on other planets was, in this article and at this point in Whewell's life, taken to be evidence against the nebular hypothesis. This argument was combined with other "Facts" which Whewell alluded to in order to cast doubt on nebular cosmogony. Whewell's attitude to this hypothesis (which will also be discussed in Chapter 3) was distinctly negative at that point in time. His evident opposition to nebular evolution at this time probably arose at least in part because it had been recently claimed as a proven theory by the author of *Vestiges*, and more importantly because in his view the stochastic and uncontrolled outcomes of such an

---

[179] Todhunter, *Whewell*, vol 1, pp. 188, 317.
[180] W. Whewell, 'Second Memoir on the Fundamental Antithesis of Philosophy', *Transactions of the Cambridge Philosophical Society*, vol VIII, part I (Cambridge, 1849) pp. 614 – 662, 615 – 616. See below for further discussion of Whewell's attitude to *Vestiges*.

apparently random development process conflicted with "the Idea of Man as the principal Object in the Creation;"

This line of argument is consistent with his frequent employment of both idealist metaphysics and inductive reasoning. It is important to come to an understanding of why Whewell held these views at this time in order to appreciate the reasons which have been put forward by historians for his subsequent changes of emphasis and belief in 1853. Whewell's attachment to idealism is usually attributed to his reading of Immanuel Kant and of continental philosophy in general. This putative affiliation with the views of the 'German Romantics' offered potential dangers as well as benefits because "extreme idealist philosophy dissolved the distinctions between man, God and nature, and challenged the authority of Revelation."[181]

Richard Yeo has also identified a revival of seventeenth-century Neoplatonism in the work of Whewell and has, like Laura Snyder, pointed out that in addition to metaphysics, Whewell saw theology as a fundamental epistemology which was not to be divorced from the world of science:

> He proclaimed the religious and intellectual value of natural science while repudiating the empiricist philosophy of science promoted by the utilitarians. He stressed the role of metaphysical concepts in physical knowledge, and offered an idealist philosophy of science which might satisfy the requirements of a Christian natural theology.[182]

By the late 1840s, as we have just seen, Whewell clearly shared with some supporters of idealism the concept that man occupied a special position in the schema of the cosmos. His principles included a belief, which he shared with Chalmers, that the ideas or laws which govern the universe are 'necessary' in the sense that they were and are pre-existing in the mind of the deity. In his view, therefore, man is the sole entity, other than the creator, who is capable of understanding questions of design, intention and morality in the universe; a view which contrasts markedly with his earlier thoughts on the same topic expressed in his *Bridgewater Treatise*. Thus, in the revised Whewellian

---

[181] R. Yeo, 'William Whewell, natural theology and the philosophy of science in mid nineteenth century Britain', *Annals of Science,* 1979, 36:5, pp. 493 - 516, 497.
[182] Yeo, 'Whewell', p. 515. See also L. J. Snyder, 'It's *All* Necessarily So: William Whewell on Scientific Truth'**,** *Studies in History and Philosophy of Science,* 25, 5, (1994) pp. 785-807.

cosmos, man could aspire to approach a comprehension of the mind of God and that hypothesized achievement would represent the pinnacle of human endeavour.[183]

At the other extreme, and despite his original tentative support for the ideas expressed in the nebular hypothesis, Whewell could not accept the deist position which would allow for the entire cosmos, including its sentient inhabitants, to unfurl as a consequence of adventitious evolutionary processes over which the creator exercised no immediate (and possibly not any) control and in which man is not accorded a special position in the process of Creation.[184]

Whewell was unhappy with the extensive use of such developmental ideas by the author of *Vestiges of the Natural History of Creation.* He claimed to be particularly horrified by the lack of clear understanding of standards of scientific proof in the book:

> For the Vestiges has its hold on its readers, as it seems to me, by their want of the apprehension of the difference of the nature of truth and falsehood in science and philosophy; and this is a support which no argument can remove, but which on the contrary blunts the point of every good argument.

Whewell's dislike was shared by fellow Lancastrian Richard Owen (1804 – 1892) and his Cambridge colleague Adam Sedgwick (1785 – 1873); "You would be surprised to hear the contempt and abhorrence with which Owen and Sedgwick speak of the Vestiges."[185]

From Owen, Whewell had also obtained the idea that the development of both extinct and extant vertebrate species depended on the existence of templates or archetypes thus "affirming that the ideal exemplar for the vertebrate animals existed as an idea in the Divine Mind."[186] This concept of a 'unity of plan' provided support for the concept of the nomological development of a diversity of species as opposed to the teleology of many natural theologians.

---

[183] L. J. Snyder, 'Lord only of the ruffians and fiends'? William Whewell and the plurality of worlds debate', *Studies in History and Philosophy of Science*, 38 (2007) pp. 584 – 592, 587 – 588.
[184] See below and Chapter 3 for further discussion of Whewell's changing views on the nebular hypothesis.
[185] Whewell to Rev. F. Myers, March 16, 1845. Stair Douglas, *Whewell*, p. 317 - 319.
[186] Yeo, 'Whewell', p. 508.

Arguably the primary cause of Whewell's dislike of the hypotheses unveiled in *Vestiges* was the removal of the unique nature of man as God's special creation and the lack of any reference to final causes:

> I have attempted to show that, dim as the light is which science throws upon creation, it gives us reason to believe that the placing of man upon the earth (including his creation) was a supernatural event, an exception to the laws of nature. The Vestiges has, for one of its main doctrines, that this event was a natural event, the result of a law by which man grew out of monkey. As to the degree of resemblance between the author and the French physiological atheists, he uses reverent phrases: theirs would not be tolerated in England. But I do not recollect any reference to final causes in him.[187]

In Whewell's mind the avoidance of final causes was to be read alongside the slighting reference to "reverent phrases" as indications of doubt about the author's faith in the veracity of revealed religion. Clearly the deployment of certain types of metaphysical argument provided a set of diagnostic data which led many readers, including Whewell, to believe that they could divine the heterodox leanings of the anonymous author.

Whewell's formal response to *Vestiges* took the form of a rehash of some selected excerpts of his own works in an 1845 book intended as a rebuttal of the elements of the anonymous *succès de scandale* with which he disagreed. This indirect attack, with the title *Indications of the Creator*, was published anonymously, presumably because Whewell did not wish to be seen as validating or giving equal authority to the supposedly scientific content of *Vestiges* by attaching his own name to the counter argument. One of the objectives of his work was to point out that some of the ideas used by the equally anonymous author of *Vestiges* were actually speculative conjectures rather than firmly established theories; the nebular hypothesis being a specific example. He also used extracts from his own treatises on scientific methodology to identify what he saw as deficiencies in the approach of the author of *Vestiges*.[188]

In due course Whewell wrote an anonymous essay in which he substantially revised his previously held position on the probability of pluralism. Crowe's account of this period noted that Frederick Burnham has argued that Whewell's change of mind with respect to the 'truth' of pluralism was

[187] Whewell to Rev. F. Myers, March 16, 1845. Stair Douglas, *Whewell*, p. 318.
[188] W. Whewell, *Indications of the Creator* (London, 1846).

motivated by his known preference for the concept of a creation which proceeded by the secondary operation of God's laws on the contents of the cosmos. In other words, his subsequent rebuttal of pluralism contains evidence of "his emphasis […] on the nomological as opposed to the teleological form of the design argument."[189]

This partiality for nomological explanations actually aligned Whewell rather more with contemporaries like John Frederick William Herschel (1792 - 1871) than with the teleological approaches of a William Paley or a Thomas Chalmers, despite his evident early admiration for the latter. It was a common characteristic of the people who at that time formed a younger generation who we tend to think of as emergent 'scientists' (a term actually coined by Whewell himself) and who represented a more open and questioning approach to explanations of natural phenomena.[190] And, of course, it is important in gaining an understanding of how Whewell's intellectual views were formed to note the more evident physical proximity and social intercourse that he experienced with Herschel, Adam Sedgwick (1785 - 1873) and his other peers who formed the overlapping emotional communities of theology and natural philosophy at Cambridge, whereas his contact with the father figures of natural theology was more remote in both time and space.[191]

In contrast to Burnham's explanation, John Hedley Brooke has argued that the main purpose of the 1853 *Essay* was to further refute the evolutionary hypotheses promoted by *Vestiges*:

> By 1849 the *controversy* may have been old, but the need for independent instruction was as pressing as ever. Is it not possible that Whewell's *Essay* was in some measure conceived to provide such instruction? His intentions do not stand out with great clarity--and yet that is precisely what one would expect if he was taking a left-handed swipe at the development hypothesis. Did Whewell calculate that to detonate the plurality of worlds was one way of exploding the presuppositions that had made *Vestiges* so dangerous? Did he, perhaps, give the game away in a letter to Forbes: 'I shall be surprised if anyone thinks that I give any support to the man of the *Vestiges*. It seemed to me that my book might have some value as a strong case exactly opposed to his?'[192]

---

[189] Crowe, *extraterrestrial*, p. 266.
[190] C. G. Gillespie (Ed)., *Dictionary of Scientific Biography*, vol XIV (New York, 1976) p. 292.
[191] Although William Paley died in 1805, Chalmers' career did overlap with that of Whewell and they did indeed meet at, for example, the British Association meeting in Cambridge in 1833. Hilton, *Atonement*, p. 60.
[192] J. H. Brooke, 'Natural theology and the plurality of worlds: Observations on the Brewster-Whewell debate', *Annals of Science*, 1977, 34:3, pp. 221 – 286, 267. Includes a quotation from a letter from Whewell to J. D. Forbes, 19 February 1854, recorded in Todhunter, *Whewell*, vol 2, p. 400.

This argument from the negative appears a little tentative at first sight and taken alone is not particularly convincing. Brooke could have provided further ammunition for his thesis if he had more clearly highlighted one specific quotation from *A Dialogue on the Plurality of Worlds,* appended to some editions of the *Essay*. Here the writer made a more direct comparison with the main thrust of *Vestiges* whilst also coming very close to revealing the identity of the author of *Essay*:

> If he were to try to connect me with an answer to that book, which went through two editions, under the title of Indications of the Creator, he would be nearer the mark. At least I adopt the sentiments of this latter book; and they agree with those of the Essay, as you may satisfy yourself by looking. In both works, the placing of man on the earth is regarded as an event out of the ordinary course of nature; directly the opposite of the doctrine of the Vestiges.[193]

There are therefore at least two available explanations for Whewell's change of mind on pluralism. The first posits a preference for nomological accounts of the process of creation. This cosmogony also allowed him to place man at the pinnacle of sublunar creation with an aspiration to an understanding of the thoughts of the deity, the mind of man perhaps being an analogue for the mind of the creator in the same way as vertebrate body plans were seen to be templates for future development. An alternative argument is "that Whewell wrote one anonymous book in reply to another, or at least partly so, sacking life on other planets to make room for the final causes that went with special creation on this one?"[194] It is certainly clear that he objected strongly to both the style and content of *Vestiges* and it also seems probable that the very popularity of the work was also a source of concern, as he recognised that its wide readership represented a genuine threat to his own metaphysical, religious and scientific beliefs.

A third partial explanation, based on Whewell's idealism, has been offered by Yeo, although he conceded that his thoughts are "complementary to this [Brooke's] analysis,";

---

[193] W. Whewell, *A Dialogue on the Plurality of Worlds* (London, 1853) pp. 52 – 53. This appears to be the passage to which Brooke referred in note 285 on page 267 of 'Brewster-Whewell', although the page number given differs from that in the 1853 edition which was appended to *Of the Plurality of the Worlds: an essay*.
[194] Brooke, 'Brewster-Whewell', p. 267.

> Whewell's rejection of the plurality of worlds is seen as an important aspect of his defence of an idealist epistemology. In asserting the unique place of man in the universe, he was able to rationalize the notion of a close affinity between the mind of man and the mind of God."[195]

On reflection, however, these explanatory accounts are contributory but at the same time insufficient as a totalising account of the evolving *Weltbild* which motivated Whewell to produce such a controversial reversal of his previous position that he again chose to publish it anonymously. Clues to a more fundamental but also more subjective cause lie in an examination of recent changes which had taken place in Whewell's emotional life and their relationship to the major arguments which he made in the *Essay*.

Taking the latter point first, it is clear from the structure and content of the 1853 book that Whewell, an ordained minister of the Church of England, wanted to preserve the fundamental Christian message of hope and salvation in the form of a special revelation communicated to "the race of man" alone:

> Revealed Religion teaches us […] that by his [God's] dealings with the race of man in the earlier times, and at various intervals, he made preparation for the mission of a special Messenger, whom, in the fulness of time, he sent upon the earth in the form of a man; […] The arrival of this especial Message of Holiness, Judgment, and Redemption, forms the great event in the history of the earth, considered in a religious view, as the abode of God's servants.[196]

In making this argument Whewell was in part relying on his earlier assertion that the placing of man on Earth was a special event and, in effect, the final cause of Creation. The status of man as the recipient of divine revelation was thus also explained. At this point in his process of psychological construction, Whewell had clearly distanced himself to some extent from his earlier approval of the work of Thomas Chalmers, particularly on the question of the consolatory power of a cosmos teeming with life.[197]

---

[195] Yeo, 'Whewell', p. 506.
[196] Whewell, *Essay*, p. 44.
[197] See, for example, Whewell, *Dialogue*, pp. 42 – 43.

It can also be seen, however, that Whewell was still sharing some of the thought processes which had activated his predecessor. Both men, for example, claimed that their thoughts on matters of theology at a time of crisis and 'conversion' were in part stimulated by a study of Pascal's Christian apology (the *Pensées*) which Whewell mentioned in one of a series of letter to his friend and colleague Sir James Stephen (1789 – 1859); "I have some speculations of the nature of those of Pascal, though I have not referred to him in them."[198] The reason he gave for not including his unspecified "speculations" was a fear that; "The public is ready to take offence at any speculations on religion which are at all out of the common track,". An objective reader might also suspect that Whewell would have had some difficulty in promoting the irrational, rather depressing and Jansenist views of the French philosopher.[199] Pascal's *Pensées* were, however, evidently compatible with the *Weltbild* of a convalescent Chalmers and Whewell's interest in them is perhaps an indication of a similar turn to a fatalistic frame of mind at a time when he feared for his wife's future.

Stephen, who had by then been appointed Regius professor of modern history at Cambridge, wrote a series of letters in which he persuaded Whewell to tone down some of his more pejorative anti-pluralist rhetoric in favour of a more measured and objective style of argument.[200] In the reply to Stephen quoted above, Whewell switched from his academic authorial voice into a suffering self who hinted at the "natural sorrows" which were subsuming his innermost thoughts at that time:

> I am greatly grateful for your kind sympathy in our sorrows. They are not single, for James Marshall [his brother-in-law] has just lost a child. Well for us if we can find in our philosophy anything which can elevate and moralize our natural sorrows.[201]

The loss of his sister's child was by no means the only personal tragedy that had occurred or was in the process of occurring at the time when he wrote the *Essay*. Like Chalmers he suffered a series of family illnesses and losses at a period in his life when he had also detected some signs of vulnerability in his personal health.[202] Although he did not personally undergo a near fatal illness, he experienced a

---

[198] Whewell to James Stephen 6 September 1853. Todhunter, *Whewell*, vol 2, pp. 379 - 380.
[199] Wilde, 'Pascal', pp. 70 – 83.
[200] See Todhunter, *Whewell*, vol 2, pp. 379 – 396 and Crowe, *extraterrestrial*, pp. 293 – 296.
[201] Whewell to James Stephen 6 September 1853. Todhunter, *Whewell*, vol 2, p. 380.
[202] Stair Douglas, *Whewell*, p. 195. Whewell to Adam Sedgwick 13 April 1853. Stair Douglas, *Whewell*, p. 424.

similar series of traumatic losses and events, albeit at a different life stage (Whewell was 59, whereas Chalmers had been 30 years younger at the time of his conversion). Whewell's suffering self was informed by the experience of the loss of close relatives at a time when he was anticipating the impending death, after considerable suffering, of his wife.[203] Chalmers' response to crisis had been to adopt and promote evangelism and pluralism, both concepts which were prominent in the contemporary cultural context. Whewell, on the other hand, whilst undergoing a similar sequence of loss and potential bereavement was led by his pre-existing thoughts on the purposes of creation to emphasize God's special purpose in the creation of humans and consequently to rule out the existence of extraterrestrial intelligences.

Whewell's darker years had begun towards the end of 1851:

> Mrs. Whewell a little while ago received a kind letter from Mrs. Mackreth, expressing your sympathy with our great loss of my dear brother-in-law Myers, whom I had come to love as a brother, and whom I shall never cease to miss and to mourn. We have had, I grieve to say, another shadow long hanging over us in the alarming illness of Mrs. Temple, a sister of my wife's, who has been supposed for some time to be in a hopeless state.

His niece and near contemporary biographer commented briefly on this period in his life; "The year 1851 closed in gloom. The letters of 1852 are few in number and show traces of anxiety and depression. Kreuznach was again recommended, and again resorted to."[204]

William and his wife Cordelia visited Bad Kreuznach, a spa town in the Rheinland-Pfalz district of Germany, on several occasions to 'take the waters' and to seek some alleviation for the symptoms of the ultimately fatal illness which had first surfaced in 1844.[205] Kreuznach was also the location in which, during the summer of 1853, William wrote his *Essay*, at a time when the seriousness of his wife's long-term condition had become increasingly evident:

> The return to England took place at the end of September, and two letters to Dr. Mackreth show with what pain the truth was being recognised that Kreuznach had done little for Mrs. Whewell's health, and that cause for the gravest anxiety remained.[206]

---

[203] Stair Douglas, *Whewell*, p. 444.
[204] Whewell to Dr. Mackreth 18 December 1851, Stair Douglas, *Whewell*, p. 421.
[205] Ibid., p. 307.
[206] Ibid., p. 425.

Another letter written by Whewell at this time reveals the depth of his concern as he experienced "the overwhelming ebbs and flows of hope and fear". These sentiments were to be shared within a very limited contemporary circle and were not intended "to become matter of discussion to ordinary acquaintances." Nonetheless, they were simultaneously being preserved for futurity, representing a potential, but postponed, public performance of apprehension and emotional turmoil. [207]

In his correspondence with Cordelia there was almost no discussion of the details of his wife's illness or the nature of her sufferings. There is, however, ample evidence of Whewell's performance of concern as well as the empathetic and resigned self which he felt it appropriate or necessary to adopt. Shortly after the seriousness of her illness became evident, he talked about his admiration for her resignation which he felt he must now reluctantly adopt and "make common stock with":

> I am grieved that you speak of pain and weariness, but they may lead to comfort and gratitude. For gratitude at any rate we have abundant cause; and if need be I must make common stock with you in your 'resignation,' which I used to exclaim against. I hope this change in my estimate of qualities is because I am become more reasonable.[208]

The language used here, including "comfort", "gratitude" and "resignation", reflect a religiously informed model of an appropriate response to her "pain" and "weariness" together with a somewhat gendered reflection on the way in which her example has caused him to become "more reasonable." As noted in Chapter 1, an attitude of resignation, translated into heightened religiosity, was a common by-product of tubercular infection which may have been the underlying cause of Cordelia's slow 'decline'.

As further examples of the nature of their relationship, Stair Douglas included in her biography a small collection of thirteen "poems [which] were written by Dr. Whewell at the time of the death of his first wife, and printed for private circulation." [209] A brief excerpt from one should

---

[207] Whewell to Dr. Mackreth 6 October 1853. Stair Douglas, *Whewell*, pp. 425 - 426.
[208] Whewell to Cordelia Whewell 18 June 1844. Stair Douglas, *Whewell*, pp. 309 – 310.
[209] Ibid., pp. 557 – 586.

suffice to give a flavour of the whole. The reader is left with a clear impression that Cordelia's death was preceded by a series of conversations which, although having a morbid and fatalistic tone, were intended to provide comfort to both her and her spouse:

> Ever by me be remember'd the words that cheer'd thy departure,
> Cheer'd thee uttered then, uttered often before:
> 'Grant, Lord, that as we are buried with thee in our baptism,'
> When Death over her hung this was the pray'r that she pray'd,
> 'So through the Grave, the Gate of Death, we may pass to our rising,
> 'Ris'n to a joyfuller life thy resurrection may share.'[210]

It is very evident from the content and style of these poems that the consolation promised by orthodox Trinitarianism was fervently sought by both Whewell and his wife. Indeed, their apparent calm acceptance of Cordelia's forthcoming demise echoes several prototypes for this kind of deathbed Christian confession which the author must have been aware of. One year before Whewell published his *Essay*, for example, "Dorothea Palmer, sister of the first Earl of Selborne, died of consumption [tuberculosis?] in 1852 at the age of about 23." During her fatal illness she took comfort from "John Keble's consolation poetry, *The Christian Year*," which provided her with a pattern to be followed:

> Dorothea Palmer's death was a story of absolute resignation to God's will and a strong but simple faith. […] Her brother Revd George Horsley Palmer hoped to follow Dorothea's example when his turn came to die: 'I cannot wish or desire more blessedness—her faith—her meekness—her brightness and resignation indeed deprives death of every sting.'[211]

It should be borne in mind that the Stair Douglas biography contains multiple elements, including poems and private letters which were, we assume, the unabridged work of her uncle. In Whewell's correspondence with his wife's sister, for example, Stair Douglas found further evidence of a consolatory narrative in the form of a remembrance, or reconstruction, of a deathbed conversation between William and Cordelia in which they appear to be attempting to adopt an almost Christ-like resignation, echoing the passage from Matthew's Gospel which related the events in the Garden of Gethsemane prior to the arrest of Jesus:

---

[210] W. Whewell 'The first Sabbath after the funeral' in Stair Douglas, *Whewell*, pp. 557 – 561.
[211] George Horsley Palmer to William Palmer, 15 July 1851, *Selborne Papers* (Bodleian Library, Oxford) MS Eng. misc. c. 691, folios 3 – 4., quoted in Jalland, *Death,* p. 43.

> In praying by her side, I said, more for myself than for her, 'If this cup may not pass from me except I drink it ' ... and I could not finish the sentence, but she finished it and said, 'Thy will be done.' It is very hard to say, my dear sister, but I must learn the lesson of you as soon as I may.
>
> She said, 'Do not put upon my grave-stone anything that is merely sad and sorrowful.' I replied, 'We are not as those who sorrow without hope.' 'Yes,' she said, 'not without hope;' and I added, 'Your own device which you gave to Susan: "We live to die, we die to live."[212]

The argument which has been made in the preceding paragraphs is that in Whewell's case the concept of pluralism was not only informed by metaphysics but also by a very personal concern for the preservation of a form of theology in which Christian soteriology could be accommodated. It had, in his *Weltbild*, become a pre-requisite of the preservation of the self, or selves, that the crucifixion and resurrection were events unique to earth:

> If this act of sacrifice is as truly singular as Whewell understands it, then no other planet can have benefitted from God's love in the same way, and thus humanity must be a correspondingly unique life form in terms of intelligence and moral capacity.[213]

Having used the first four chapters of the book to lay out what were in effect his religious, moral and, particularly in the light of the hypothesis outlined here, personal issues with the possible existence of extraterrestrial life, he moved on to state several more evidently 'scientific' themes. His key point in this section he called the 'geological argument', although it was actually a discussion about the duration of past time. Staring with a review which drew from his own academic background and earlier debates on the topic of geology he concluded that it was difficult to avoid the conclusion that; "There is therefore nothing, in what we know of the Cosmical conditions of our globe, to contradict the Terrestrial evidence for its vast antiquity, as the seat of organic life."

---

[212] Whewell to Mrs. F. Myers [his sister] 23 December 1855. Stair Douglas, *Whewell*, pp. 448 – 450. The quotation which alludes to events in Gethsemane was taken from Matthew 26:42. "We live to die, we die to live." is a paraphrase of Romans 14:8.
[213] Brown, 'Devotional', p. 138.

Astronomy, which he acknowledged "claims a sort of dignity over other sciences, from her antiquity, her certainty, and the vastness of her discoveries.", had in his view added to the findings of geology the notion that the universe is characterised by both vast space and deep time:

> And as the infinite extent which we necessarily ascribe to space, allows us to find room, without any mental difficulty, for the vast distances which astronomy reveals, and even leaves us rather embarrassed with the infinite extent which lies beyond our farthest explorations; so the infinite duration which we, in like manner, necessarily ascribe to past time, makes it easy for us, so far as our powers of intellect are concerned, to go millions of millions of years backwards,[214]

Having raised the possibilities of "infinite extent", Whewell then decided *au contraire* to restrict the opportunities for pluralist biology by attempting to minimise the physical space available for such developments. He argued "that the Sun is the largest Sun" in the universe and that the earth could be the largest solid planet, with the same restriction of interstellar *terra firma* in mind:

> So far as we yet know, the Sun is the largest Sun among the stars; and we shall attempt to show, that the Earth is the largest solid opaque globe in the solar system. Some System must be the largest and most finished of all; why not ours? Some planet must be the largest planet; why not the Earth?[215]

Similarly, in a chapter on 'The Nebulae' he claimed, on the basis of John Hershel's observations of the Magellanic Clouds, that all 'unresolvable nebulae' are indeed nebulous and do not constitute thousands or even millions of remote star systems which might be locations for life, thus also refuting the relatively recent claims of resolvability made by Lord Rosse .[216]

In a further bid to counter the potentially infinite scale of the universe and the consequently large number of habitats for life suggested by astronomy, and to allow his main argument to take centre stage, he pointed to the long ages of geological time which had expired on earth before the rise of man which was in Whewell's view a unique act of creative fiat:

> When, therefore, Geology tells us that the earth, which has been the seat of human life for a few thousand years only, has been the seat of animal life for myriads, it may be,

[214] Whewell, *Essay*, pp. 101, 68
[215] Ibid., p. 160.
[216] Ibid., pp. 113 – 139. See Chapter 3 for an extended discussion of the observations made with Rosse's telescopes.

> millions of years, she has a right to offer this, as an answer to any difficulty which Astronomy, or the readers of astronomical books, may suggest, derived from the considerations that the Earth, the seat of human life, is but one globe of a few thousand miles in diameter, among millions of other globes, at distances millions of times as great.[217]

His proposition therefore was that the presence of human beings occupies such a tiny proportion of the total history of the Earth that it probably has not happened and indeed may never happen on other planets, which allowed him to assert the special nature of mankind and to argue that there had been only a single act of divine revelation and redemption:

> He has bestowed upon this small part of His creation, mankind, this special care; - He has made their period, though only a moment in the ages of animal life, the only period of intelligence, morality, religion.[218]

The main thrust of this argument against pluralism, based on the epistemologically unusual combination of limited real estate and a lengthy timeline of which the existence of man only represented a small fraction, was to be subsequently taken up by several commentators.[219] For Whewell himself, this argument constituted a kind of special pleading which allowed his subjectivity to preserve the concept of a personal theistic deity who can care for the physical, moral and spiritual welfare of a limited population of human souls.

Reaction to Whewell's *Essay* were, to say the least, somewhat mixed despite its overt apologetic intent. John Herschel doubted whether Whewell was sincere in his conclusions, whilst incidentally providing some independent confirmation of the negative state of Whewell's *Weltbild*:

> The essay on the 'Plurality of Worlds' (attributed to him, though published anonymously), can hardly be regarded as expressing his deliberate opinion, and should rather be considered in the light of a *jeu d'esprit*, or possibly, as has been suggested, as a lighter composition, on the principle of '*audi alteram partem'* undertaken to divert his thoughts in a time of deep distress.[220]

---

[217] Whewell, *Essay*, pp. 102 – 103.
[218] Ibid., p. 103.
[219] Crowe, *extraterrestrial*, pp. 457 – 475.
[220] J. F. W. Herschel in *Proceedings of the Royal Society*, vol XVI, pp. LX – LXI. Quoted in Todhunter, *Whewell*, vol 1, p. 187. '*Audi alteram partem'* can be translated as 'the other side should be heard'.

In general the *Essay* did not seem to chime well with much previous thinking on the topic of extraterrestrial life and it attracted the ire of many supporters of pluralism including the Scottish astronomer and physicist David Brewster.[221] Brewster began a lengthy and vitriolic campaign against Whewell's publication, seeking to defend a vision of a universe in which God had created a plenitude of life bearing planets as compared with the somewhat dismal vision of a single inhabited world "unoccupied for millions of years".[222] One of the intriguing elements of this debate for more recent historiography is the unexpected religious alignments of the protagonists. Brewster, a theologically conservative Scottish evangelist, argued in favour of a plethora of evolutions which, though aligned with some tenets of natural theology, also smacked somewhat of deism. On the other hand, Whewell, a liberal Anglican, wanted to bolster the more traditional account given by revealed religion which posited the planet earth as a 'special case'.

The attitude of Brewster provides an interesting parallel with the earlier case of Thomas Chalmers who was Brewster's contemporary and occasional colleague. Chalmers, who had been born into a similar geographical and religious milieu, and who shared his proselytising tendencies, had likewise promulgated the concept of a populous universe as evidence of God's creative and redemptive powers following his 'Pauline' conversion. As Brooke commented in his dissection of the debate; "For historians of science it provides an interesting case-study in the 'openness' of astronomical data to interpretations strongly informed by metaphysical and theological commitment."[223]

By way of contrast with the changing theological stance which we have just noted, it is difficult to discern any significant shifts in Whewell's political views in the same time period. Early in his career he had displayed a certain level of conservatism in the matter of freedom of worship in Trinity College, but on the other hand he had also supported the Catholic Emancipation Act and the repeal of the Test and Corporations Act of 1828, so we are led to the conclusion that his views were neither of a

[221] This debate is covered at some length in both Crowe, *extraterrestrial*, pp. 300 – 304 and Brooke, 'Brewster-Whewell'.
[222] Ibid., p. 278.
[223] Ibid., p. 279.

particularly Tory or Radical persuasion. Instead, he generally pursued a middle path of being a "constitutional conservative" and an "old Whig" throughout his life:

> As a young man he seemed inclined to take a Liberal line, for he opposed a petition from the University against the Roman Catholic claims in 1821, […]. But in those stormy days of the Reform Bill, when so many ancient friendships were destroyed he took no decided line: and latterly he abstained from politics altogether.[224]

Although his fellow Cambridge graduate, John Willis Clark (1833 - 1910), may have viewed Whewell's political views as studiedly neutral it is, in fact, clear that he would not have become the Master of Trinity College, and the husband of Cordelia, if he had not been seen as sufficiently conservative by his predecessor; "[Christopher] Wordsworth, an unreconstructed Tory", who refused to resign:

> … until the election of a Conservative government in the autumn of 1841. Whewell was recommended to the Queen by the prime minister, Peel, and duly appointed master. Simultaneously, Whewell had advanced his own career and obtained a position for which celibacy was not a prerequisite.[225]

The change of *Weltbild* in and around 1853 did not, if we take Clark's comments as a guide, lead to any noticeable changes in matters political which carried less emotional freight than the existential concerns which inhabited much of his theology, thereby creating a requirement for the parallel construction of an anthropocentric cosmology.

Bearing in mind that Whewell had been a very able scientist, administrator and author it is not hard to imagine that he was well aware that some of his correspondence would ultimately appear in the public domain and he therefore may well have carefully constructed his literary persona to be congruent with his public utterances as a minister and Master of Trinity College in a fashion analogous to the passive

---

[224] Whewell engaged in a vigorous debate with the Reverend Connop Thirlwall about the requirement for compulsory College Chapel attendance for Dissenters. But he did not hold any animosity towards Thirlwall and was pleased that the "Whig Ministry" had awarded him a "valuable living in Yorkshire." See W. Whewell to C. Thirlwall, 28 May 1834 and W. Whewell to A. Whewell, 19 December 1834. Stair Douglas, *Whewell*, pp. 162 – 168. Snyder, *Reforming*, pp. 216, 223. J. W. Clark, *Old Friends at Cambridge and Elsewhere* (London, 1900) p. 10.

[225] N. W. Gillham, *A Life of Sir Francis Galton: from African Exploration to the Birth of Eugenics* (Oxford, 2001) p. 41.

voice and inert style adopted by Darwin as a strategy to forestall potential biographers.[226] Nonetheless, it seems that underlying the public self there was indeed a strong bond of affection between Whewell and his wife and it is not difficult to perceive that the long periods of illness in Kreuznach and Lowestoft which preceded her death had placed a strain on Whewell which Stair Douglas described in ways which are suggestive to the more recent reader of the symptoms of depression.

As noted above, John Herschel had opined that these stressful events might have provided a sufficient cause for Whewell's otherwise unexpected reversal on the topic of pluralism. [227] It is perhaps, therefore, appropriate to note that the firm hope of salvation for himself and those close to him was offered as a message of consolation to Herschel by Whewell in a letter which written in 1861, following a similarly stressful event, the death of a niece who had married into Herschel's family:

> So great is this calamity, it may seem at first to deprive of their value your remaining possessions. And yet, my dear Herschel, it is not so. You are still richer in objects of love and sources of earthly happiness than any one whom I know, and so I trust you will soon come to feel. And with regard to her we may feel, persons at your age and mine, that the separation cannot be for long. There is nothing but what may well be borne, in the thought that we shall have to follow in a few short years. As we go onward in life, the next world comes to be peopled with your loved ones more than this. The thought of her angel life may sweeten and elevate our earthly life.[228]

In his anonymous and widely circulated *Essay* Whewell had chosen to restore to his version of the universe a single and personal revelation. The life-event crises and the publication of the *Essay* in 1853 also coincided with noticeable shifts in Whewell's views on metaphysics. These changes are subtler but nonetheless consistent with his evolving *Weltbild*. The main change was the final maturation of his conception of human thoughts as "shadows" of "Divine Ideas". This was a logical extension of his earlier thinking about the way in which the ability to comprehend God's thoughts is proof of man's unique position in creation:

---

[226] J. Sturrock, *The Language of Autobiography: studies in the first person singular*, (Cambridge, 1993) pp. 215 – 216.
[227] Stair Douglas, *Whewell*, pp. 421 – 428, 435, 442.
[228] Whewell to John Herschel 27 January 1861. Stair Douglas, *Whewell*, pp. 520 – 521.

> As we have seen, by the mid-1850s Whewell came to found his epistemology on a theological base. Since our Ideas are "shadows" of the Divine Ideas, to see a law as a necessary consequence of our Ideas is to see it as a consequence of the Divine Ideas exemplified in the world. Hence the more we idealize the facts, the more difficult it will be to deny God's existence.[229]

The overall tone of the *Essay*, combined with it having been published anonymously (thus potentially adding nothing to Whewell's already considerable reputation as a distinguished polymath), suggest that its main purpose must have been as an exercise in which he succeeded in reversing those elements of his previous cosmological thinking which, it now seemed, militated against a full acceptance of orthodox soteriology at a time of personal crisis; "a consummation Devoutly to be wish'd."[230]

Throughout the nineteenth century there were many other commentators who wrote or spoke on the topic of pluralism and the likelihood of extraterrestrial life. For the most part they followed the spirit of Chalmers' earlier contributions and were in favour of the concept. There were, however, a few exceptions, i.e. opponents of pluralism, who constituted an interesting minority which in due course included Whewell. The latter group was joined later in the century by a well-known populariser of astronomy, Richard Proctor who, following an intense internal debate, reversed a theological position which had been prompted originally by an emotional challenge to his *Weltbild*. At the time of this unconversion he also rethought his views on the relative epistemic authorities of religion and science. This interior review, which took place in response to one specific event and its reception by his peers and in the public press, also caused him to re-evaluate his position on the probability of extraterrestrial life, although not as radically as Whewell, and following an entirely different, or indeed opposing, narrative arc.

Proctor's early life and career are not well documented. Some of the best available sources of information on Proctor's life and thoughts are the obituaries written by his colleagues and his own published output in the form of books, articles and his many contributions to a magazine called

---

[229] Snyder, *Reforming*, p. 92.
[230] Shakespeare, 'Hamlet', Act 3, Scene 1, p. 861.

Knowledge which he founded in 1881 and edited until his death in 1888.[231] The relevant archive resources include a series of vitriolic epistles to the Astronomer Royal and various journals in which, having been rejected as a candidate for the Royal Astronomical Society's Gold Medal, he proceeded to vent his spleen with fellow members of the Society.

He also engaged in several disputes about funding proposals and astronomical techniques culminating in "A vigorous war of words [which] was carried on in *The Times*". This particular disagreement concerned the proposed observations of the 1874 transit of Venus and it led to a note expressing "strong disapprobation" of Proctor's written comments being published by the Council of the Society and the termination of his brief occupancy of the office of Secretary.[232] These incidents provide pointers to one of the persistent features of Proctor's *Weltbild*; his tendency to vigorously oppose any attempt to constrain his freedom of expression and a noticeable resentment of authority in any form.

We do know that his mother, who had expressed a wish for him to pursue a theological vocation, died while he was at the University of Cambridge. The loss of his mother "to whom he was devotedly attached", combined with the commencement of a presumably compensatory interfaith relationship with Mary Mills "a young Irish lady" whom he married shortly thereafter, seem to have been the main causes of a dip in his subsequent attainment. He graduated as twenty-third wrangler in 1860; "a degree which greatly disappointed his friends, many of whom had already recognised his remarkable talent."[233] Some of his later displays of animus in his relationships with various peers and a negative attitude to being reproached by figures in authority can probably be traced to this educational underachievement and the contingent impairment of his career options.

A domestic financial crisis caused by the failure of a New Zealand bank in 1866 led to his decision to take up self-employment as a writer of popular books on astronomy and other scientific themes. His

---

[231] J. D. North, 'Proctor, Richard Anthony' in C. G. Gillespie (ed.), *Dictionary of Scientific Biography*, vol XI (New York, 1975) pp. 162 – 163.
[232] J. L. E. Dreyer and H. H. Turner (eds.), *History of the Royal Astronomical Society: Volume 1 1820 – 1920* (1923, repr. Oxford 1987) pp. 176 – 184. Proctor acted as Secretary from 1872 to 1874; a brief period compared with both his predecessor and his successor (see table on p. 251 of the *History*).
[233] A. C. Ranyard, 'Richard Anthony Proctor', *Journal of the Royal Astronomical Society*, XLIX, 4 (Feb. 1889) pp. 164 - 167.

fluctuating and unpredictable income may well have been a further stimulant for his heated disputes with more fiscally secure correspondents who occupied positions of relative power.[234]

It eventually became evident that at some time after his marriage he had converted to Catholicism. His friend and colleague Edward Clodd (1840 - 1930), himself a Unitarian '"sitting under" Dr. James Martineau, believed that it had been the emotional impact of the loss of his first son, "his darling boy", in 1863, which had precipitated Proctor's "perversion" and that he was "seeking consolation in the Roman Catholic Communion".[235] The grief he shared with his wife as a consequence of this bereavement, added to the pressure to convert which her family and the officiating priest may well have applied prior to the marriage, would have provided powerful motivations to adopt her religion.

Proctor's theological views were discussed at some length in a series of letters received from and written to Clodd during July 1870. Clodd's presumption of a relationship between the death of Proctor's son and his subsequent conversion must be read alongside Proctor's own comment that it was "nearly 3 years since I became a Cath." Thus there was, according to Proctor, a significant interval between the tragedy of losing the boy and his conversion to the Catholic faith which indicates that, as in other cases to be studied later, there can be a delay of several years between the locus of a *Weltbild* dislocation and a subsequent epistemological or theological shift. In the same letter he also revealed that it had taken him a long time to completely come to terms with Catholic doctrine; "It seems to me <u>now</u> as though 3 years ago I had comparatively slight reason for accepting the churches authority, & that the reasons I have now are overwhelmingly strong."[236] We might reasonably assume that this assertion was an attempt to 'talk up' an inner conviction which was in fact less than completely solid.

The discussion of Proctor's conversion process had begun with a letter from Clodd thanking him for a copy of his recent publication *Other Worlds than Ours* in which he [Clodd], almost in passing, pointed out that he had gained the impression from the final chapter that Proctor might be "willing to

---

[234] Dreyer and Turner, *History*, pp. 167 – 168. Crowe, *extraterrestrial*, pp. 368 – 369.
[235] E. Clodd, *Memories* (London, 1916), pp. 58 - 59.
[236] Proctor to Clodd, 27 July 1870. Leeds University, Brotherton Library Special Collections, *Clodd Correspondence*.

abrogate private judgement when I should feel bound to exercise it." This comment led to Proctor's subsequent admission of his acceptance of Catholicism and hence his rejection of private judgement and acceptance of Papal infallibility; two key doctrines of the Catholic church. But the description of this process, especially in relation to private judgement, gives the reader considerable grounds to suppose that the impact of the original emotional stimulus had faded somewhat and that by 1870 Proctor's faith was founded as much on ratiocination as it was on spiritual conviction, and therefore was vulnerable to ongoing doubts which he was trying hard to ignore:

> Whether I was in those times more changeful than most men I do not know; but certain I am that there was a continual fluctuation in my views, for I was at the pains to record from time to time the condition of my mind as respects religion. That such fluctuation should eventually lead to the rejection of Christian doctrine altogether seems to me a perfectly logical termination to the mental conflict. […] I look at the so-called freedom of private judgement as a delusion and a snare![237]

Proctor's religious views did indeed become increasingly sceptical over the course of time, as noted by Clodd in his memoirs; "However, the illusions begotten of his unbalanced emotions [i.e. the loss of his son] were dispelled in later years, and he died an Agnostic."[238] His approach to religion in 1870, which was in general to accept the teachings of the Catholic church despite his earlier misgivings, has also to be read against a background of a more general move to *a la carte* personal theologies during the latter part of the nineteenth century as will shortly be demonstrated in an examination of the sceptical views of his peers.[239] It is evident from the duration and uncertainty of his interior debate that such an intellectual weighing of the arguments had led to a decision which could very easily be reversed by further mental struggle, as was shortly to be the case. Thus Proctor in due course succumbed to the "so-called freedom of private judgement" despite his earlier self-denial.

Turning to the specific topic of Proctor's attitude towards pluralism and the evidence of intersection with theological motifs, it is clear that he was initially an enthusiast for Chalmers' view of a universe widely populated with alien lifeforms. *Other Worlds than Ours* (subtitled 'The Plurality of Worlds

---

[237] Proctor to Clodd, 27 July 1870, Clodd to Proctor, 11 July 1870, Proctor to Clodd, 12 July 1870. *Clodd Correspondence*.
[238] Clodd, *Memories*, p. 60.
[239] J. Harris, *Private Lives, Public Spirit: Britain 1870 – 1914* (London, 1994) pp. 169 – 177.

studied under the light of recent scientific researches') was his "first major success" as an author.[240] This book, which had prompted the flurry of correspondence between him and Clodd, was influenced by, and was in many ways a response to, the preceding debate between Brewster and Whewell on the topic of pluralism, coming down fairly solidly on the side of Brewster's ideas, which had included the concept of "the immense varieties of the forms of life" to be found in the universe:

> But it is when we consider recent discoveries in their relation to the existence of other worlds, when we attempt to form a conception of the immense varieties of the forms of life corresponding to the innumerable varieties of cosmical structure disclosed by modern researches, that we recognize the full significance of those discoveries.[241]

Proctor was also clearly cognizant of the religious sub-text which had informed the debate for preceding protagonists, although he also expressed his doubts about their reception in the context of the ways in which personal religion was coming to the fore by 1870; "from the comments which have been made on this part of the works of Chalmers, Whewell, Brewster, and others, whether a single reader of those works has found the religious views of any one of their authors congenial with his own."

His final chapter began with a restatement of the issue which had preoccupied many of his predecessors, the question of how a single deity could provide "care and solicitude" for individual human beings at the same time as bestowing "infinite love" on "uncounted millions" which, in the light of his concurrent interior debate about the doctrines of the Catholic church, reflected his personal angst as well as that of the population at large:

> IT has been customary, in treatises on the plurality of worlds, to discuss the religious difficulties which seem to suggest themselves when man regards the universe around him as thronged with worlds, each peopled with millions of living creatures, and many perchance the abode of intelligent and therefore responsible beings. Accustomed to regard himself as in a special manner the object of God's care and solicitude, it is not without a sense of pain that he is brought to contemplate the possibility that other creatures may exist in uncounted millions whom God regards with infinite love and interest.

---

[240] Crowe, *extraterrestrial*, pp. 369 – 370.
[241] R. A. Proctor, *Other Worlds than Ours* (1870 repr. New York, 1886) p. 21.

By 1875, however, his views on the probability and universality of extraterrestrial life had significantly altered. Having published a somewhat sceptical essay in 1873 which argued on empirical grounds that the existence of complex life-forms on Mars was unlikely, he developed a rather more "Whewellite" thesis in two subsequent books:

> Readers of the first three essays in Proctor's *Our Place among Infinities* and of the first essay in his *Science Byways* could scarcely doubt that his views had undergone a major transformation since 1870.[242]

In these two new sources Proctor concurred with Whewell by expressing several objections to the universality of life on other planets. On the one hand he had become increasingly convinced that Jupiter and Saturn were still in the throes of condensing from a primeval nebula (following a Laplacian planetary evolution schema) and were consequently both too warm and too diffuse to support any form of life which we would recognize.[243] This idea had first been outlined in *Other Worlds* and had received limited approbation from John Herschel at that time.[244] Proctor also recapitulated the key chronological argument made by Whewell in his *Essay* about the long eras of time which must have elapsed and will pass by in the future during which no life or very limited lifeforms may exist on any given world:

> Whether we turn our thoughts to planet, sun or galaxy, the law of nature (recognised as universal within the domain yet examined), that the duration of life in the individual is indefinitely short compared with the duration of the type to which the individual belongs, assures us, or at least renders it highly probable, that in any member of any of these orders taken at random, *it is more probable that life is wanting than that life exists at this present time*.[245]

Although Proctor had given the reasons for his change of mind as being his evolving views on the constitutions of the gas giants and a reconsideration of the viability of Whewell's chronological argument it is apparent that there was another key factor influencing his *Weltbild*; he had effectively decided to divorce science from religion and treat them as two distinct and incommensurable

---

[242] Crowe, *extraterrestrial*, p. 373.
[243] R. A. Proctor, *Our Place among Infinities* (London, 1875) p. 11, 66 – 67.
[244] Herschel to Proctor, 11 May 1870. Royal Society Herschel MSS HS 14.123.
[245] R. A. Proctor, *Science Byways* (London, 1875) p. 34. Italics in original.

epistemologies. Even in 1870, before the formal revocation of his faith, his conviction that both space and time are infinite meant that he could not accept the conventional cosmogony of revealed religion:

> I have spoken of the creation of all things, whereas, in the sense in which men can alone interpret such words, we cannot reasonably conceive that there ever was a creation; and I have spoken of the beginning, whereas we cannot conceive that there ever was a beginning in the sense implied.[246]

Another way to consider this disconnect is that Proctor now found it impossible to continue to bridge the gulf between the language and actions of the two emotional communities to which he had hitherto subscribed; a conjunction which he had previously been able to bridge more or less successfully but which had become too big a gap for him to be able to continue to negotiate. Proctor's 'divorce' also suggests the after-effects of a significant shift in perceptions of the relative epistemic authority of science and religion since Whewell had published his *Essay* in the early 1850s.[247] In some ways Proctor was now adopting the very distinction between an unknowable deity and the laws known to natural philosophers, the erstwhile 'god of the gaps', which Whewell had anticipated but had also decried as a path to potential unbelief:

> … we are utterly powerless to conceive or comprehend the idea of an Infinite Being, Almighty, All-knowing, Omnipresent, and Eternal, of whose inscrutable purpose the material universe is the unexplained manifestation.[248]

The specific event, or sequence of events, which drove Proctor to his theological schism has been briefly mentioned in extant historiography. Bernard Lightman, for example, has noted that; "According to one obituary account, Proctor severed his connection to Catholicism in 1875 when he was told that some of his astronomical theories were not in conformity with the teachings of the Catholic Church."[249]

---

[246] Proctor, *Other Worlds*, p. 308.
[247] Turner, 'Victorian Conflict', pp. 370, 374. Two of the significant events which had occurred in the meantime were the publications of Darwin's theory of evolution in 1859 and a theologically controversial edition of *Essays & Reviews* in 1860.
[248] See Chapter 3 for a discussion of Whewell and the 'god of the gaps' concept. Proctor, *Our Place*, p. 34.
[249] B. V. Lightman, *Victorian popularizers of science: designing nature for new audiences* (Chicago, 2007) p. 311. Crowe, *extraterrestrial*, p. 375, also references this statement from an obituary ('Richard A. Proctor Dead' published in *The New York Times* of 13 September 1888, p 1.

That Proctor's attitude to religion had undergone a step-change is in fact very evident from two articles published in November 1875 in the *Chicago Daily Tribune*. In the first of these an editorial commentary made a clear connection between Proctor's rejection of Catholicism and his espousal of "the facts of that branch of science which he so ably represents,":

> Mr. Proctors' views have undergone considerable change […] with reference to their relation to religion and revelation. Prof. Proctor was formerly a Catholic. He was recently offered a Professorship of Astronomy and Mathematics in a Catholic College in England, but found that his views were such that he could not conscientiously accept it.[250]

The second article focused on a letter from Proctor to the *New York Times* in which he endeavoured to explain his reasons for his change of position and to specifically relate them to a series of events which had occurred during the previous year; the address by John Tyndall to the British Association in Belfast and some of the critical responses which it had received. These developments had in turn forced the often dogmatic and confrontational Proctor into a pessimistic position where his "choice between these two alternatives could not be doubtful.". Although his rationale is couched in quite moderate terms, it is not difficult to detect an undercurrent of anger and frustration with the clerics of his former chosen church:

> Let the dogmatic teachings of a particular Church be called A, and let the teachings of science be called B. Then either (1) A and B are consistent, or, being inconsistent, the error lies (2) with A or (3) with B. Two years ago I was satisfied with the first of these explanations. But you know what happened after the Belfast address. Theologians, who ought at least to know what their church requires, proclaimed loudly that the views B are utterly inconsistent with the views A. They convinced me that this is so; while I remained as well satisfied as ever that views B are right in the main. My obvious inference is that some error exists in views A. Theologians who teach A assure me that I must either accept A, without question, or depart from among them. My choice between these alternatives could not be doubtful. Hence simply the most marked circumstances of my change of position.[251]

Proctor did not restrict his comments on the *Belfast Address* and its consequent impact on his previous acceptance of the Catholic church's doctrine of private judgement to this letter alone. He also made it

---

[250] 'Prof. Proctor: Changed views as to Science and Religion', *Chicago Daily Tribune*, 10 November 1875, p. 7.
[251] 'Prof. Proctor: Germs of his present views in his earlier writings', *Chicago Daily Tribune*, 14 November 1875, p. 3.

a key point of his lecture tour in north America, adopting a presentation style in which he appeared to be delivering an assertive sermon on 'the religion of science' as again reported by the *Chicago Daily Tribune,* apparently quoting *verbatim*:

> ... that that fine address, his outspoken statement of the present position of science (or if you prefer it, the present position of the great majority of scientific men) led to an outburst of angry feeling. […] No form of vituperation was spared, and if threats of personal violence were not resorted to, they were adequately represented by warnings that an eternity of torment would reward what - even as thus misunderstood - was yet the expression of Prof. Tyndall's loyalty to the truth as he saw it.
>
> It has thus become my duty - in mere loyalty to truth - not to indicate what is my precise belief in matters religious [...] but to reaffirm my views respecting the great doctrine of cosmic evolution which has become within the last few years the touchstone of scientific men,[252]

Proctor's typology of the reactions to the *Belfast Address* focussed, as might have been expected given his combative stance on other issues, on the most negative commentaries; "No form of vituperation was spared,". He similarly took notice of the overt threats of "an eternity of torment" made by Tyndall's opponents. In picking out these aspects of the affair he chose to overlook the many voices which were raised in support of Tyndall's presentation.

Tyndall, in his role as newly installed president, had delivered the address which prompted Proctor's apostasy to the British Association for the Advancement of Science in Belfast in August 1874. The content which had so offended some commentators was indeed generally viewed by his audience as being rather more controversial than was normally expected for such an inaugural address; "Probably no single incident in the conflict of religion and science raised so much furor."[253] Despite its apparently provocative content, however, the range of reactions to Tyndall's presentation was somewhat more heterogeneous and reflexive than Proctor's simplified version of events, which understandably focussed on the reaction of Catholic spokespersons, might have us believe. Some

[252] 'Changed views', p. 7.
[253] Turner, 'Victorian Conflict', p. 373.

reviewers treated Tyndall's thesis with an equanimity almost approaching approbation, as in the case of *The Times*.[254]

The more negative responses came, predictably, from the mouthpieces of conservative elements of the religious establishment. In this context it is relevant that the speech was delivered in Belfast, the land of Tyndall's birth, well within virtual earshot of the many Roman Catholic constituents of the island of Ireland. It could be seen to have been deliberately provocative. William Francis Barry (1849 – 1930), the author of a lengthy article in the *Dublin Review,* certainly thought so (albeit with a certain unreflective irony arising from the way "truths" were posited as underpinning "Faith"):

> To a Catholic, the mere account of what he holds, and the names of such as hold with him, are ample demonstration that he is really is an adversary of the truths without which Faith becomes an absurdity.[255]

Barry's assumption that the speech represented an attack on elements of Catholicism, in particular its attitude to scientific education, was confirmed by Tyndall's subsequent comments in the '*Apology for the Belfast Address'* in which he made it clear that he had particularly in mind a petition submitted by students at the Catholic University of Ireland in November 1873:

> It expresses the profoundest dissatisfaction with the curriculum marked out for the students of the University; setting forth the extraordinary fact that the lecture-list for the faculty of Science, published a month before they wrote, did not contain the name of a single Professor of the Physical or Natural Sciences.[256]

Thus it would appear clear that a significant objective, if not the main motivation, for delivering the *Belfast Address* had been Tyndall's objections to the educational policies of the Irish Catholic establishment especially with respect to their lack of support for the sciences. His intention, however, was sufficiently well concealed by his overall approach to questions of science and religion and his declaration of support for scientific naturalism that it also provoked

---

[254] The *New York Times,* 5 September 1874, pp. 1 – 4, printed a review of the speech and its positive reception in the British press under the heading 'The Origin of Man'. On 7 September 1874, p. 3, the same journal reprinted a generally favourable review from the *London Times* entitled 'The Progress of Science'.
[255] W. F. Barry, 'Mr. Tyndall and Contemporary Thought.' *The Dublin Review,* 1836 - 1910; Oct 1876, 27, 54, pp. 431- 469, p. 469.
[256] J. Tyndall, 'Apology for the Belfast Address' in J. Tyndall, *Fragments of Science: a series of detached essays, addresses and reviews*, vol II (New York, 1892), pp. 202 – 223, p. 211.

responses from other sectors of the Christian church, including a series of lectures sponsored (and authored in part) by the Moderators of the General Assembly of the Presbyterian Church in Ireland.[257] The general tone of the comments from the liberal churches in mainland Britain, however, was more measured, seeking to assure their own constituencies that science is not incompatible with revealed religion rather than rejecting Tyndall's thesis outright.[258]

It is evident therefore that the reception of Tyndall's address was divided into two broad camps. The first we might broadly summarise as those elements of the London based press who viewed themselves as modern, intellectual and broadly liberal (in terms of religion rather than necessarily in politics). The second group, in contrast, was more conservative, generally provincial and religiously convinced or oriented. Proctor chose to mentally delete the first faction, even though his subsequent words and actions suggested that he was clearly a fellow traveller of the metropolitan materialists, and to focus entirely on the more negative comments emanating from the proponents of revealed religion, particularly those who belonged to the Catholic church, of which he had been a member for about eight years.

One could also argue that Proctor had been emotionally swayed by the combination of his marriage and the loss of his son to adopt a religious position which was in fact significantly at odds with the milieu of scientific naturalism in which he subsequently found himself. Proctor had been moving away from traditional theology for some time and although reactions to the events surrounding the *Belfast Address* may have been the final straw for him, he was in any case already heading in the general direction of some form of agnosticism. As the headline attached to the previously quoted letter, published in November 1875 ('Germs of his present views in his earlier writings') implied it was certainly possible for a contemporary editor to perceive that Proctor's altered perspective had been some time in the making.[259]

---

[257] W. Johnson (ed.), *Science and Revelation; A Series of lectures in reply to the theories of Tyndall, Huxley, Darwin, Spencer, etc*. (Belfast, 1875).
[258] See, for example, J. Martineau, 'Modern Materialism: Its Attitude towards Theology', *The Contemporary Review*; 1 December 1875; 27, pp. 323 – 346.
[259] 'Germs', p. 3.

Proctor's changing *Weltbild* can be read in part as a reaction to some other contemporary developments, including the first salvo by John William Draper (1811 - 1882), aimed primarily at the "pretensions of the Roman Catholic Church and its pontiff", in what was to become labelled retrospectively as the 'conflict thesis' and, closer at hand, the opinions of his two friends (and co-contributors to *Knowledge*) Edward Clodd and Edward Burnett Tylor (1832 - 1917).[260] His correspondence with Clodd on the subject of his Catholicism, which began in 1870, had been perhaps more an indication of 'honest doubt' than it appeared at the time and was in fact a form of soul searching into which religiously informed reactions to the *Belfast Address*, and the vehement opinions of supporters of the Church of Rome in particular, acted as the final nails in the coffin rather than prime movers in the process of his unconversion. In any event, as time progressed Proctor increasingly became an advocate for a broadly agnostic approach to theology.

It is not unreasonable to also suppose that he chose to emphasize his emerging religious neutrality as an element of his newly established public and scientific self, particularly when corresponding with journalists or addressing large audiences. The timing of his letters to the American press suggest that his combative stance may have been emphasized and publicised for the purposes of 'drumming up' larger audiences for his lecture tour. Joshua Nall has made the case that, in the years following his initial commercial success with *Other Worlds*, Proctor endeavoured to create a space for "science workers" like himself who would survive and prosper by the delivery of imaginative (read 'popular') and copiously illustrated astronomical productions, garnished with a light dusting of facts, somewhat after the style of Nichol a couple of decades earlier.[261]

In *Our Place among Infinities*, published to coincide with the American tour, he appeared to repeat the conclusions on the omnipresence and omniscience of God which had previously surfaced in *Other Worlds*. In the 1875 volume, however, he also entertained a new level of doubt and left it open to the reader to ponder the feasibility or otherwise of theological traditions; "Inconceivable that the whole

[260] J. R. Moore, *The Post-Darwinian Controversies: a study of the Protestant struggle to come to terms with Darwin in Great Britain and North America, 1870-1900* (Cambridge, 1979) pp. 20 - 29. The views of Clodd and Tylor are discussed in more detail below.
[261] J. Nall, *News from Mars: Mass Media and the Forging of a New Astronomy, 1860-1910* (Pittsburgh, forthcoming September 2019).

universe can be for all time the scene of the operation of infinite personal power, omnipresent, all knowing." To which he added a concluding statement of his new manifesto on the separation of the two epistemologies:

> Science is in the presence of the old, old mystery; the old, old questions are asked of her, - "Canst thou by searching find out God? canst thou find out the Almighty unto perfection? It is as high as heaven; what canst thou do? deeper than hell; what canst thou know?" And science answers these questions as they were answered of old, - "As touching the Almighty, we cannot find Him out."[262]

The final sentence in this quotation was a pointer (conscious or otherwise) to the metaphysical direction of travel towards the 'Unknowable' that Proctor was to pursue during the final thirteen years of his life.

Proctor was clearly familiar with the then fashionable interpretations of the origins of a variety of religions which provided further support for his newly sceptical interpretation of the teachings of the church by providing an apparently rational account of how belief systems based on superstitions had become the basis of subsequent theologies. Three years before the *Belfast Address* his colleague Edward Tylor, who was a member of the X-Club, published his *magnum opus* entitled '*Primitive Culture'* which promulgated a whiggish hypothesis of social and religious progress. One of his distinctive contributions to the study of comparative religion, subsequently adopted by early sociologists, was the concept that animism was the earliest and most 'primitive' type of religious belief.[263] He argued that such belief systems had evolved in due course into the various types of theism; the latter forms being, in Tylor's view of comparative religion, different in content but not necessarily in type.[264]

Tylor, of course, was not the only author seeking explanations of the history and potential functionality of religions in societies. Contending hypotheses of religious development included the "corruption of language", possible Aryan origins and the deification of the sun popularised by Max Müller. Also available to the student of theological evolution was the competing concept of the

---

[262] Proctor, *Infinities*, p. 34. Compare with Proctor, *Other Worlds*, pp. 333 - 334.
[263] E. B. Tylor, *Primitive Culture*, 2 vols (London, 1871). E. J. Carlton, *Patterns of Belief. Volume 2: Religions in Society (*London, 1973) pp. 53 – 57.
[264] M. Wheeler-Barclay, *Science of Religion in Britain, 1860-1915*. (Charlottesville, VA, 2010), pp. 71 – 103.

propitiation of ancestors (sometimes in the form of 'ghosts') which was the specific viewpoint of Huxley and Spencer.[265] The latter idea was closely related to the parallel contemporary vogue for 'euhemerism', which sought to relate religious ideas back to real antecedent events and personalities.[266]

Another contributor to Proctor's *Knowledge* was in the process of forming his own views on the origins of religions. Edward Clodd was a convinced evolutionist who had written biographies of Spencer and Charles Darwin. In 1873 he published a history of religion for children which attempted to demonstrate how humanity's thoughts on such topics as creation and the Gods had evolved in an intellectual sense, eventually producing monotheistic religions.[267] Over time Clodd became increasingly agnostic presumably, in part at least, as a result of discussions with his colleagues:

> During the latter half of the 1870s Clodd became part of an intellectual circle that included prominent scientific naturalists such as Grant Allen, W. K. Clifford, T. H. Huxley, and Leslie Stephen. By 1880 Clodd could no longer accept a liberal theistic position and adopted a form of agnosticism. He believed that the idea of God, a futile attempt to explain the mysteries of existence, had been inherited from earlier, more primitive ages.

Clodd's loss of faith eventually led to the publication in 1880 of *Jesus of Nazareth*, an attempt to recover a historical Jesus as a realistic human being which included naturalistic explanations for apparently miraculous events. This book drew so much criticism from, in particular, Catholic opponents that Clodd subsequently "decided to avoid all direct criticism of religious beliefs in the future".[268]

Proctor must have been aware of the sceptical and rationalist views of his colleagues and, given that he did not negatively comment on their articles (some of which he published in *Knowledge*),

---

[265] H. Spencer, 'The origin of animal-worship, etc' *in The Fortnightly Review*, May 1870 (vol 13 old series, 7 new series) pp. 535 - 550.
[266] For a further discussion of Müller's views see G. Beer, '"The Death of the Sun": Victorian Solar Physics and Solar Myth.', in B. Bullen (ed.) *The Sun is God: Painting, Literature and Mythology in the Nineteenth Century* (Oxford, 1989), pp. 159 – 180. See also: Wheeler-Barclay, *Religion*, pp. 32, 37 - 70. E. Clodd, 'The Birth and Growth of Myth', *Knowledge*, vol 4, 21 September 1883, pp. 182 – 184.
[267] E. Clodd, *The Childhood of the World: a simple account of man in early times* (London, 1873).
[268]Lightman, *Victorian popularizers*, pp. 256 - 257.

presumably approved of, or at least understood, their thinking.[269] His personal explanation of the evolution of theology was a variant of sabaeanism (also known as sabianism); the idea that primitive religions arose as a belief in the divine nature of the more prominent heavenly bodies. Or, to put it another way, the attribution of personal and divine characteristics to astronomical objects:

> And while we must remember how much astronomy owes to astrology, with its natural but erroneous fancies, we must not forget that in every nation of olden times, the studies of the heavenly bodies was a most important part of religion. Observation of the heavenly orbs signified observance of the gods of heaven. Last, but also highest and purest of all forms of nature worship, was that which had the dome of heaven for its temple-roof, which saw its deities visibly enthroned there or moving in solemn order above the bowed heads of their worshippers, while all earthly temples were but as altars within that glorious abode of the gods.[270]

Discussions of the 'primitive' nature of such beliefs also gave Proctor the opportunity to comment on a parallel viewpoint which he promoted in later life. Proctor held very negative views on astrology (as compared with astronomy), viewing it as dangerously close to irrational superstition or the potential entanglement of a faith-based system with 'proper science', a trap from which he had successfully extricated himself. Proctor accordingly wrote several articles which debunked the idea that the movements of the planets could somehow be linked to human destiny.[271]

Perhaps the best known example of his thinking on ancient astronomy is the relatively extensive amount of effort he put into books, articles and correspondence (in the pages of *Knowledge*) promoting the idea that the Great Pyramid had been constructed as an ancient Egyptian observatory, a scientific instrument, built for the purpose of making more refined astrological predictions for the sponsoring Pharaoh:

> The mystery of the Great Pyramid resides chiefly in this: that while certainly meant to be a tomb, it was obviously intended to serve as an observatory, though during the lifetime only of its builder, and was also associated with religious observances. […] The remaining portion of the work shows how potent were those ancient superstitions about

[269] See, for example, Clodd, 'Myth', pp. 182 – 184 and G. Allen, 'Our Ancestors: I – The Stone Age Men', *Knowledge*, vol 1, 24 February 1882, pp. 351 - 352.
[270] R. A. Proctor and A. C. Ranyard, *Old and New Astronomy* (London, 1892) pp. 15 - 30.
[271] See, for example, R. A. Proctor, 'Astrology', *Myths and Marvels of Astronomy* (New York, 1877) pp. 1 – 52.

> planetary influences—and their bearing first on Jewish, and later on Christian festivals and ceremonial.[272]

It seems that Proctor believed in a form of dialectic through which the empiricism of astronomy had gradually subsumed and overtaken superstition in the form of astrology, an obvious parallel to his personal experience of the, in his view, incompatibility of religion and science.[273]

In the light of Proctor's forthright comments in 1875 on the reception of Tyndall's *Belfast Address* and his collaboration with contemporary rationalism it is unsurprising that he abdicated from further attempts to align the relative epistemic authorities of religion and science but instead decided to treat the two as incommensurable. Nonetheless several of his early editorial pieces in *Knowledge* were designed to defuse a possible criticism that these two contrasting sources of meaning were in conflict or that the study of science was somehow a path to atheism.[274]

Later in the life of his journal he felt more able to express alternative points of view. He concurred with suggestions that his personal position was close to agnosticism and that he shared with his co-evolutionist Spencer a semi-belief in an ill-defined higher power, "The Unknowable", who was responsible for all of the elements of the universe which could not be understood by mere mortals. A position which he acknowledged was in fact barely discernible from that of agnosticism:

> In a kindly notice of my essays on "The Unknowable" in *KNOWLEDGE*, which I saw recently in *Watts's Library Guide*, the remark is made that though I "object to the term 'agnostic' as inadequately expressing my views," I am in sympathy with those who are recognised as belonging to the agnostic school of thought." I am not sure that I have ever expressed any- objection against the term "agnostic," though I admit that no such term can quite adequately express the views of a school; but emphatically I am in sympathy with the school called, for convenience of reference, Agnostic.[275]

---

[272] R. A. Proctor, *The Great Pyramid: observatory, tomb, and temple* (London, 1883) pp. v - vi.
[273] Proctor, *Infinities*, pp. 313 – 323.
[274] The second article in the first edition of *Knowledge* was indeed such an apologetic. R. A. Proctor, 'Science and Religion. By the Editor', *Knowledge*, vol 1, 4 November 1881, pp. 3 - 4.
[275] R. A. Proctor, 'Religion and the Unknown', *Knowledge*, vol 10, 1 July 1887, p. 197. Earlier essays on the topic of the Unknowable can be found in 'Death of Worlds', *Knowledge*, vol 3, 4 May 1883, p. 263 and 'The Unknowable; or, the Religion of Science', *Knowledge*, vol 9, 1 December 1885, p. 37.

As David Gange has pointed out: "This was a [Spencerian] metaphysic in which worship of an Absolute that transcended human conception should persist, but in which all anthropomorphism, Christology, and Church or Bible teaching must be thrown to the winds."[276]

Lightman and Crowe have both observed that Proctor's change of religious direction can be traced to the mid-1870s and that he "was also indebted to Spencer's theistic version of agnosticism, unlike both Allen and Clodd."[277] If we take into account Proctor's own words, we can see that the actual sequence of events started with his rejection of Catholicism and its attitude to scientific naturalism.. It seems that henceforth he adopted a vaguely theistic position, although statements of specific belief are noticeable by their absence from his later works. Proctor's theological 'divorce' also provided the space in which his emergent ideas about a non-Trinitarian god of nature could be overtly expressed.

Lightman has argued that Proctor's metaphysical world view was based on a conviction that the driving force behind all changes in the universe is evolutionary; whether operating at a microscopic or a macroscopic scale. Karl Guthke concurred that Proctor disavowed teleology and design in his later work, taking instead a developmental view of the universe which he derived from his reading of *The unity of worlds and of nature* by Baden Powell (1796 – 1860) to which he added his belief in an omnipotent and designing being.[278] The expandable scale of evolution also accounted, in Proctor's mind, for the view that there may, at the very largest scale, be clusters of galaxies like our own which contrasted strangely with his negative views on the possible extra-galactic origin of Herschel's observed nebulae.[279]

At the mid-point of his cosmic scale Proctor perceived a role for planetary evolution. The gas giants in our solar system were to be placed at an earlier point on a hypothetical developmental scale and had therefore not yet sufficiently condensed to the point where they might constitute solid bodies,

---

[276] D. Gange, *Dialogues with the Dead: Egyptology in British Culture and Religion, 1822-1922* (Oxford, 2013), pp. 201 - 202.
[277] Lightman, *Victorian popularizers,* p. 315. Crowe, extraterrestrial, p. 375.
[278] Lightman, *Victorian popularizers,* pp. 313 – 314. K. S. Guthke (tr. H. Atkins), *The last frontier: imagining other worlds, from the Copernican revolution to modern science fiction* (Ithaca NY, 1990) pp. 341 – 343.
[279] Herschel's correspondence with Proctor on the topic of the extra-galactic nebulae (or absence thereof) was included as an addendum to R. A. Proctor, *Other suns than ours: a series of essays on suns – old, young and dead* (1887 repr. London, 1903) pp. 393 – 419.

whereas the inner planets are currently much more suited to the support of life.[280] He thus became somewhat of a 'fence-sitter' on the question of the probability of extraterrestrial life when compared with the other two main commentators discussed in this chapter. Given these conclusions, and in the context of his developing distaste for religious enthusiasm, he proceeded to construct a halfway house between the populous cosmos of the evangelist Brewster and a Whewellian vision of man as the only higher form of life.

Unlike the relatively gradual metamorphosis of Proctor's *Weltbild*, it is clear from the work of his near contemporary biographer that a relatively young Thomas Chalmers had undergone a significant and rapid conversion to an enthusiastic adoption of redemptionist Trinitarianism as a result of personal loss and trauma. He expressed his new-found evangelism in both his exhortations from the pulpit and in the form of a book which implicitly sought to expand considerably the magnitude of God's congregation. In the sphere of political economics he perceived that the antidote to Malthusian pessimism, of which he had been an early adherent, particularly in his rural parish, lay in the doing of good works by the bourgeoisie and via the moral and religious improvement of the working classes and the poor. These solutions drew significant criticism from contemporary theologians and politicians, being seen as too "parochial and voluntarist" especially when he attempted to apply them in a large city.[281] Chalmers' remodelled *Weltbild* nonetheless prompted to adopt a form of holism in which the intentions of the Deity and the truth of Christianity could be assisted on earth (and presumably on other planets) by the actions of right-thinking and religiously motivated individuals.

A mature Whewell, for his part, had travelled in the opposite direction. As a supporter of natural theology in the 1830s, he initially followed the route laid out earlier by Chalmers. In the 1850s, however, he had shifted, under the influence of the loss of close relatives and the serious, ultimately fatal, illness of his wife to an anti-pluralist position which sought to preserve the concept of personal salvation for Cordelia and himself. Whewell's changed views were also supported by some strong empirical arguments; once he had decided to reverse his direction of travel he was able to show that

[280] See, for example, Proctor, *Infinities*, pp. 67 – 68.
[281] Hilton, *Atonement*, p. 62.

there are many pointers to the improbability or, at the very least, relative scarcity of other populated planets.

Richard Proctor, by way of contrast, took up two different positions on pluralism during the time period when his theological position could reasonably be said to have moved considerably. In 1870, whilst professing an adherence to Catholicism, his stance was more Brewsterish than Whewellian and therefore more in favour than not of a populated universe. By 1875, apparently in response to the negative reactions of his co-religionists to Tyndall's *Belfast Address* and influenced by his own increasing scepticism, which in turn was partly founded on the ideas of his contemporaries and colleagues, he had decided to re-examine his reception of the empirical evidence for extraterrestrial life. He concluded, with Whewell, that the prospects were not at all good, apart perhaps from the residual possibility of life on the inner planets of the solar system.

As a consequence of the way in which public discourses of religion and science had evolved during the 1860s and early 1870s, together with the parallel 'privatisation' of personal religion, Proctor was the first of this trio to accept that it had become socially and psychologically feasible to clearly differentiate between these two overlapping epistemologies. He was also strongly influenced by both internal angst and the often provocative contributions of other contributors to his magazine. To put it another way, Proctor, unlike Whewell or Chalmers, perceived that he no longer needed to 'square the circle' of attempting to straddle two emotional communities whose discourses he perceived to be incommensurable, but could instead reasonably nail his colours to the mast of science whilst offering a vague reverence to the Unknowable.

In this context it is also interesting to attempt to understand how the subjects discussed above would have understood the nature and 'personality' of God. Projection of the self onto or into the controller of the universe is a longstanding idea which has interpretive power and can assist us in understanding why particular subjectivities occupied their chosen stances with respect to cosmogony, chronology

and theology.[282] Applying this proposed diagnostic to our chosen personal histories we can see, for example, that a relatively youthful Whewell, whose career was still very much in the ascendant, envisioned an expansionist and all-encompassing deity in the 1827 sermon to his Cambridge colleagues:

> What if we had in our imaginations limited the moral dealings of the Almighty to our own species? – perhaps even forgetting all that is revealed or hinted in scriptures of other races of spirits whose God and Master He also is – …[283]

By 1853, however, at a time when personal tragedy was close at hand, he had reimagined the deity as a more sympathetic figure able to provide consolation and succour at a time when he was himself providing continual care for his wife:

> … God has an especial care for the race of man. The earth, thus selected as the theatre of such a scheme of Teaching and of Redemption, can not, in the eyes of any one who accepts this Christian faith, be regarded as being on a level with any other domiciles. […] Or if we believe the Astronomers, will not such a belief lead us to doubt the truth of the great scheme of Christanity [sic], which thus makes the earth the scene of a special dispensation?[284]

Thomas Chalmers, by way of contrast, reacted to his personal brush with mortality by conceptualizing a stern taskmaster who expected people to achieve their own salvation by means of sexual self-control and moral improvement.[285] This controlling cleric and his judgemental God represented a significant shift away from an earlier 'Moderate' deity whose disengaged and indolent earthly servant had applied minimal effort in carrying out his parochial duties. This change became evident shortly after his lengthy convalescence when:

> … Chalmers appeared upon the quiet, Moderate-dominated religious scene of northern Fife as an impassioned Evangelical preacher, proclaiming man's total depravity and alienation from God, and his absolute dependence upon divine grace for salvation. With powerful oratory, he now pleaded with men to embrace the Evangelical views which he had previously denounced.[286]

---

[282] K. Armstrong, *The History of God: The 4,000-Year Quest of Judaism, Christianity and Islam* (London, 1999) p. 415; "The German philosopher Ludwig Andreas Feuerbach (1804-72) argued that God was simply a human projection in his influential book The Essence of Christianity (1841)."
[283] Todhunter, *Whewell*, vol 1, p. 326.
[284] Whewell, *Essay*, pp. 44 – 45.
[285] For evidence of Chalmers' moral paternalism see: Hilton, *Atonement*, pp. 88 – 89, 208. Hilton's view is summarised succinctly by Smith, *Science*, p. 20.
[286] Brown, *Chalmers*, pp. 44 - 50.

This paternalistic God was evidently compatible with the emergence of a remade and re-energised Chalmers, an autocratic leader who became the first Moderator of the Free Church following the great disruption of 1843:

> He employed the parallel hierarchies of Church Extension committees and Church courts to impose his personal will upon the Church and nation. In his personal life, he was often domineering and dictatorial. [...] He could be a tyrant at home with his family. He had an explosive temper, and was quick to perceive a personal affront, often when none was intended. In most of his relationships, he demanded absolute loyalty.[287]

Finally, there is another interesting but rarely discussed question which should be asked with respect to pluralism, and which is still present in discussions on this topic; why did (and do) many people assume that life on other planets is more 'advanced' than the human race? This issue seems be particularly apposite in the context of the early nineteenth century as that was an era during which there was also considerable debate between the proponents of monogenetic and polygenetic accounts of human evolution.[288] The latter viewpoint overtly cast other races as belonging to different and inferior species. Were human beings, by extension, now to be considered as a lesser developed and perhaps uniquely sinful race when compared to aliens? It was a period of continuing imperialist expansion, so it might be argued by analogy that just as Europeans had 'discovered' new worlds, subject populations and emerging commercial opportunities, so they in turn might be subsumed or exploited by colonialists from other planets. There may well also have been an element of a hangover from earlier cosmologies in which the earth was surrounded by higher planes inhabited by angels and other superior beings who stood in the role of intercessors between Man and God.[289] Whatever, then, was the cause of this inferiority complex, it is difficult to find many enthusiasts for pluralism who have not assumed the superiority of the extraterrestrial other.

---

[287] Brown, *Chalmers*, p. 334, p. 284.
[288] For an outline of the monogenesis vs. polygenesis debate see, for example, R. J. C. Young, *Colonial desire: hybridity in theory, culture and race* (London, 1995) pp. 6 – 13.
[289] The hierarchy of created entities has been known since classical and Neoplatonic times as *scala naturae* or 'The Great Chain of Being'. In the seventeenth century natural philosophers began to recast the chain as being spread throughout our own and other solar systems. See Lovejoy, *Great Chain,* pp. 24 – 66, 99 – 143.

Chapter 3. "And eddied into suns, that wheeling cast / The Planets": the nebular hypothesis and progressive cosmogony.

> But the lower lip, which is drawn inwards with the curve of a conch shell, - oh what a convolute of cruelty and revenge is there! Cruelty! – to whom? Revenge! – for what? Ask not, whisper not. Look upwards to other mysteries. In the very region of his temples, driving itself downwards into his cruel brain, and breaking the continuity of his diadem, is a horrid chasm, a ravine, a shaft, that many centuries would not traverse;[290]

This imaginative and fearful description of the nebula in Orion, which Thomas De Quincey mistakenly supposed he had based on a drawing of the object as seen through a giant telescope belonging to William Parsons (1800 – 1867, 3rd Earl of Rosse), suggests at least two sources of inspiration. On the one hand, De Quincey had an established record as a writer of surreal essays which he himself declared to be the results of the "dreams" of an "opium eater".[291] But his conclusion that the nebula contains "a horrid chasm, a ravine, a shaft, that many centuries would not traverse;" adds a further dimension to his description. His interest in the results of observations made by astronomers, including his close friend John Pringle Nichol, enabled him to comprehend at a cognitive as well as an affective level that the universe is a vast, ancient and potentially hostile environment which no longer gave the impression of having been created solely or even primarily for the benefit of human beings.[292] The effects of his opium consumption, a habit which Nichol in due course also acquired, would have contributed significantly to the sense of expanding cosmic time and slowness of interstellar motion which he had earlier encountered in his dreams.[293]

De Quincey's comments were made in the context of the debates surrounding two new ideas of the evolution of the universe, collectively known as the nebular hypothesis. As might be expected, the preferred outcomes in this astronomical discourse had at least as much dependence on the ideological views of the participants and their personal emotional histories as they did on astronomical

---

[290] T. De Quincey, 'System of the heavens as revealed by Lord Rosse's telescopes', *Tait's Edinburgh magazine*, Sep 1846; 13, 153; pp. 566 – 579, p. 571. De Quincey's "fabulous" description was in fact based on an earlier drawing made by John Herschel, see: J. Smith, 'De Quincey's Revisions to "The System of the Heavens"', *Victorian Periodicals Review*, 26, 4 (Winter, 1993), pp. 203 – 212.
[291] De Quincey, *Confessions*, Second Edition, pp. 11 – 12.
[292] A. Murray, 'Vestiges of the Phoenix: De Quincey, Kant and the Heavens', *Victoriographies* 1.2 (2011) pp. 243 – 260. doi:10.3366/vic.2011.0031
[293] De Quincey, *Confessions*, Second Edition, pp. 158 – 160. Nichol, *Ben Rhydding*, pp. 1 – 5.

observations. In a manner analogous to the pluralism discourses which were examined in Chapter 2, the proponents and opponents of nebular cosmogony entangled their views of stellar evolution with concepts of how the universe is governed and how people should be ruled i.e. religion and politics. It has already been argued that they developed these complexes of ideas and feelings, which have been combined under the umbrella term *Weltbild*, in response to a portfolio of familial, educational and cultural contexts and employed them as models by which to understand the world in which they found themselves. But, as with the other subjects of this thesis, it transpires that they experienced significant, and sometimes rapid, alterations of perspective. Such changes can be seen to be related, to a greater or lesser extent, to preceding significant life events and sometimes also with parallel shifts in other epistemologies.

Two of the subjects to be discussed in this chapter were, perhaps unsurprisingly, also engaged in the pluralism debate; namely William Whewell and Thomas Chalmers. Nichol, on the other hand, had very little input to questions concerning the possible existence of extraterrestrial life but he did play a significant role in the promotion of nebular cosmogony. It will be shortly be shown that after the significant disruption to his *Weltbild* which occurred in 1836 he had developed and publicised very definite views on the origins of heavenly bodies.

Nichol also represented a relatively new phenomenon in academia, having become a professional astronomer after the serious illness which led to his 'divorce' from the established church. It will be argued that, like Chalmers, his emerging interest in and deployment of astronomical topics enabled him to combine the language and performances of one emotional community, the established Church, and deliver them into the parallel communities of academia and popular science with considerable success. At the same time he began to tone down his previously declared support for radicalism and political progress, although he retained an interest in the progress of nationalist revolutions and the secularisation of education throughout the remainder of his life.

The other main actors to be considered in some detail in this chapter are the amateur astronomer William Parsons and his co-observer Thomas Romney Robinson (1792 - 1882). Parsons was an

Anglo-Irish hereditary peer and a prominent member of the protestant ascendancy. Robinson was a Church of Ireland minister and Director of the Armagh Observatory. Rosse and Robinson both held structural positions in Anglo-Irish society which, though remunerating them more than adequately, as a landlord and professional astronomer respectively, also set them in political and theological opposition to the majority of the inhabitants of the island, some of whom were required to fund their aristocratic and astronomical activities via rents and tithes.[294]

Prompted by apprehensions arising from the potential disruption of the metastable Irish political and religious status quo which they associated with progressive cosmology they were, to slightly differing degrees, inclined to deny the concept of nebular evolution.[295] Rosse's motivation for studying nebulae also seems to have been bound up in a sense of filial duty which was motivated by the impact on his father of the loss of his brother at a relatively young age. He successfully combined his intention of carrying on his father's interest in the interaction between astronomy and theology, culminating in the construction of a giant telescope, with an emergent enthusiasm for engineering projects leading to his family's subsequent engagements with technological innovations and entrepreneurial success.[296]

The nebular hypothesis was closely aligned with, was influenced by and influenced in turn, parallel debates about the age of the planet earth. These discussions had been stimulated by discoveries in geology and palaeontology which had emerged at roughly the same time as astronomers had significantly extended the bounds of the known universe. Both sources of physical knowledge were in clear conflict with the traditional creation stories promulgated by major religions and therefore became part of a contested space in which theologians like Chalmers and astronomers like Nichol

---

[294] Gunn, *History*, p. 140, points out that the formation of the aristocracy was based more of kinship than wealth and that; "according to Dror Wahrman," middle-class identity was "predominantly political not social,".
[295] J. A. Bennett, *Church, State and astronomy in Ireland* (Armagh, 1990), pp. 59 – 84, 104 - 108. See also Schaffer, 'nebular' and the discussion of Nichol's political views below.
[296] 7th Earl of Rosse, 'William Parsons, third Earl of Rosse', *Hermathena*, No. 107 (Autumn 1968), pp. 5 – 13, p. 12, "The second son, Clere, became a highly successful railway engineer and was responsible for constructing railway lines throughout the world, especially in South America; while the youngest, Charles, became world-famous as the inventor of the steam-turbine."

sought to validate their opposing views of God's degree of control over the unfolding of the universe and, by extension, the management of souls.

Several historians of science have found the fluctuating fortunes of the nebular hypothesis during the nineteenth century to be a microcosm of the ways in which developments in the pattern science of astronomy have been articulated and communicated to peers and to the public. These interchanges between proponents and opponents of the hypothesis were subsequently and somewhat simplistically presented as one of many skirmishes in the hypothesised wider 'war' between science and religion. In practice, although it is a reasonable assumption that most supporters of the idea of an extended period of creation during which solid bodies cooled and condensed from diffuse clouds of heated gases were unlikely to hold literalist views of the Genesis creation story, they were nonetheless also unlikely to repudiate revealed religion *in toto* or to assume that naturalistic cosmogonies somehow obviated the existence of the deity.

Closer examination of the context in which the nebular hypothesis played out, as demonstrated by post 1980s historiography, has, as with other scientific narratives of the period, revealed a more nuanced picture. Historians have undertaken detailed examinations of role of social status in the making of science as well as the interactions between practitioners and their instruments, tools, and reproduction techniques. Scholars, including Schaffer and Jim Secord, have also pointed out the significance of the political agenda being pursued by some supporters of the nebular hypothesis and the reforming objectives which underlay some of their public statements.[297]

[297] Specific coverage of the historiography of the nebular hypothesis can be found in a number of articles including: S. G. Brush, 'The nebular hypothesis and the evolutionary world view', *History of Science*, xxv (1987), pp. 245 – 278, M. A. Hoskin, 'Rosse, Robinson and the Resolution of the Nebulae', *Journal for the History of Astronomy*, .21, 4, (Nov., 1990), pp. 331 – 344. M. B. Ogilvie, 'Robert Chambers and the Nebular Hypothesis', *The British Journal for the History of Science*, 8, 3 (Nov., 1975), pp. 214 - 232, Schaffer, 'nebular', S. Schaffer, 'On astronomical drawing' in C. A Jones and P. Galison (eds.), *Picturing science, producing art* (New York, 1998), pp. 441 – 474. S. Schaffer, 'The Leviathan of Parsonstown: literary technology and scientific representation', in T. Lenoir (ed.) *Inscribing science: scientific texts and the materiality of communication* (Stanford, 1998) pp. 182 – 222 and O. W. Nasim, 'Observation, working images and procedure: the 'Great Spiral' in Lord Rosse's astronomical record books and beyond*', The British Journal for the History of Science*, 43, (2010), pp 353 – 389. doi:10.1017/S0007087410000051.

Observations made in 1840s Ireland of a totemic astronomical object, Messier 42 (more commonly known as the Orion nebula), were employed in an attempt to demolish nebular cosmogony and its associated narrative of extended timescales and post-creation developmental changes within the universe. The outcome of this apparently empirical evidence was that, even though it appeared at the time to have settled the debate decisively in favour of a wholly stellar basis for nebulae in general, the Orion observations did not have the effect of destroying evolutionary cosmogonies to the extent that some observers and commentators might have hoped for and expected. Despite the way in which aristocratic authority had been asserted via control of the means by which truth claims were tested and the management of the transmission of results, doubts eventually crept into the minds of both the astronomers and their audiences.

The observations of various nebulae previously identified by the Herschels as probably being gaseous in nature provides a further illustration of the ways in which the subject's *Weltbild* drives epistemological outcomes. In the case of the nebular hypothesis the management of both social and instrumental interactions was particularly evident in the case of Robinson and his subjective interpretations of telescopic observations in support of his theological and political opposition to nebulosity. He elicited further support by appealing to the difficult to challenge aristocratic authority of his patron who was ready and willing to act as the defender of a religiously conservative position.

Robinson's attempt to unseat nebular cosmogony was to result in doubtful, and possibly even wilfully manipulated, interpretations of ostensibly objective findings. Wolfgang Steinicke has asserted that Robinson's tacit intentions were supported not only by overt massaging of his truth claims, but also by subtle manipulation of the tools used in observation.[298] The processes of translation and inscription involved in capturing these astronomical results facilitated Robinson's interpretations to such an extent that both he and the other participants, including Lord Rosse, were enabled to 'see' the results which they desired and expected.

[298] W. Steinicke, 'The M51 mystery: Lord Rosse, Robinson, South and the discovery of spiral structure in 1845', *Journal of Astronomical History and Heritage,* 15, 1 (2012) pp. 19 – 29.

In the process of uncovering the various causes and effects of the shifting views of the selected subjects, this chapter will also examine some of the ways in which progressive thinkers like Nichol were able to present the 'new astronomy' to broader audiences. These public performances enabled astronomers to dovetail into parallel debates about the nature and duration of terrestrial formation processes and which supported the changing understanding of terrestrial development then being argued by geologists. New interpretations of the age and extent of the universe not only enhanced the case for the longevity of the earth but also considerably extended the eighteenth-century findings which had unseated the solar system from its formerly central position. Such concepts, like the burgeoning potential population of extraterrestrials, repositioned human beings as relatively minor players who may not actually represent the final cause of a vast creation.

The nebular hypothesis debate had its origins in conflicting explanations of the origins of the stars and planets i.e. the cosmogony of the universe itself. Pierre-Simon Laplace (1749 - 1827) built on the views of several predecessors by pointing out that the shared orbital directions and similar inclinations to the ecliptic of most of the objects in our solar system is highly improbable on the conservative hypothesis of a random distribution, but fits well with the idea of condensation from a rotating nebula, thus neatly side-stepping the violation of the principle of conservation of angular momentum which had been an inadvertent by-product of earlier proposals.[299] Reactions to a subsequent English translation of this work were often negative and hostile as Laplace, like other *Aufklärung* thinkers, was viewed as a controversial authority on matters philosophical, being identified in Britain as a rationalist, empiricist and probably atheistic 'fellow traveller' of the French revolution..[300]

---

[299] S. J. Schechner, *Time & Time Again: how science and culture shape the past, the present and future* (Cambridge MA, 2014) pp. 14 – 15. G. J. Whitrow, 'The role of time in cosmology', in W. Yourgrau and A. D. Breck (eds.), *Cosmology, History and Theology* (New York, 1977), pp. 159 – 177, pp. 167 – 168.

[300] The English version of Laplace's nebular hypothesis appeared as P. Laplace, (tr. Rev. H. H. Harte) *The System of the World* (London, 1830), vol II, book V, chapter VI, pp. 324 – 342 and Note VII, pp. 354 – 369. Laplace asserted that the odds against the various satellites whose rotations are known having the same direction of rotation are 2000:1. His translator added a note on page 538 to the effect that there is a probability against a random occurrence of the coplanar and rotational symmetry of the solar system of 4 billion to 1, based on a method using the sum of least squares. The method is documented in pp. 498 – 500 but no detailed workings are given for the specific calculation quoted in support of the nebular hypothesis. R. Hahn, *Pierre Simon Laplace, 1749–1827: A Determined Scientist*. (Cambridge MA, 2005) pp. 202 - 204.

Whatever Laplace's actual theological views may have been, the reception of his views on planetary evolution was bound to be equivocal as they contained more than a suggestion that the role of the deity as controller of the unfolding of the earth's history was perhaps almost incidental. The introduction of an idea which smacked of the possibility of 'accidental' cosmic development was especially troubling for people who believed that God was the prime mover of a pre-ordained and invariant process which would, by following the divine plan, inevitably lead to the creation of the human race and its eventual salvation.

An alternative nebular hypothesis which tended at times to be entangled with Laplace's narrative came about as a result of observations made by William Herschel, as a result of which he spent a considerable period of time classifying the various nebulae in a fashion somewhat analogous to the classifications of living things which were then in vogue amongst naturalists.[301] Herschel, having studied many phenomena which could loosely be categorised under the general heading of nebulae, gradually came to the conclusion that those which were unresolvable (at least by means of the technology at his disposal) are formed from a "shining fluid". These objects he believed were future sidereal systems in their nascent stage.[302] This general conclusion, in some ways less theologically challenging than Laplace's speculation, was subsequently supported by Herschel's son John, whose important role as an arbiter of astronomical orthodoxy will be discussed in due course.

Some commentators tended to conflate these two accounts of the origins of stars and planetary systems when making their subsequent contributions to the debate. The potential for such confusion was assisted by the combination of the two ideas under the newly-minted title of the "nebular hypothesis" in a relatively brief chapter contained in the third *Bridgewater Treatise* written by the Reverend William Whewell, whose complex and evolving metaphysical and religious views have been covered at some length in the preceding discussion of pluralism. As will become evident in the

[301] Schaffer, 'Bedlam'.
[302] Brush, 'nebular', p. 251-252.

narrative of nebular observations in Ireland, this semantic ambiguity could be deployed to conflate a disproof of one form of the nebular hypothesis with the other.

Whewell's 1833 *Bridgewater Treatise* not only combined two different arguments into an apparently unitary hypothesis but also set the stage for the significant contribution made by Nichol. Whewell, a liberal Anglican, acknowledged the value of natural theology and accepted its central tenet that the existence and beauty of the universe are evidence of the handiwork of the deity.[303] It may seem somewhat surprising, therefore, that he took a quasi-empiricist view of the nebular hypotheses of Herschel and Laplace and held that they might turn out to be valid narratives of cosmic development, although they were awaiting confirmatory evidence. This view, which ran counter to the thinking of some other natural theologians, was in fact quite consistent with Whewell's evolving metaphysical stance.

Whewell was willing to concede the probable correctness of other conclusions arrived at by Laplace regarding the duration of periodic events in the solar systems perhaps extending over periods of millions of years and "that some of these apparent derangements have been going on in the same direction since the beginning of the history of the world." He nonetheless proceeded to disagree strongly with the presumed anti-theist views of the French *philosophe* on the subject of final causes by advancing the idea that the "researches of science" would transfer "the notion of design and end" from "the region of facts to that of [secondary] laws":

> Thus, Laplace, of whom we have already spoken, as one of the greatest mathematicians of modern times, expresses his conviction that the supposed evidence of final causes will disappear as our knowledge advances, and that they only seem to exist in those cases where our ignorance leaves room for such a mistake. […] We may observe that we have endeavoured to give a very different, and, as we believe, a far truer view of the effect which philosophy has produced on our knowledge of final causes. We have shown, we trust, that the notion of design and end is transferred by the researches of science, not from the domain of our knowledge to that of our ignorance, but merely from the region of facts to that of laws.[304]

[303] Whewell, *Astronomy*, pp. 181 – 191.
[304] Ibid., pp. 163, 348 – 349.

His concurrent positions as ordained cleric and academic geologist meant that he could and would embrace both of God's books as well as the emerging speculations of the physical sciences.[305] In order to achieve this synthesis, however, it was necessary for him to also accept the 'working out' of the divine plan by means of demonstrable and discoverable secondary laws. Whewell here also anticipated a concept which in the twentieth century became known as the 'god of the gaps' argument. It is generally held to have been first documented in the 1890s by Scottish evangelist Henry Drummond (1851 - 1897). This form of Christian apology endeavours to prove the existence of God by pointing to extant lacunae in scientific knowledge. Whewell had, sixty years prior to this formulation, also foreseen Drummond's counter argument which pointed out the inherent risk that "the cloud may lift" and all such gaps would disappear, thus negating the role of God as prime mover. For both Whewell and Drummond it was a far better strategy to acknowledge God's ownership of the potentially discoverable rules by which Nature operates.[306]

Whewell's suspicion that nebular cosmogonies might be solidified as a result of future developments turned out, in some respects, to be correct. He was, by the logic of his own argument, eventually forced into a position of fairly uncritical acceptance of true nebulosity as one leg of support for his version of the functioning of final causes. In due course he decided to accept that the existence of unresolvable nebulae had been confirmed by the southern hemisphere observations of John Herschel thus simultaneously, and perhaps inadvertently, opening the door to the possibility that nebular cosmogony is a real phenomenon. He adopted this slightly awkward posture because, as we saw in Chapter 2, it suited his 1853 thesis that human beings are a unique life form.

His *Bridgewater Treatise* had anticipated such an outcome by claiming that it would not at all detract from the overarching theme of God as "a wise and good Creator", adding a moral dimension as well as a purpose to the construction of the universe:

> Leaving then to other persons and to future ages to decide upon the scientific merits of the nebular hypothesis, we conceive that the final fate of this opinion can not, in sound

[305] Crowe, *extraterrestrial*, pp. 267 – 270.
[306] H. Drummond, *The Lowell Lectures on the Ascent of Man* (New York, 1894) p. 333.

> reason, affect at all the view which we have been endeavouring to illustrate; the view of the universe as the work of a wise and good Creator.[307]

Nichol, for his part, had clearly read the section of Whewell's work which spoke about the nebular hypothesis and which appeared to him to coincide with his own ideas about a universe which had developed gradually over time. Following his unconversion and at the time of his appointment as a professional astronomer he became one of the most vocal popularisers of the hypothesis in both of its forms. Schaffer's view is that Nichol was the prime mover who created and popularised a discourse of nebular cosmogony from a few strands of available narrative.[308] Nichol did indeed play a significant role in bringing the idea to public notice, although it is also evident that preceding authors (Kant, Laplace, William Herschel, Comte and others) had published various earlier forms of the hypothesis and that it had already been utilised in heated (and heat-based) arguments about geological formation processes during the 1820s.[309] Nichol had published a brief review of the ideas of Laplace and Herschel in the same year as Whewell's *Bridgewater Treatise*, but it was not until 1836 that he wrote a lengthier essay, subsequently published in the *London and Westminster Review*, in which he expounded an extended exploration of his evolutionary ideas.[310]

As a relatively young man Nichol is reported to have been precociously successful in achieving academic recognition; "at college he got every prize he ever tried for." He also suffered from unspecified health problems and a penchant for flights of imagination:

> There are still people at Hawick who can tell stories of the thin handsome youth who astonished every one by his brilliancy, and interested all the ladies by his weak health and poetic fancies.[311]

---

[307] Whewell, *Astronomy*, pp. 190 – 191.
[308] Schaffer, 'nebular', pp. 134 – 135.
[309] Ogilvie, 'Robert Chambers'. P. Lawrence, 'Heaven and Earth – the relation of the nebular hypothesis to geology', in Yourgrau and Breck (eds.), *Cosmology*, pp. 253 – 281.
[310] J. P. Nichol, 'On some recent discoveries in astronomy', *Tait's Edinburgh magazine*, 4.19, October 1833, pp. 57 – 64. Nichol, 'Speculation'.
[311] Knight, *Memoir'*, p. 6. It should be noted in passing that Nichol may be yet another example of a tuberculosis sufferer who survived several medical crises and lived to a reasonable age as compared with his contemporaries.

It is interesting to note here that elements of Nichol's *Weltbild*, including his physical well-being, were already perceived as performative selves by his peers. The reception of his "poetic fancies" mirrored that of some better-known contemporary authors who were concurrently engaged in dying romantically, being interestingly ill or weeping over works of art and literature. This kind of emotional response was at that time generally considered to be either an indication of a feminine nature in women or to the onset of intellectualism in men.[312] The positive feedback accorded to his "weak health" and his early poetry seem to have provided him with useful resources for later public performances and to have stimulated him to deliver further evidence of break-downs and the production of popular scientific literature during his subsequent career.

It is also clear that at the time of his appointment to the chair of Astronomy in 1836, Nichol shared with some of his peers a central project of social reform.[313] He may well have viewed the need for change at that time as being urgent, or, as White once put it:

> Radicals, on the other hand, are inclined to view the utopian conditions as *imminent*, which inspires their concern with the revolutionary means to bring this utopia to pass *now*.[314]

Nichol's political views were of such a nature that it is easy to understand that some of his future opponents in the nebular hypothesis debates, presumably including Rosse and Robinson, were in no small part also reacting to what they perceived to be the potentially dangerous views of '"those washed & unwashed Radicals" who had kept the country in a state of alarm since the Reform Bill.'[315] They viewed the ideas of 'progressive' cosmology as being in some way bound up with an agenda derived in large part from Ricardian political economics and promulgated by the 'Philosophic Radicals'. Such a consonance of epistemologies could be found in the articles which Nichol had

[312] Dixon, *Britannia*, pp. 140 – 152.
[313] Schaffer, 'nebular', pp. 142 – 143.
[314] H. White, *Metahistory: The Historical Imagination in Nineteenth-Century Europe* (Baltimore, 1973) p. 25.
[315] Secord, *Sensation*, p. 227, including a quotation from a letter written by W. Smyth to W. Whewell on 29 January 1845.

contributed to several liberal publications including *Tait's Edinburgh Magazine* and the *London Review*.[316]

Amongst the range of topics covered by Nichol, mainly prior to his professorial appointment and during a period of time, 1832 to 1837, which saw both the passing of the first Reform Act and considerable opposition to the fixing of grain prices, were tracts on such themes as the inequity of the Corn Laws, the injustice of the use of tithes to support the Church of Ireland and the repressive approach of some members of the protestant ascendancy in that country, which included Rosse and Robinson, with regard to both the economic and spiritual concerns of their tenants:

> Let him murmur against the tax, and, if he be a tenant-at-will, a *notice to quit* will be the answer. If he have a lease, its renewal will depend upon the readiness with which he pays his tithes; and, even while the term of the lease may be remote, the landlord has numerous modes of chastising him, should he dare to lift up his ideas to the prospect of religious equality.[317]

His views on the use of tithes to support the established church in a predominantly Catholic country were consistent with his generally negative attitude towards religious conformity following his unconversion. This personal position also explains his subsequent opposition to the enforcement of theological orthodoxy on would-be academics, represented by the requirement to "subscribe the special articles of a Church":

> Moved by anxiety that a religious spirit shall pervade all teaching, - […] – the Founders of many of our Educational Institutions (among others, of the Scottish Universities) have sought to secure fitting dispositions in the Instructor, by demanding that, previous to his induction in office, he subscribe the special articles of a Church.[318]

One of his most prominent early opponents, at least in Nichol's own mind, had been Thomas Chalmers. Nichol had taken specific aim at his fellow Scot on the topic of Chalmers' 1832 attack on those political economists who denied the influence of Malthusian principles. In his rebuttal, Nichol

---

[316] Schaffer, 'nebular', pp. 142 – 147. NB the *London Review* was renamed *London and Westminster Review* in 1836.
[317] J. P. Nichol, 'The Irish Tithe Bill', *Tait's Edinburgh magazine*; Jul 1837; 4, 43; pp. 402 – 404, p. 403.
[318] J. Willm, (tr. J. P. Nichol), *The Education of the People: a practical treatise on the realm of extending its sphere & improving its character. With a preliminary dissertation on some points connected with the present position of education in this country by J. P. Nichol, LL. D.* (Glasgow, 1847), p. lxii.

employed the rhetorical device of almost excessive praise followed by the dismantling of one's opponent's argument which features, for example, in Shakespeare's narrative of Mark Anthony's funeral oration for Julius Caesar.[319] In Nichol's view, Chalmers not only preferred a cosmological steady state in which God has created and still rules over all of the stellar systems in their final, stable forms, he had also projected similar principles of stability (and lack of progress) onto "the only tolerable" political system, an absolutist monarch ruling a feudal society:

> Dr. Chalmers possesses too much prudence to admit of his entirely cutting himself loose; but he has never taken sufficient note of the progress of events; and his sentiments on all practical matters are marked, accordingly, by a tendency towards absolutism and mere fancifulness. There is an amusing *naiveté* in that announcement somewhere in the volume referred to, of the form of government which he considers to be the only tolerable one. He wishes a King upon the Throne, and nobles around him, clad, we fancy, in mail jackets, and swelling with the *virtues* and *charities* of feudalism;[320]

It may well also be the case that a more subjective cause of Nichol's animus against his fellow Scot was a sense of oratorical envy. Although separated in time by a quarter of a century, or roughly one generation, both men in due course became known for their ability to command the attention of large audiences even when, in Nichol's case, discussing "minute processes" rather than leading them "into realms of illimitable space.":

> … when he spoke rather of minute processes than general results the attention was as close and the interest almost as keen as when he led his listeners into realms of illimitable space. Since the day when Chalmers delivered his sermons in the Tron Church no public speaker north of the Tweed had so enchained his hearers. One who was himself a most accomplished lecturer was wont to say that all that the people of Scotland knew of astronomy they had learnt from Thomas Chalmers and John Pringle Nichol.[321]

Nichol had, despite his later reservations about the role of the established Church in oppressing Irish tenants and the standardisation of theology within education, "passed through the Divinity Hall [of

---

[319] T. Chalmers, *On Political Economy in connection with the Moral State and Moral Prospects of Society* (Glasgow, 1832). J. P. Nichol, 'Dr. Chalmers', *Tait's Edinburgh magazine*, Nov 1832; 2, 8; pp. 189 – 195. Shakespeare, 'The Tragedy of Julius Caesar, *Shakespeare*, pp. 798 – 821, Act 3, Scene 1, p. 812.
[320] Nichol, 'Dr. Chalmers', p.194.
[321] J. MacLehose, *Memoirs and Portraits of One Hundred Glasgow Men.* (Glasgow, 1886) p. 250.

The University and King's College of Aberdeen], and was, before attaining his majority, licensed as a preacher." by the Church of Scotland, but:

> … he only appeared two or three times in the pulpit, and at one of these - […] - he completely broke down. Whatever was the cause, he soon abandoned theological study, and devoted himself to that of astronomy.[322]

It is clear from this comment that two important changes in Nichol's *Weltbild* occurred almost simultaneously; a severe illness leading to a break with the Church of Scotland and a significantly increased interest in the science of astronomy.

The subsequent arc of Nichol's career also makes it quite clear that this break down was not due to a failure of nerve or 'stage fright'. As noted above he became an accomplished performer in the virtual pulpit of public performance. Although his future subject matter would give the external appearance of being grounded in objective science, he shared with Chalmers and other contemporary performers of popular astronomy such as Ormsby MacKnight Mitchel (1810? – 1860) a pseudo-theological delivery style, verging on the elegiac, with multiple references to the powerful attributes of the deity at key points, particularly in his introductory and concluding statements.[323] His lectures were delivered in tones of reverential awe which provided a continued linkage to the vague but satisfying concept of a creative genius, an "Infinite Essence" which he, and presumably his audience, conceived of as being the orchestrator of the universe:

> No! above, below, around – there is GOD; there, his universal presence, speaking to finite creatures in finite forms a language which only the living heart can understand. […] – there is the Infinite Essence, and the mystic development of His Will![324]

An additional reading of Nichol's approach is that he permitted himself, as a result of his breakdown, to elide his personal theology with the external trappings of astronomy thus allowing him to deliver a

---

[322] J. H. Parker (ed.), 'Professor Nichol', *The Gentleman's Magazine: and historical review*, July 1856 - May 1868; Nov 1859; 207, p. 536.
[323] F. A. Mitchel, *Ormsby MacKnight Mitchel: Astronomer and General. A Biographical Narrative.* (Boston, 1887) pp. 161 – 162. O. M. Mitchell, *Popular Astronomy* (London, 1860) p. 290. Examples of Nichol's theological interjections can be found in J. P. Nichol, *The Stellar Universe: views of its arrangements, motions, and evolutions*. (Edinburgh, 1848) pp. vii – viii, 223 – 227.
[324] Nichol, *Architecture*, p. 219.

series of public sermons on sublime and celestial themes which were consistent with his somewhat unconventional *Weltbild.*

One contemporary biographer, the Glasgow publisher James MacLehose (1811 – 1885), described the events which led to his moving away from the public avocation of Presbyterian orthodoxy in the following terms; "a change in his theological views led, shortly after his ordination, to his leaving the ministry, and giving himself up to the educational work".[325] His son, John Nichol (1833 - 1894), who in due course also became a University of Glasgow professor, reported this period in his father's life in greater detail. He recalled that the change of heart coincided with a recurrence of a "rapid fever" which befell Nichol senior. According to his son, there was a real concern that he might not survive his latest illness:

> My father had again fallen into bad health, and had to resign his position as Rector in Montrose. Old people whom I saw there last winter told me stories of him, and how few expected his life would last, he looked so thin and worn.

Nichol's subsequent change of religious perspective, as noted above, seems to have a direct connection with his preceding illness.[326] This more nuanced version of the incident in question is of significant value in any attempt to understand Nichol's shifting *Weltbild* and appears to some extent to run parallel to the experiences of Thomas Chalmers, but with a significantly different, indeed opposing, narrative arc; from public ecclesiastical conformity towards private doubt.

The extensive library in Nichol's house included the writings of a number of eighteenth-century Unitarian divines which may have been passed down from his father of whom, however, we have very little knowledge other than that he was "tender as a lamb, and as firm as a rock", often engaged as an independent arbiter in local disputes.[327] Nichol's general approval of Unitarianism and, in particular of the lectures given by the American Unitarian theologian William Ellery Channing (1780

---

[325] MacLehose, *Memoirs,* p. 249.
[326] J. Coutts, *A History of the University of Glasgow; from its foundation in 1451 to 1909* (Glasgow, 1909), p. 388. MacLehose, *Memoirs*, p. 249.
[327] 'Professor Nichol', *The Scottish Review*; January 1860; pp. 1 – 17, p. 12. Knight, *Memoir*, p. 5.

– 1842), is further confirmed by an anecdote dated to the early 1850s.[328] Towards the end of his own life Nichol junior again mentioned his father's shared religious preference; "'I am a Christian,' Nichol [the son] said to me in one of our last talks; and he went on to add that he was a Unitarian, and that his father had been the same."[329]

Unlike the case of Chalmers we unfortunately have limited evidence as to Nichol's state of mind before and after his distinct change of theological direction. It would seem probable that Nichol would have had some significant issues with the Calvinist orthodoxy of the Church of Scotland, or as his son put it succinctly; "In religion he thought for himself, and, of course, arrived at his own conclusions."[330] Assuming that he had been raised with a knowledge of Unitarianism, Nichol would have had difficulty in accepting the doctrines that only predestined 'saints' would be 'saved' at the Resurrection.[331] This point of view seems to have been partially shared with Thomas Chalmers who otherwise advocated views consonant with the evangelical wing of Calvinism.[332] The key difference between the two men and therefore a possible explanation for their divergent responses to severe illness lies in Nichol's preceding exposure to religious heterodoxy; under stress he instinctively reverted to a position which was no longer congruent with a calling to the ministry, at least not in conjunction with the Church of Scotland.

Nichol's post-unconversion career was mainly focussed on astronomy, a discipline which, in the 1830s, was not considered to be a requirement for any profession and lay "outside the course prescribed for the Degree in Arts,":

> In 1836 he was appointed, by the Crown, Regius Professor of Astronomy in the University of Glasgow - an election which has some additional interest from the fact that Carlyle was among the competitors. The subject of astronomy being outside the course

[328] Knight, *Memoir*, pp. 118 - 121. The reference to "Dr. Channing" is attributed by Nichol junior to a "Rev. A. Mackennal"
[329] Ibid., p 301. This comment is also attributed to Mackennal, but the conversation seems to belong to a much later period i.e. 1891-2.
[330] Ibid., p 51.
[331] The University of Aberdeen has been associated over time with a level of sympathy for the Anglican Church and latitudinarian views. See, for example, N. Landsman, *From Colonials to Provincials, American Thought and Culture 1680 -1760*. (Ithaca NY, 1997) p. 64.
[332] Brown, *Chalmers*, pp. 114 – 115.

> prescribed for the Degree in Arts, and none of the professions requiring any knowledge of it, the number regularly enrolled in the class was and has been very limited;[333]

Fortunately, given the relatively sparse enrolment in his classes, Nichol was not confined to operating in a single subject or faculty but could claim an implicit authority to extend his sphere of operations well outside his apparent remit. With the tacit support of his peers, he engaged, or offered to engage, in the teaching of natural philosophy, natural history and moral philosophy.[334]

The pending appointment was nonetheless of sufficient public interest, presumably because of the way in which the new astronomy was seen to be entangled with theology, to be widely covered in the press. Given also Nichol's lack of experience in the subject and his previous performance of a political self who had been engaged in writing polemics for radical journals, the contested space in which the role of chair in astronomy came to be awarded was clear to both the newspapers and to Nichol's supporters who attempted to enlist the powerful aid of a former opponent:

> Radicals such as the MP and fellow Scot Joseph Hume [...] were powerful allies in Nichol's application for the Glasgow astronomy chair when it became vacant in January 1836. The Liberal press campaigned for Nichol, Tory newspapers protested, and help was prudently sought from the great evangelical leader Thomas Chalmers.[335]

The possible involvement of Chalmers in Nichol's campaign seems surprising given their differing political and theological views. One the one hand, they could be seen as potential kindred spirits as they did in fact share a similar background. Both were relatively well-educated middle-class men who had originated from adjacent counties in rural eastern Scotland. Nichol, the more overtly progressive candidate, was, on the other hand, born twenty-four years later than the Presbyterian evangelist, so had little or no recollection of the discourses surrounding the French Revolution which seemed to have been instrumental in blunting the more libertarian tendencies of Chalmers and his contemporaries.[336]

---

[333] MacLehose, *Memoirs*, p. 249.
[334] Coutts, *History*, p. 388.
[335] Schaffer, 'nebular', p. 149.
[336] Brown, *Chalmers*, pp. 28 – 29.

The potentially problematical request for assistance from Chalmers, however, serves to remind us that the older man was not in fact a stereotypical reactionary in terms of his political thinking:

> He opposed Parliamentary Reform but supported Catholic Emancipation, repeal of the Corn and Combination Laws, reduction of tariffs, and an income tax, while his closest political associates – Wilberforce, Calthorpe, and Whitmore – all supported the Liberal Tories.[337]

Chalmers also held positive views on the utility of education which were similar to those of Nichol. There was also perhaps more convergence between the two men on questions of religion than one might initially assume.[338]

Nichol, an existing member of academic staff "who had shown great aptitude and versatility as a lecturer" would also have been seen by the university authorities as clearly preferable to the controversialist and metropolitan views of the inexperienced Thomas Carlyle (1795 – 1881), a polymath and essayist who was living in London whilst working on a history of the French Revolution.[339] In a similar contest held in 1854, for example, Nichol's son, whose *Weltbild* incorporated a similar tendency to youthful radicalism, was one of sixty students who unsuccessfully supported the candidacy of Carlyle as Rector of the University, despite the risk of being "publicly held up as 'Deists', 'Atheists' and 'Pantheists.'"[340]

Carlyle was significantly less qualified than Nichol for the job which he appeared to have applied for more in hope than expectation during a period of enforced impecunity whilst writing his as yet unpublished three volume *magnum opus*. According to one biographer:

> In a moment of discouragement at the beginning of 1836, he even wrote to propose himself for a professorship of astronomy which had become available at Glasgow. Fortunately, nothing came of it.[341]

It is interesting to note in passing that Carlyle's own *Weltbild* was so significantly impacted by recurrent "dyspepsia" that, as Rebecca Stott has argued, he externalised his internal eruptions in the

---

[337] Hilton, *Atonement*, p. 61.
[338] Brown, *Chalmers*, pp. 191 – 192.
[339] Coutts, *History*, p. 388. J. Nichol, *Thomas Carlyle* (London, 1892) pp. 63 – 73.
[340] Knight, *Memoir*, p 114.
[341] F. Kaplan, *Thomas Carlyle: a biography* (Cambridge, 1983) p. 232.

form of the "geological catastrophist narratives" which he used as a metaphor for French revolutionary politics:

> But although the metaphor of revolution may start in Carlyle's own, very uncomfortable, bowels, it finds its full expression in large-scale geological narratives of earth change in the analogy Carlyle makes between bodies and rocks. […] he not only uses apocalyptic water from geological catastrophist narratives as a means to describe revolutionary crowds, but also proposes that revolution itself is a kind of violent natural spasm in history.[342]

Nichol's appointment to the chair in astronomy was followed by the publication of his July 1836 major article on the nebular hypothesis. In this paper Nichol argued that the cosmos had unfolded gradually over time in response to rules and processes which may have been stochastic in their effects and therefore, or so it would appear to some opponents of the hypothesis, not under the control of a deity. He was particularly exercised by earlier objections to the hypothesis which had been raised by some theologians. William Paley, for example, had dismissed Laplace's speculation as being one of "the guesses of those who reject an intelligent Creator."[343]. Chalmers, though happy to populate other planets with living beings, had claimed in his *Bridgewater Treatise* that:

> The dispositions of matter in the planetary system were fixed at the original setting up of the machine. The laws of matter were ordained for the working of the machine. The former, that is, the dispositions, make up the framework, or what may be termed the apparatus of the system. The latter, that is, the laws, uphold the performance of it.[344]

In his determination to follow an independent and progressive academic stance, Nichol unsurprisingly failed to agree with his fellow Scot on the applicability of traditional arguments based on the initial creation of all matter in its final form, subsequently regulated by the predictable effects of the divinely ordained laws of motion as described by Newton.[345] He dismissed the view that hitherto uncomprehended, but potentially explicable, phenomena like the formation (or 'collocation') of stellar

---

[342] R. Stott, 'Thomas Carlyle and the Crowd: revolution, geology and the convulsive 'nature' of time', *Journal of Victorian Culture*, 01 March 1999, 4, 1, pp. 1 – 24, p. 11.
[343] W. Paley, *Paley's Natural Theology*, vol II (London, 1836) p. 18.
[344] T. Chalmers, *The Adaptation of External Nature to the Moral and Intellectual Constitution of Man.* vol 1 (1833, repr. London, 1839) pp. 30 – 31.
[345] Hilton, *Atonement*, p. 363.

systems or for that matter the developmental processes by which a leaf is formed "would constitute a better argument for the being of God," by again pointing to the necessary actions "of that power by which they are evolved from the almost unorganized germ,". Nichol similarly complained that "certain writers [Chalmers] have strangely thought fit to launch at the nebular hypothesis the charge of impiety" by a "common and gross abuse of the argument from final causes", presumably feeling that such theological cosmodicies were no longer relevant.[346] Smith has noted that Nichol's views on collocation and the nebular hypothesis continued to be debated well in to the 1840s as the "university reformers" attempted to "simultaneously combat the threats from both biblical literalism on the one extreme and aggressive materialism or naturalism on the other."[347]

Nichol concurred with Whewell both on the operation of secondary laws as the underlying 'machinery' of cosmogony and on the dangers of proofs based on current ignorance of the development processes utilised by nature. He perceived the latter as being potentially falsifiable claims which, if anything, would lend support to materialist arguments rather than mitigating against them. Unlike Whewell, however, he did not hold to the notion that God must have set up the initial conditions of the universe such that the outcome of the operation of secondary laws in support of final causes must inevitably follow. Nichol believed that evolutionary processes derived from and mediated by natural laws had been and still were operative in the universe, but it is unclear both from these early writings and his subsequent productions to what extent his underlying and almost pantheistic "Infinite Essence" was disposed to intervene from time to time to guide terrestrial and celestial events.[348] Holding a progressive political viewpoint, he also needed and wanted to allow room for the human race to achieve future improvements by dint of its own capabilities and efforts.

Although the events of 1836 represented a clear shift from any possibility of a career in the established Church to an avocation in the field of astronomy, Nichol's overt political radicalism, by way of a distinct contrast, seems to have diminished thereafter, as evidenced by a cessation in the

[346] Nichol, 'State of Discovery', pp. 406 - 408. It is clear from the context of his comments that Chalmers was the intended target of Nichol's extensive footnote.
[347] Smith, *Science*, pp. 25 - 26.
[348] Nichol, *Stellar*, pp vii – viii. Also see comments on his engagement with occasionalism below.

production of polemical writings from 1837 onwards. This less dramatic alteration of his views on politics may indeed have been more influenced by the structural changes which accompanied his appointment to a senior role in academia. The general tenor of his subsequent output seems to have been to offer the merest nod in the direction of Trinitarian theology and very little political commentary other than continued support for the benefits of an education unconstrained by religious orthodoxy and unsuccessful attempts to promote some of his more progressive colleagues into academic posts. His potential power base within the University of Glasgow was however significantly constrained by his lack of progress in creating a new observatory despite his over-enthusiastic spending on equipment; "Nichol was broke and his finances under attack from the conservative Faculty".[349]

In due course he appeared to undergo a slow drift towards a Liberal-Conservative position, thus again aligning him more closely with Chalmers than might have been predicted during the early years of his career. MacLehose's opinion was that Nichol's views in relation to politics and religion pursued opposing directions of travel during his lifetime:

> In his early years a Radical, as the term was then understood, he latterly inclined to what has been called Liberal-Conservativism, his ideal of an English statesman being more nearly represented by Lord Palmerston than by either Mr. Gladstone or Mr. Disraeli. Inspired, as is everywhere apparent in his works, by a deep spirit of reverence, he was in his later days more and more sceptical as to definite doctrines.[350]

In contrast with MacLehose's summary of the political stance adopted by Nichol, his son noted that "In politics he was a temperate radical, verging, about the close of his life, towards becoming a whig." Nichol junior also reported his father's continuing interest in liberal theology and the progress of radical politics in other European countries during the 1850s, including meetings and correspondence with the nationalist revolutionaries Giuseppe Mazzini (1805 - 1872) and Lajos Kossuth (1802 - 1894). Nichol's second marriage, in 1853, to the abolitionist and suffragist Elizabeth Pease (1807 – 1897),

[349] Schaffer,' nebular', pp. 149 – 150. For Nichol's views on education and religion see Willm, *Education*, pp. xi – lxxxiii.
[350] MacLehose, *Memoirs*, p. 252.

motivated him to add to his political portfolio the cause of emancipation in the United States; "the great Anti-Slavery movement of those days".[351]

For a period in the 1840s, Nichol's personal version of metaphysics underwent a temporary aberration, becoming akin to that of a Malebranchian occasionalist. Some of his peers believed that this continued to be his position for the remainder of his life. After his death, for example, one obituary described him as having held God to be an ever-present entity who, like a Platonic demiurge, "literally creates the universe every moment" rather than being a chronologically distant deist progenitor.[352] Nichol's views were echoed in typically more florid fashion by his friend Gilfillan:

> Nichol […] never loses sight of the universe as an instant, ever-rushing emanation of the Deity. "God," he says, quoting a friend of kindred spirit, "literally creates the universe every moment." He is led by Boscovich's theory of atoms to suppose an infinite Will, producing incessantly all force and motion.[353]

These two accounts of Nichol's views do indeed seem to describe a more monist approach, though there is little or no evidence from his later writings to suggest that he continued to support such a view. Both his previous and his later writings on astronomy envisioned a distant "Power" who lies beneath and subtly influences the world as we see it rather than intervening on a constant basis. These comments from an obituarist and a popular essayist seem to indicate some distance between their authors' understanding of Nichol's views and his own later statements on the topic of religion, perhaps indicating that, as in the complex case of his political proclivities, Nichol was particularly adept at performing multiple selves which seemed to fit the various different contexts in which he operated.[354]

Both sources cited above (the *Scottish Review* and Gilfillan) have in fact reproduced elements of a paragraph which originally appeared in Nichol's 1846 book *Thoughts on some important points relating to the system of the world* where this panentheist concept was attributed to "a valued friend

---

[351] Knight, *Memoir*, pp. 100 - 121, 58.
[352] 'Professor Nichol', pp. 5 – 6.
[353] G. Gilfillan, *A Second Gallery of Literary Portraits* (Edinburgh, 1850) p. 247.
[354] See discussion below of the ideas presented in *The Stellar Universe.*

yet destined to hold, if he is spared in life and health, one of the most distinguished places in the science and literature of the country,". The complete original quotation reads:

> God literally creates the Universe every moment. Every instant is a new morning of creation. He is the Alpha and the Omega; the beginning and the ending; the Creator, the Sustainer, the Provider, 'in whom we live, move, and have our being.[355]

Nichol had taken this quote verbatim from a lecture given earlier in the year by the "valued friend" Samuel Brown (1817–1856) who was mainly noted for his popularisation of the views of a Ragusan Jesuit, Roger Joseph Boscovich (1711 – 1787), on the identical nature of the atoms of different substances which, if true, would lead to the possibility of transmutation of elements, thus symbolically reawakening the exoteric objectives of earlier Alchemists.[356] Brown's 1843 application for the Chemistry chair at the University of Edinburgh was rejected due to the failure of other chemists to reproduce his earlier (1841) reported success in transmuting carbon into silicon. In 1846 Brown was continuing to lecture on the topic of chemistry and disseminating his view that a fourth phase of the history of society should be added to the three previously proposed by Auguste Comte (1794 - 1859); a stage in which faith would have priority over reason as the driver of development and discovery. This line of argument had at that time also impressed itself on such luminaries as "Sir William Hamilton, [Francis] Jeffrey, [Thomas] Chalmers, [Julius Charles] Hare, [Thomas] Carlyle, [Sir Robert] Christison, and [Edward] Forbes" [357]

There seems little doubt, therefore, that Brown's lecture had, at least for the time being, influenced Nichol while he was in the process of preparing *Thoughts*. Nichol's occasionalist flirtation can also be seen as foreshadowing the later attempt by the Jesuit Gerard Manley Hopkins (1844 - 1889) to reconcile the finite life of the physical world with the hoped-for continuity of God's sustaining

---

[355] J. P. Nichol, *Thoughts on some important points relating to the system of the world* (Edinburgh, 1846) p. viii. The original quotation was subsequently reproduced in a collection of Brown's lectures: S. Brown, 'The History of Science (1846)', *Lectures on the Atomic Theory and Essays Scientific and Literary*. vol 1 (Edinburgh, 1858) pp. 299 – 344, p. 332.

[356] Like many esoteric organisations, Alchemists concealed their inner and more spiritual goals within an exoteric outer shell such as the search for a method of transmuting lead into gold. See S. J. Linden, *Darke Hierogliphicks: Alchemy in English Literature from Chaucer to the Restoration* (Lexington KY, 1996) pp. 7, 11.

[357] S. T. Hall, *Biographical Sketches of Remarkable People, chiefly from Personal Recollection, Miscellaneous Papers and Poems* (London, 1873) p. 54.

presence and the preservation of the soul.[358] This novel metaphysics also potentially solved the thorny question of how divine control can be exerted in an apparently chaotic universe, even though Brown's thesis in many ways ran contrary to Nichol's previous position on secondary laws and seemed to limit the possibility of autonomous and progressive human development. Nonetheless, this excursus into an exotic alternative provides us with a glimpse of the plasticity of Nichol's *Weltbild* and his continuing partiality to novel and potentially disruptive concepts, including a parallel and well documented flirtation with phrenology.[359]

Nichol's uncritical acceptance of Brown's unconventional views on chemistry and societal evolution turned out to be a brief deviation during the mid-1840s. The idea of constant intervention does not sit well with the vaguely imagined universal architect found in most of Nichol's preceding and subsequent works. Excluding the Brownian episode, his religious beliefs evolved over time after his rejection of a theological vocation to a sceptical position on the topic of revealed religion, although his public pronouncements were somewhat constrained by the controversies which accompanied the publication of *Vestiges* and his own bankruptcy.[360]

By 1848 Nichol's interventionist deity, had reverted to an unchanging and uninvolved "Power" who had originally orchestrated creation but appeared to be no longer intimately involved in the evolution of the unreal or insubstantial universe inhabited by humans:

> Or below, is there not a Power, fixed, abiding – an energy which changes in feature only, (as the expression of one's countenance,) but which itself never changes – a grand substratum which alone is true existence – the only positive reality in the Universe?[361]

These rather transcendental reflections, which resemble one of De Quincey's opium dreams and perhaps were similarly stimulated, do not suggest that a coherent theology was operating in Nichol's mind; more a vague intuition that the visible cosmos is in fact a transitory illusion. He also does not

[358] Brown, 'Devotional', pp. 45 – 62.
[359] Schaffer, nebular, p. 148.
[360] Secord, *Sensation*, pp. 466 – 467 documents Nichol's negative reaction to the publication of *Vestiges* and provides a reference to the announcement of his bankruptcy in *The Times* of 30 March 1842.
[361] Nichol, *Stellar*, pp. vii – viii, 18.

seem to have held a belief in a personal connection with a theistic deity; his 'Power' does not appear to intervene directly in his, or anyone's, personal life and is thus an entity not much better defined or more approachable than Spencer's and Proctor's vague conceptions of the Unknowable.

It was at about this time that Nichol had succumbed to the influence of a cocktail of pharmaceuticals which he reported as a "long standing" dependency on "opiates and anodynes". In 1847, or earlier, he was, "stricken by a low and nervous fever" and his physician "than whom a kinder never existed, fondled me with opiates." The consumption of these psychotropic substances had initially delivered "a delicious feeling of pleasure in mere *being*, which the late metaphysician, Dr Thomas Brown considered a separate and distinctive *sense*." This separation of the self or selves from the stress, weakness and pain he experienced in the everyday world was eventually replaced by far less pleasant visions which caused him to suffer significant sleep loss:

> But the day of vengeance – of terrible although most fitting compensation - came swift; […] And through an appalling kind of propriety, the blow fell earliest on that very portion of my existence which was first soothed by the hollow promise of consolation – I mean the hours of sleep. [362]

In due course he travelled to Ben Rhydding in Yorkshire to take a course of hydrotherapy as a potential cure. It is not clear from his account of this treatment, published in 1852, when he had first been exposed to psychotropic substances, but it seems likely, in the general context of early nineteenth-century pharmaceutical treatment, that they would also have been prescribed during the earlier bout of the "long standing" illness which led to his theological breakdown.[363] We can, in any case, safely conclude that for most of the period during which he enjoyed his greatest successes in publishing and lecturing he would have also been regularly consuming psychoactive agents. Both the sporadic ventures into unconventional sciences and his penchant for psychotropic medication seem to reflect a tendency, shared with his friend De Quincey, to experiment with novelty and affect. A suitable subject for further investigation would clearly be an endeavour to determine to what extent

[362] Nichol, *Ben Rhydding*, pp. 1 - 5.
[363] V. Berridge, *Demons: our changing attitudes to alcohol, tobacco, & drugs* (Oxford, 2013) pp. 12 – 35.

the power and impressiveness of Nichol's public performances and writings were influenced by his chemically altered mentality and physiology.

In 1837 Nichol had reiterated and expanded his views of the nebular hypothesis in a book which took the form of a series of letters to a lady. This description can be read as a periphrasis implying that the work was suitable for a less well-educated (and less affluent) audience. Its object was "to popularize the stupendous wonders that have been discovered in astronomy, […] during the present century;"[364] One of these wonders, in his view, was the vast distances from earth at which stellar objects might now be presumed to lie. At one point in the book he inferred a distance to the furthest resolvable star clusters (as observed through Herschel senior's largest telescope and as previously estimated by Herschel himself) of around two million light years. [365]

One contemporary reviewer, in a frequently employed nineteenth-century trope, interpreted Nichol's statements in "this admirable work" to the effect that the universe is infinite in both duration and extent. This interpretation led the reviewer to recognise that under these circumstances time could become transcendental in an eternal universe; "the reader will have impressed upon him the infinity of space; and the eternity of time, if that can be called time which hints no idea of a beginning, no prospect of an end."[366] But, as we shall see, Nichol's opinion on the nature of time was itself variable and his works do not exhibit a consistent idea of whether the universe is or is not finite in duration and extent.

It has already been noted that the notion of developmental processes for stellar and solar systems aligned well with Nichol's earlier radical views on the political and social progress of humanity. The nebular hypothesis, which remained one of his key themes throughout his performances of popular

---

[364] 'Dr. Nichol's Architecture of the heavens (Book Review)', *The Spectator*, 22 July 1837; 10, 473, pp. 689 – 690.
[365] Herschel, 'Catalogue', quoted in Brush, *Nebulous Earth*, p. 35. Nichol, *Lady*, pp. 37 - 46.
[366] The *Spectator* reviewer quoted Nichol's estimate of the distance to the furthest visible objects to be 11, 765,475,948,678,678,679 miles. This translates to approximately 2,000,000 light years. Corrected for the current value of the distance to Sirius (which Nichol used as his standard of brightness) the contemporary solution would be 2,580,000 light years. 'Architecture', *Spectator*, p. 690. The reviewer's final phrase is an unattributed (but presumably well-known) quotation from J. Hutton, *Theory of the earth, with proofs and illustrations. In four parts*. vol 1 (Edinburgh, 1795) p. 200.

astronomy, was also a key ingredient of a master narrative of evolution at all levels; the other main components being geological and biological development theories. All three of these related concepts seemed to require long timescales for their processes to unfold. His adoption of nebular cosmogony assisted at least two elements of this overall argument by enabling him to successfully 'bridge the gap' and to bring in parallel ideas of lengthy chronologies which supported the second leg of the tripod, namely the sphere of geology.

Nichol's sub-text of combining astronomical and geological evolutionary processes and timescales is clearly indicated in *Architecture* by the way in which he endeavoured to extend the concept of the lengthy development of the earth's surface to our planetary neighbours:

> See now the supposed geological aspect of our fellow planets and the cessation of the riotous disturbing volcanic powers as they get old.[367]

This coincidence of developmental ideas was one of several concepts picked up and expanded in *Vestiges.*[368] The authorship of this controversial synthesis of developmental hypotheses was variously attributed to several prominent Victorians, including Nichol himself, but was eventually revealed posthumously (by his friend and correspondent Alexander Ireland) to be the Scottish publisher Robert Chambers (1802 - 1871).[369]

The Chambers brothers (Robert and William) were the proprietors of *Chambers' Edinburgh Review* a politically progressive organ which had printed, and would continue to produce, a number of favourable editorial comments on Nichol's works.[370] Chambers was conscious of the probable objections which he would encounter from the conservative voices of those religious enthusiasts whom he referred to as "the saints", to the extent that he added a terminal disclaimer to his work in an attempt to deflect future criticism and censure, or in his terms; "some views about religion which will help greatly, I think, to keep the book on tolerable terms with the public, without compromising any

---

[367] 'Architecture', *Spectator,* p. 690.
[368] P. Elliott, 'Erasmus Darwin, Herbert Spencer, and the Origins of the Evolutionary Worldview in British Provincial Scientific Culture, 1770–1850', *Isis*, 94, 1 (March 2003), pp. 1 – 29.
[369] J. A. Secord, 'Behind the veil: Robert Chambers and *Vestiges*' in Moore (ed.) *History*, pp. 165 – 194, p. 186. Secord, *Sensation*, pp. 495 – 498.
[370] See, for example, 'Professor Nichol's Views of the Architecture of the Heavens.', *Chambers' Edinburgh journal*, 29 July 1837, pp. 210 – 211.

important doctrine."[371] Nonetheless, the negative reactions which greeted the publication of *Vestiges*, a book which bore more than a passing resemblance to his own publications, must have had a profound impact on Nichol at a time which coincided with a severe personal financial crisis. This convergence of events would account for his preference to avoid being conflated with either authorship of the book or promotion of its ideas.[372]

A key establishment figure who provided a distinctly negative view of the perceived secularising intentions of the anonymous author of *Vestiges* as well as expressing strong doubts about the science presented therein was John Herschel. He was also the acknowledged authority to whom, as we saw in Chapter 2, Proctor appealed to for support of his ideas about extra-galactic nebulae and to whom the key participants in the cosmogony debate looked for confirmation and validation. Herschel had, by the 1840s, become an adviser to the government and an authority for the general public on matters scientific in general and of astronomical orthodoxy in particular. His reputation was in part based on the significant expansion of the "star gauges" of the heavens created by his father and aunt Caroline Herschel (1750 - 1848), which included a lengthy expedition to South Africa in the 1830s during which he surveyed the skies of the southern hemisphere.[373]

As a younger man Herschel had rejected his father's pragmatic plan for a financially secure career in the Anglican Church. He not only entertained religious doubts at that time but was also somewhat dismissive of those who took up the profession for primarily pecuniary reasons; "For verily, the church is the Lord's beehive and many are the drones which infest the same". In 1816 he had agreed, with some evident reluctance, to take up the 'family business' in the form of the astronomical work begun his by his by now dying father, "thus accepting the role of dutiful son". This decision was also driven by the considerable stress he underwent during his father's serious illness, which began in 1813, when Herschel junior had experienced a "personal crisis centered around problems of career,

[371] R. Chambers, Letter to A. Ireland (1844) in Secord, 'Behind the veil', pp. 171 – 172.
[372] Coutts, *History*, pp. 388 -389.
[373] G. Buttmann (tr. B. E. J. Pagel), *The Shadow of the Telescope: A Biography of John Herschel* (Guildford, 1974) pp. 92 – 111, pp. 120 – 129.

sexuality, and conflicts with his father."[374] Whilst it is tempting to see in the resolution of this crisis a parallel with Nichol's conversion to science and astronomy it is evident that Herschel's decision also had a lot to do with a performance of filial duty.

It was also a sublimation of what might in other people have surfaced as a religious impulse into the 'church of science' in which the highest duty is to uncover the rules and mechanisms by which the deity governs the universe. Whereas Nichol under stress had reverted to a form of religion which had been received prior to his education in the tenets of Presbyterian orthodoxy, Herschel had no clear theology to fall back on. His father's views have been described as vaguely deistic or pantheistic. Over time, and especially after his marriage to the daughter of a Scottish Presbyterian, the younger Herschel gradually developed a weak form of theism which extended to an assumption that in due course he would "ascend to a future life in a higher state of existence."[375]

But this was by no means a complete conversion to orthodox religion. In 1865, whilst distancing himself from what he saw as the "Pantheist" concept of an uncreated world, Herschel pointed out to an ecclesiastical correspondent his repeated affirmations of the spiritual nature of force and described a panentheistic universe not dissimilar to that which had been proposed by Nichol in 1846. His omnipresent and omniscient, but possibly disengaged, "Deity" is a:

> … being who is present in every point of space & at every instant of time; - who is cognizant of every movement & action of every particle of matter; who either once and for all originally endowed or at every instant continues to endow these particles with all the powers and properties they have;[376]

Herschel's attitude to the nebular hypothesis, unsurprisingly, started from a relatively uncritical acceptance of his father's idea of stellar evolution. His correspondence on the topic of the Laplacian variant, however, suggests that Herschel views of his peers' contributions was partly shaped by the

---

[374] S. S. Schweber, 'John Herschel and Charles Darwin: A Study in Parallel Lives', *Journal of the History of Biology*, 22, 1 (Spring, 1989), pp. 1 – 71, pp. 9, 14.
[375] Schweber, 'Herschel', pp. 8 – 12, 41. Buttmann, *Telescope*, pp. 172 – 173.
[376] Herschel to the Bishop of Kingston, 14 July 1865, Royal Society Herschel MSS HS 24.118.

political and religious affiliations of his correspondents, but were even more heavily influenced by his opinion of the logical consistency of their arguments.

He took a strong dislike to *Vestiges*. He saw it as metaphysically controversial in that its thesis of a continuum of development from Laplace's planetary formation hypothesis through to the process of speciation was a 'bridge too far' even for Herschel's general acceptance of divine operation through secondary laws. Herschel was unwilling to accept any suggestion that the production of current state of the universe could have been the result of the operation of stochastic processes whose existence had not been empirically confirmed.[377] But he also disliked the lack of quality and consistency in its argumentation, declaring that "I think it one of the shallowest productions I have seen […] and full of misstatements, and errors of construction and logic."[378]

His correspondent on this occasion was Adam Sedgwick who also held a nuanced view of the nebular hypothesis; "I delight in the nebular hypothesis. It was a glorious speculation of your immortal Father's.", but he likewise condemned *Vestiges* as "rank materialism - foul and fetid;"[379] Sedgwick subsequently went into print with his own criticisms of *Vestiges*, buoyed by several arguments which he had first sounded out with Herschel in this exchange of letters. Intriguingly, in his discussion of errors in the hypothesis as expounded by Chambers, Herschel can think of ideas which would "go some way to help us out of the scrape […] a legitimate working out of my Father's views of nebular aggregation. But it is not what is commonly called 'the nebulous hypothesis'."[380] Sadly, but perhaps predictably in the light of his tendency to diffidence in such matters, Herschel did not deign to publish his version of this component of the hypothesis which could also have provided further confirmation that his approach to this argument was founded primarily on his interpretation of physical laws rather than any parallel epistemology.[381]

---

[377] Schweber, 'Herschel', pp. 31 – 32.
[378] Herschel to Sedgwick, 15 April 1845, Royal Society Herschel MSS HS 15.427.
[379] Sedgwick to Herschel, 11 April 1845, Royal Society Herschel MSS HS 15.425.
[380] Herschel to Sedgwick, 5 April 1848, Royal Society Herschel MSS HS 15.438. Presumably Herschel here is again making a distinction between his father's hypothesis and the Laplacian planetary cosmogony.
[381] Herschel's eclectic and consciously 'en amateur' approach to matters scientific is discussed in both Buttmann, *Herschel*, pp. 55 – 57 and Schweber, 'Herschel', pp. 68 – 69.

Herschel also discussed this topic with John Stuart Mill (1806 - 1873), a progressive thinker and an agnostic with a distinctly negative attitude towards the established church who had published many articles by Nichol and other radicals.[382] The supposed proof of the nebular hypothesis provided by Auguste Comte was rejected by Herschel on the basis of the circular logic on which it depended. Herschel was fairly scathing in his comments on Comte's argument; "a vicious circle in the reasoning or some equivalent fallacy."[383] That he was unhappy with the illogicality of Comte's argument was also made clear in the speech to the British Association meeting at Cambridge which had originally prompted the writing of Mill's letter to him:

> … where, I would ask, is there a student to be found who has graduated as a Senior Optime in this University, who will not at once lay his finger on the fallacy of such an argument, and declare it a vicious circle.[384]

At the same time, there must be a distinct suspicion that Herschel's vehement rejection of the Comte 'proof' of the nebular hypothesis also related to its use by Chambers in the opening chapter of *Vestiges*. As Mill subsequently confided in a letter to the French positivist:

> Or, l'auteur des "Vestiges" cita votre vérification de l'hypothèse de Laplace. C'est, je crois, ce qui détermina l'attaque de Herschel, et Sedgwick vous attaque de même dans le passage ci-joint.[385]

Wanting to maintain his reputation as an objective arbiter and an interpersonal style which stemmed from his shyness and avoidance of conflict Herschel asked Mill to try not to give offence to the French humanist as a result of his remarks.[386]

---

[382] W. Stafford, *John Stuart Mill* (Basingstoke, 1998), pp. 64 – 65. An example of an article written by Nichol and published by Mill can be found in: J. P. Nichol, 'ART. I.-On Political Economy, in connexion with the Moral State and Moral Prospects of Society.', *Westminster Review*, Jan. 1824 - Jan. 1836; Jul 1832; 17, 33; pp. 1 – 33.

[383] Herschel to Mill, 16 July 1845, Royal Society Herschel MSS HS 12.332.

[384] J. F. W. Herschel, 'Address to the British Association for the Advancement of Science, June 19. 1845' in *Essays from the Edinburgh and Quarterly Reviews, with addresses and other pieces* (London, 1857), pp 634 – 682, pp. 666 – 667.

[385] F. E. Mineka (ed.), *The Earlier Letters of John Stuart Mill 1812 – 1848 (Volume XIII of the Collected Works of John Stuart Mill),* (Toronto, 1963), pp. 677 - 679, Letter 467 to Auguste Comte dated 18 July 1845.

[386] See Schweber, 'Herschel', pp. 16 – 17, for comments on Herschel's avoidance of conflict and shyness. In Herschel to Mill, 13 July 1845, Royal Society Herschel MSS HS 12.330, Herschel asks Mill to avoid upsetting Comte. The salient portion of this letter is also reproduced in Mineka, *Letters*, p. 675 n3.

Herschel was then, by dint of his reputation and position in society, a widely accepted referee who had adopted an intermediate position on the reliability of the nebular hypothesis and to whom several participants in the nebular debate would in due course appeal in the hope of receiving confirmation of the validity of their respective view-points. His well-known views on the merits of inductive thinking, when combined with the earlier comments made by Whewell on the potential for future proofs of the nebular hypothesis, established an intellectual environment in which there was space for the production of new empirical evidence; an opening which was shortly to be filled by an endeavour of industrial proportions in the centre of Ireland.[387]

The primary supporting evidence for the sidereal nursery component of the nebular hypothesis, originally formulated by Herschel senior, was contained within the many telescopic observations that he, his sister Caroline (1750 - 1848) and his son had made. They found that a significant number of the two thousand or so nebulae that they had catalogued appeared to consist of clouds of gas or 'shining fluid'. These structures could potentially be seen as the nurseries of future stellar systems; an indication that the evolution of the structure of the universe was still in progress. Opponents of the concept that creation was incomplete, imperfect and capable of being modified by processes which had the appearance of random ebb and flow, like the Brownian motion of dust motes, were therefore keen to demonstrate that no such irresolvable nebulae existed and that they were all in fact collections of completely formed stars.[388]

The 'nebulosity deniers' obviously welcomed an apparently major blow which was struck by the use of a technological artefact which possessed the attributes of impressive scale and significant cost as well as presumed incontestable accuracy. Unfortunately, from their point of view, the anticipated authority of this astronomical tool was to prove much more elusive and its outcomes far more difficult to manage than its constructors and users originally hoped.

[387] On the popularity of Herschel's manual of inductive reasoning, see: Secord, *Visions*, pp. 80 – 82.
[388] I. R. Morus, *When Physics became King* (Chicago, 2005) pp. 202 – 208.

The 'Leviathan of Parsonstown' was a six-foot reflecting telescope built by William Parsons at Birr Castle in Parsonstown (now the town of Birr in County Offaly) in the midlands of Ireland. This was actually an unsuitable location in view of the restricted opportunities for observation it provided due to the prevailing climate.[389] The "great telescope" also had limited manoeuvrability, being supported by two great stonework pillars which significantly constrained its lateral movement:[390]

> Astronomers spend weeks at Parsonstown, and yet perhaps enjoy only one or two really good nights for observation. When to these atmospheric impediments is added the comparatively limited lateral range of the great telescope, a long space of time will appear to be required for making a through and general search of the heavens.[391]

Despite these obstacles, in early 1846 Parsons succeeded in training the Leviathan on the Orion nebula, perhaps the most notable of a list of nebulae previously reported to be unresolvable by John Herschel, and had found that it apparently could be resolved into individual stars and therefore did not consist of or contain Herschel's 'shining fluid'.[392]

The decision to build the world's largest telescope in such an evidently unsuitable location obviously begs the question of Rosse's motivations for carrying out such a difficult project, given also that the end product would be of limited usefulness. This question has been studied by Trevor Weekes (1940 – 2014) who concluded that Rosse's father, Lawrence Parsons (1758 – 1841, 2nd Earl of Rosse), was the most likely key influence in his son's future interest, noting that William's early education took place at Birr Castle under the supervision of his parents.[393]

Parsons junior subsequently graduated from Trinity College Dublin and then spent one year at Oxford University where he was awarded first class honours in mathematics. He joined the Royal Astronomical society in 1822. "By 1827, he had begun experiments in mirror manufacture" but his

---

[389] S. Schaffer, 'Astronomers mark time: discipline and the personal equation', *Science in Context*, 2, 1, March 1988, pp. 115 – 145, p. 126. Parsonstown subsequently reverted to the more traditional name 'Birr' and King's County is now known as County Offaly. Hoskin, 'Rosse Robinson', p. 333, p 341.

[390] T. R. Robinson, 'On Lord Rosse's Telescope (Continued)', *Proceedings of the Royal Irish Academy (1836-1869)*, vol 3 (1844 - 1847), pp. 114 - 133, pp. 118 – 123.

[391] 'Travels in Search of Lord Rosse's Telescope', *Chambers' Edinburgh Journal*, 26 December 1846; 156; pp. 401 – 404, p. 404.

[392] T. R. Robinson, 'On the Present Condition of the Earl of Rosse's Great Telescope', *Proceedings of the Royal Irish Academy (1836-1869)*, vol 4 (1847 - 1850), pp. 119 - 128.

[393] T. C. Weekes, 'Origin of the 3rd Earl's interest in astronomy' in C. Mollan (ed.), *William Parsons 3rd Earl of Rosse: Astronomy and the castle in nineteenth-century Ireland* (Manchester, 2014) pp. 30 – 43.

work on more sizeable telescopes did not really take off until after his marriage in 1836 to a wealthy Yorkshire heiress, Mary Field (1813 - 1885), who was able to fund her spouse's enthusiasm for this particular form of engineering project.[394] By 1840 Rosse was collaborating with Robinson, a semi-professional astronomer, who became his main cheerleader as well as being a key factor in his desire for the construction of large telescopes and the search for true nebulosity.[395]

Prior to his marriage there had been one other significant event which may have materially influenced Rosse's decision to engage with entangled questions of cosmology and theology. The relatively early death of his younger brother John Clere Parsons (1802 - 1828) gravely affected his then elderly father. An ensuing "long period of deep affliction" led in due course to the publication of the 2nd Earl of Rosse's slightly unexpected but thoughtful treatise, *An Argument to prove the Truth of the Christian Revelation*, which he dedicated to his late son:

> He died on the 10th of August, 1828, when it was fondly hoped that he was just about to gather the fruits of his honourable labour. During the long period of deep affliction for so great a loss, I studied the subject of this argument.[396]

It does not take a great stretch of the imagination to see that Parsons senior's desire to prove the correctness of revealed religion was strongly linked to the premature death of his second son and was in due course to lead to a performance of filial duty by his eldest son which was analogous to the case of the Herschels.

The main theme of this book was an argument, which Lawrence developed at some length (443 pages), to the effect that Moses had correctly described the sequence of events which unfolded during the creation of the world. Since the Patriarch could not have had first-hand knowledge of this history he must therefore have received a divine revelation; thus establishing both the truth of religion and the accuracy of Genesis. A contemporary reviewer of the book noted the emotional connection between "the hope of meeting the lost one [his son] in another and a better world:" and Parsons' endeavour to

---

[394] Weekes, 'Origin', p. 34. Alison, Countess of Rosse, 'Part 2: Family Life at Birr' in Mollan (ed.), *Parsons*, pp. 55 – 70. 7th Earl of Rosse, 'William Parsons'.
[395] Bennett, *Church*, p. 104.
[396] 2nd Earl of Rosse, *An Argument to prove the Truth of the Christian Revelation* (London, 1834), p. iii.

"apply the evidence of external nature directly to the proof of Revelation, without the intervention of Natural Religion."[397]

In the course of his argument the 2nd Earl attempted to unravel the genesis of planet earth, including some favourable references to the nebular hypothesis of "La Place", albeit perhaps without a completing understanding of the implications thereof. He demonstrated some familiarity with current astronomical thinking, including a reference to Herschel's recent *Treatise on Astronomy*, and expressed a hope that future scientific discoveries would provide further support for his thesis; "in the science of astronomy, that much remains to be discovered? […] And also that many discoveries will be made respecting those luminous appearances in the heavens, called nebulae?" [398] Lawrence Parsons' grief-driven thesis, with specific reference to the question of the origins of the mysterious nebulae, appeared to have thereby set the agenda for the initial observations to be made with the Leviathan.

It is also clear that the future 3rd Earl of Rosse was located in a complex and sometimes traumatic theological and political space which in due course provided additional reasons to complete his telescope construction projects. This contested cultural environment also informed and motivated his performance of multiple selves, including landlord, politician, astronomer and engineer.

The 2nd Earl had been an early supporter of Catholic emancipation to the extent of donating land for the building of a Catholic parish church well before the passing of the Roman Catholic Relief Act.[399] In the 1830s and 1840s, however, the parish of Birr was the location of one of the few nineteenth-century Catholic schisms in Ireland; an occasionally violent breakaway movement led by the Crotty cousins, Michael and William, "who became respectively, a Church of Ireland parson and a Presbyterian minister after having […] first attempted to organise a dissident group of Catholics at Parsonstown".[400]

---

[397] 'Argument to prove the truth of the Christian revelation', *The Athenaeum*, 26 April 1834; 339; pp. 311 – 312.
[398] 2nd Earl of Rosse, *Argument,* pp. 13 – 14, 40 – 41, 77 – 78, 411 – 416. J. F. W. Herschel, *A Treatise on Astronomy* (London, 1833) is mentioned in a footnote on page 34.
[399] 7th Earl of Rosse, 'William Parsons'.
[400] K. Theodore Hoppen, *Ireland since 1800: Conflict and Conformity* (Harlow, 1999), p. 79.

The effects of the rift created by the Crottys continued until at least October 1845 as can be seen in the comments made by a Scottish evangelist, James Carlile (1784 – 1854), who had been despatched to Birr on a proselytizing mission by the Presbyterian Synod. He eventually acceded to local Catholic opinion, in the form of letters written to the press by the parish priest Father John Spain (1796? - 1848), and agreed to withdraw from his attempts to address the local Mechanics Institute:

> … because Mr. Spain and I cannot agree on certain points of theology such as the right and duty of all men to read the Scriptures, and the efficacy of masses for the dead.[401]

Another indication of theological perturbances in the parish was the 1846 report, subsequently played down, of an attack on the Leviathan; "I suppose you have heard of the insane attempt which has been made to destroy Lord Rosse's great reflector upon Religious Grounds."[402] This allegation, even if untrue, suggests that there was significant local antipathy to a perhaps poorly understood and potentially hubristic device which one commentator opined might have been attacked "on the ground that it looks too profanely into the mysteries of creation!" It seems that the linkage between astronomy and religion was very much also present in the minds of the writers and readers of *The Athenaeum*, even if vicariously projected into the mind of a local "mischievous fanatic".[403] The alleged attack took place at the height of the potato famine so it is not difficult to alternatively adduce a more political motive for animosity towards this symbol of the ascendancy.[404]

County Offaly and the surrounding area were embroiled in several political controversies during the early nineteenth century, including the rise in 'agricultural' crimes and other upheavals leading up to the passing of the 1832 Reform Act. Such was the enthusiasm for this measure amongst his mainly Catholic constituents that Rosse, a Conservative, felt impelled to appear to support the Whig

---

[401] M. Hogan, 'William Parsons' influence on the town and community of Birr' in Mollan, (ed.), *Parsons*, pp. 90 – 121, pp. 96 – 99. Printed address by J. Carlile to the Roman Catholic members of the Mechanics Institute of Parsonstown, 25 October1845, Birr Castle MSS J 9

[402] Humphrey Lloyd to John Herschel, 17 October 1846, Royal Society Herschel MSS HS 11.285. Emphasis in the original.

[403] The supposed attack was also reported in the weekly gossip column of *The Athenaeum* dated 17 October 1846, p. 1072. This article, however, also suggested that the original report may have been spurious.

[404] Hogan, 'William Parsons', pp. 103 – 111.

government of Lord Grey.[405] In due course he also had to contend with several powerful movements amongst the local population who had initially pursued the cause of Catholic Emancipation and subsequently the repeal of the Act of Union. The first of these initiatives had looked to the nationalist Daniel O'Connell (1775 - 1847) as its figurehead and reached such peaks of unrest that in one instance Rosse and his father felt it necessary to call out the local militia.[406]

The sequence of events which seems to have most perturbed Rosse was a series of attacks on landlords and their agents, which culminated with the murder, in January 1839, of his relative by marriage and near neighbour Lord Norbury (1781 – 1839) "in broad daylight, just outside the walls of his home at Durrow Abbey near Tullamore."[407] The violent death of his friend occurred during the construction of Rosse's first major telescope, a three-foot reflector which was completed in late 1839. There is no available evidence which demonstrates a contingency between these two events, but the death of his neighbour and the general feeling of unrest in the area may well have contributed to Rosse's subsequent determination to positively influence the welfare of his tenants. He duly employed the local population in the various projects, including telescope construction, which he personally supervised rather than becoming a member of the growing class of absentee landlords.[408]

In the light of these 'good works', Rosse's refusal in late 1847 to institute outdoor relief can be seen as a rather more negative move. This course of action favoured ratepayers over the poorer tenants, forcing some of the latter to seek help in the already crowded workhouse. Rosse's retrogressive decision followed a trip to London during which his eldest child and only daughter, Alice (1839 - 1847), died. During this visit to the capital he was also exposed to the wave of 'famine fatigue' which had followed a short but significant financial crisis.[409] Either or both of these affects may well have had a bearing on his subsequent resistance to providing assistance in his home demesne, although there is no evidence to suggest that the loss of young Alice, whilst keenly felt by the family, had

[405] A. Shields, 'The public life and political opinions of the 3rd Earl of Rosse' in Mollan (ed.), *Parsons*, pp. 122 – 158, p. 133.
[406] Hogan, 'William Parsons', p. 94.
[407] Ibid., p. 112 – 113. Shields, 'public life', pp. 144 – 145.
[408] Hogan, 'William Parsons', pp. 105 – 106.
[409] Ibid., pp. 103 – 111.

anything like the significance for him of Darwin's loss of Annie or than the death of a son at a more mature age had had for his father.[410]

It should not be construed therefore that Lord Rosse represented an exception when compared with his peers in terms of his political views or his proprietorial interest in the preservation of his Irish estate and the protestant ascendancy. Towards the end of the famine, for example, he campaigned vigorously against the idea of his tenants being encouraged to vote for the dissolution of the Union; "a scotchman who is seriously to propose a Repeal of the Scotch Union, would be considered a fit inmate for a madhouse."[411]

His attitude towards the rights of his tenants remained both conservative and Conservative throughout his political career. Although, for reasons of expediency, he had sided with the Whig government in 1832 it became increasingly obvious from his speeches and actions, initially as an MP (1821 – 1834) and then, following his father's death in 1841, as an Irish representative Peer, that his natural inclination was to side with his fellow Tory landowners.[412] He resisted the idea of granting leases to his tenants on the grounds that it led to sub-division and eventual poverty, preferring instead to encourage emigration to reduce the population. His views on these topics were made very clear by the publication, just before his death, of a pamphlet entitled *'A few words on the Relation of Landlord and Tenant in Ireland and in other parts of the United Kingdom'* in which he made the case for continuing to treat Irish tenants in a far less favourable way than was the norm for the remainder of the country.[413]

His papers and correspondence provide almost no evidence of his views on such potentially value-laden questions as whether the universe is a dynamic entity or how firmly he adhered to the tenets of the Church of Ireland. To the extent that religion, science, politics and nationality were irretrievably

---

[410] Countess of Ross, 'Family Life', p. 57.
[411] Rosse to G. Henan, 7th June 1848, Birr Castle MSS J 11.
[412] Shields, 'public life'.
[413] 3rd Earl of Rosse, 'A few words on the Relation of Landlord and Tenant in Ireland and in other parts of the United Kingdom' (London, 1867). A copy can be found in Birr Castle MSS J 3. A strongly opposing view was expressed in: I. Butt, *The Irish people and the Irish land: a letter to Lord Lifford; with comments on the publications of Lord Dufferin and Lord Rosse* (Dublin, 1867) esp. pp. 160 – 191.

intertwined in his local time and space, however, there are reasonable grounds to suppose that the various conflicts and privations affecting his tenants were contributory factors in Rosse's decision to undertake a telescope building project which also provided him with a diversion from quotidian angst, casting him back to in time to an early interest in celestial objects which had preceded his assumption of more terrestrial duties.

That the initial objective for the new instrument was to refute the evidence of nebulosity clearly ran counter to his father's earlier endorsement of Laplace's theory. One key reason can be adduced for this change in astronomical objectives. It had become evident by the 1840s that the nebular hypothesis was seen as a supporting argument for the evolutionary, progressive and materialist ideas associated with radicals like Nichol and Mill. It was therefore anathematic to many members of the Church of Ireland as well as to Catholics.[414] More specifically, Rosse was encouraged and supported in his endeavours by Robinson, an enthusiastic cleric, who was strongly opposed to the, from his perspective, negative implications of the nebular hypothesis.

Robinson was a fellow graduate of Trinity College and a Church of Ireland minister who had the living of Enniskillen and the patronage of the Primate of All Ireland. He shared several characteristics with Nichol, including having been appointed to a role as the Director of the Armagh Observatory in 1823 despite having no previous experience in astronomy, but he held opposing views on both politics and religion. Robinson was, like Nichol, a powerful speaker much given to flights of hyperbolic overstatement when addressing audiences of amateur enthusiasts, making full use of the lively poetic imagination which he had developed at an early age, having been acclaimed as the "infant bard of Belfast". His upbringing in Ulster and an occupational dependency on the established church had combined to make him "an aggressive Ulster Episcopalian". One evident consequence of the heterogenous political and enthusiastic religious environments in which he was raised was that he

[414] See, for example, W. Steinicke, *Observing and Cataloguing Nebulae and Star Clusters: From Herschel to Dreyer's New General Catalogue* (Cambridge, 2010) pp. 104 - 109.

viewed the nebular hypothesis as a barely concealed attack on the established church and so he "preached in Dublin against Papism, materialism, unbelief, and evolution theory."[415]

Robinson was apparently so convinced of the rightness of his position and so keen to undermine the concept of ongoing cosmogonic development processes that as early as November 1840 he knew what the outcome of current and future nebular observations would be. Following a series of observations made at the castle by means of the three-foot reflector, he expressed himself in very confident terms to an audience at the Royal Irish Academy, as reported by his colleague Sir James South (1785 - 1867) to Lord Rosse:

> You cannot imagine the impression that his manner and matter made on the Academy, and his assurances that all Nebula observations must be reformed, brought in with uses by allusions to cosmogonic theories of certain astronomers, in which he gave vent to philippics [sic] against Herschel and [the?] French astronomers of no ordinary sharpness drew continued cheers from his hearers.[416]

The "philipics against Herschel" are somewhat ironic in view of Robinson's later appeals for assistance to authority of the far more established astronomer. Some of the speculative views expressed by the cleric at the meeting were clearly at variance with those of South who had a prior agreement with Robinson "that he would not make an extempore harangue but that he would bridle his warm heart's feeling with having before him a written sermon", nonetheless he "went further than I could join him".[417] Robinson's more forthright assertions were not recorded in the official proceedings of the Academy as South was subsequently able to persuade him to tone down or remove some of the pejorative comments which had been made at the actual meeting.[418]

---

[415] Bennett, *Church*, pp. 59 – 84. Lord George John de la Poel Beresford (1773 -1862) who appointed Robinson to the Armagh Observatory post became Archbishop of Armagh and therefore Primate of All Ireland in June 1822. Steinicke, *Observing*, p. 105. Schaffer, 'Leviathan', p. 207.

[416] South to Rosse, 11 November 1840, Birr Castle MSS K 1.2. Hoskin, 'Rosse, Robinson' p. 337 renders the questionable word as "the" which would make sense, but this reading is hard to agree with when examining the letter in question. Possible alternative readings include "his" and "her", but these seem *a priori* less likely.

[417] South to Rosse, 11 November 1840, Birr Castle MSS K 1.2.

[418] T. R. Robinson 'Account of the Three-feet Telescope' in C. Parsons, *The scientific papers of William Parsons, third Earl of Rosse 1800 – 1867* (Cambridge, 2011) pp 14 – 19. Reprinted from *Proceedings of the Royal Irish Academy* II, 2 (1840). Hoskin, 'Rosse Robinson', p. 337.

Rosse, whilst publicly more cautious than Robinson about claims of nebular resolvability, when conversing at dinner paraphrased Robinson's claims, telling his visitors that "42 of the 47 nebulae [from a list provided by John Herschel] have been resolved." and that "he altogether rejects the nebular hypothesis."[419] We should note here that in making statements of this nature Rosse was following Robinson's lead in obscuring the plastic boundary between the two versions of nebular cosmogony. Based on the use of the Birr telescopes to 'resolve' the Herschels' nebulae, they were implicitly claiming to have simultaneously undermined the Laplacian speculation on which the author of *Vestiges* had depended for the first leg of his controversial developmental tripod.[420]

Whilst Rosse's reported comments support the idea that negation of the nebular hypothesis had formed a significant component of his motivation for building the telescope, he also had some wider objectives. The completed instrument came to be seen as a major engineering feat and an "Irish triumph" in its own right.[421] The telescope construction projects which he undertook required him to solve some complex technical and managerial problems. For example, he needed to find a method to safely cast and accurately polish a six-foot mirror (without, as discussed below, the benefit of explicit information on the processes used by William Herschel). Robert Stawell Ball (1840 – 1913), Rosse's last observing assistant, suggested that:

> … it was more the mechanical processes incidental to the making of the telescope which engaged his interest than the actual observations with the telescope when it was completed … [and his] special interest in the great telescope ceased when the last nail had been driven into it.[422]

Success, then, possibly at the time and certainly *post facto*, was defined at least in part by completion of the telescope itself.

It is also important to note that the initial Leviathan observations took place just before the great potato famine. This tragic event significantly reduced the use of the telescope between its completion

---

[419] See, for example, Hoskin, 'Rosse Robinson', p338 and Schaffer, 'Leviathan', p.214. Frances Power Cobbe to Louise Cobbe, dated to the 1840s, Birr Castle MSS J 7. Also see F. P. Cobbe, *Life of Frances Power Cobbe by herself* (New York, 1895), vol 1, p. 177. NB Rosse seems to be slightly misquoting Robinson (see below).
[420] Schaffer, 'nebular', pp. 138 – 139.
[421] Schaffer, 'drawing', pp. 456 – 461.
[422] R. S. Ball., *Great Astronomers* (London, 1895) p. 287 quoted in Steinicke, 'The M51 mystery', p. 22.

in 1845 and the end of the famine in 1848.[423] It has been inferred, as noted above, that Rosse's additional objectives in the whole enterprise of the Leviathan included not only a need to demonstrate his mastery of the requisite engineering techniques but also to exercise benevolence as a landlord at a time of severe food shortages and great social dislocation.[424] Rosse had in any case provided a worked example of the capability of the Anglo-Irish ruling class in rivalling, or indeed improving upon, the astronomical products of Georgian England.

The initial usage of the Leviathan consisted almost entirely of observations of nebulae, as might be expected. Successful resolution of the Orion nebula appeared to be claimed by Rosse in a letter to Nichol in early 1846 and was subsequently reported in editions of *The Times* and *The Athenaeum*.[425] These reports were not supported by any graphical representations at the time and, surprisingly, it was not until 1867 that a drawing of the nebula, as seen through the Leviathan, was made available to the public press. This delay reflects the great difficulty which observers encountered when attempting to capture an image of an object of interest from their slightly perilous position at the mouth of the great telescope often in conditions of limited 'seeing' and at times having to battle with optical defects arising from the tarnished state of the six-foot mirror. Add to these uncertainties the subjective difficulty of deciding whether or not one is observing a field of very fine stars scattered like "grains of sand", or a nebulous haze, and it is perhaps to be expected that detailed illustrations of nebulae were few and far between.[426]

Sir James South, for example, remained sceptical about some of the claims of resolution made by his fellow observers:

> The night of the 5th of March, 1845, was the finest I ever saw in Ireland. Many nebulas [sic] were observed by Lord Rosse, Dr. Robinson and myself. Most of them were for the first time since their creation, seen by us as groups or clusters of stars; while some, at least to my eyes, showed no such resolution.[427]

---

[423] 7th Earl of Ross, 'William Parsons', pp. 9 - 10.
[424] Schaffer, 'drawing', pp. 457 – 459.
[425] Schaffer, 'Leviathan', pp. 214, 216.
[426] Schaffer, 'drawing', p. 462.
[427] Excerpt from a letter written by Sir James South which was printed in the *Times* of 16 April 1845, and the *Illustrated London News* of 19 April 1845. Reprinted in T. Dick, *The Practical Astronomer* (London, 1845) p. 555.

South's comment further highlights the difficulties which confronted early Victorian astronomers and publishers when endeavouring to present a reliable image of a view as seen through a telescope. Several stages of inscription and translation occurred in the chain of events which began with the observer who had to alternate between looking through the eyepiece and endeavouring to reproduce the received image via the medium of pencil on paper in conditions of low illumination (in order to avoid ruining their adjustment to the limited light made available through the telescope).[428] And seeing itself, as noted by William Herschel, is an art which not only has to be cultivated but also diligently practised, suggesting that the brain's interpretive processes are even more important than the nature of the image which arrived at the retina.[429]

Further translations took place as the original illustrator subsequently conveyed to the engraver an interpretation of how the objects and textures in a drawing should be rendered on a printing plate. It was, in fact, only an accompanying narrative and the authority of its author that determined whether individual dots or textures on the page should be understood as clouds of stars or a field composed of a nebulous (i.e. gaseous) substance. As Nichol himself put it at this time:

> In reference to the Plates in this volume, I must acknowledge my great obligations to Lord Rosse. The remarkable Spiral Nebula is now published for the first time, through his kindness; and I am glad to state, that aided by willing and ingenious artists my rather venturous attempt to represent these masses of stars in the light in which they appear - viz: *white on a dark ground*, has been considered by his Lordship to be successful.[430]

These interpretational challenges were no doubt accompanied by the subtle but important influences of a subject's *Weltbild*; or, to put it more vernacularly 'seeing what you want to see'. In the circumstances outlined above it is perhaps not overly surprising that Robinson was able to construct the images inscribed on his eyes by the telescope in such a way as to concur with his hopes and expectations. There may also have been an at least one instance of deliberate 'sleight of hand'. Steinicke has suggested that Robinson not only succeeded in convincing himself of the purely stellar

---

[428] O. W. Nasim, 'The 'Landmark' and 'Groundwork' of stars: John Herschel, photography and the drawing of nebulae', *Studies in History and Philosophy of Science*, 42 (2011) pp. 67 – 84, pp 70 – 74.
[429] Schaffer, 'Leviathan', pp. 190 – 191.
[430] Nichol, *Thoughts*, p. x.

nature of the spiral nebula Messier 51, but then actively deceived some fellow observers by suitable selection of eyepieces to give them the impression that it is a globular cluster of stars with no hint of nebulosity, whereas a wider field of view would have revealed the spiral arms and an attendant smaller cluster which give it a much greater appearance of dynamism.[431]

Although the question of the nebular hypothesis had apparently now been 'resolved', Rosse in 1850, following the tragic events of his daughter's death and the potato famine, admitted to distinct doubts about the certainty of the observations he had previously reported:

> When certain phenomena can only be seen with great difficulty, the eye may imperceptibly be in some degree influenced by the mind; therefore a preconceived theory may mislead, and speculations are not without danger.[432]

Rosse's uncertainty, which may also reflect a revised take on Robinson's "preconceived theory", was in due course reinforced by the comments of his peers. In 1869, for example, the experienced Russian observer Otto Wilhelm von Struve (1819 – 1905), a professional astronomer who was the director of the observatory at Pulkovo, cast considerable doubt on the resolvability of Orion based on Rosse's own narrative:

> In my opinion if a nebula is resolvable it will offer the same appearance on any occasion when the images are sufficiently favourable. This admitted your own observations prove that with regard to the central part of the nebula of Orion, this term ought not to be applied; for in different nights you see areas? of resolvability in different parts of the nebula. [...] there is a tendency of the nebulous matter to form itself in separate knots sometimes in this, sometimes in another direction.[433]

Robinson, for his part, was satisfied, at least initially, in both private and public with the outcomes of his observations of nebulae through the eyepiece of the Leviathan; "We have however worked to some purpose, for of the 43 nebulae which we have examined All have been resolved ..."[434] It is

---

[431] W. Steinicke, 'Birr Castle observations of non-stellar objects and the development of nebular theories' in Mollan (ed.), *Parsons*, pp. 210 – 270, pp. 229 – 232. Steinicke, 'The M51 mystery'.
[432] 3rd Earl of Rosse, 'Observations on the nebulae' in Parsons, *scientific*, pp 109 - 124, pp. 113 - 114. It is now clear to astronomers that the nebula is a mixture of stars and gas and cannot have been 'resolvable' in the sense inferred by Rosse et al.
[433] Struve to Rosse, 28 July 1869, Birr Castle MSS L 6.1.
[434] Robinson, *Astronomical Diary*, 12 March 1845, Birr Castle MSS L 2.1.

interesting to note the subtle contrast here between the parallel claims of Rosse and Robinson; the dinner conversation of the former made it clear that at least five nebulae remained unresolved. Within a few years of the original observations, however, and perhaps more surprisingly, Robinson's confidence in the correctness of his conclusions also decreased. Thus in 1849, at a time when he might have presumed that the nebular hypothesis had been fatally holed below the waterline, his correspondence with John Herschel revealed his own uncertainty as to whether changes in the shapes of nebulae occur over time (a potentially significant argument against the hypothesis that all nebulae are clusters of stars and that the universe has been static or has exhibited only uniform motion since its creation):

> From what I have seen of nebulae, I am the more anxious that no time should be lost in securing accurate drawings, based on exact measurements, of those that are most remarkable among them. Whatever changes occur in them can only thus be ascertained; and it seems desirable that the survey be made with instrumental means as powerful as the existing condition of optical art is able to furnish.[435]

A striking feature of this request is not only the tone of anxiety evinced by Robinson but also the implicit trust which the Director of the Armagh Observatory was prepared to place in the products of the various processes of observing, drawing and engraving performed by using equipment other than the Leviathan. His potential reliance on Herschel's authority contrasted starkly with Robinson's earlier comments to a Dublin audience in which he favourably compared the openness with which the details of the design and manufacturing processes undertaken by Rosse had been documented with the lack of information on telescope manufacturing provided by William Herschel.[436] This alleged shortfall on the part of the elder Herschel was viewed by Robinson as evidence pointing to the sub-standard performance of Herschel's forty foot reflector; on which subject he conducted a brief letter-writing campaign in 1843.[437]

---

[435] Robinson to Herschel, 21 October 1849, Royal Society Herschel MSS HS 14.375.
[436] See, for example, Robinson's presentations to the Royal Irish Academy in 1840 and 1845, listed in the bibliography and collected in Parsons, *scientific*, pp. 14 - 31. The number of pages devoted to the description of the construction of the telescope are significantly greater than those which report actual findings and observations.
[437] T. R. Robinson, 'Dr. Robinson's reply to Sir John Herschel', *The Athenaeum*, Oct 21, 1843; 834; pp. 945 – 946 and 'Dr. Robinson's reply to Sir John Herschel', *The Athenaeum*, Nov 18, 1843; 838; pp. 1027 – 1028.

As Schaffer has pointed out, this attack on the reliability and quality of Herschel's equipment was deployed to highlight important differences between the two telescopic teams, including the far more open approach to design documentation and description of the construction processes performed by the Parsonstown team. These differences seem to align with the contrasting class backgrounds of the two rival constructors. Rosse was a wealthy aristocratic amateur demonstrating his grasp of technology, his authority as a landlord and his technocratic command of the workforce. William Herschel, by way of contrast, had started his working life as a bandsman and had for much of his career acted in essence as a craft worker, creating a cottage industry of telescope production in which he of necessity preserved the secrets of his success to maintain the profitability of his enterprise.[438]

Robinson's earlier attack on the reliability of William Herschel's equipment implied an indirect assault on the reliability of his nebular observations and was therefore also an animadversion against the latter's theory of the nebular genesis of stellar systems. Faced with this challenge, John Herschel supported his father's legacy and attempted to defend him against the charge that the largest telescope constructed by his father in Slough was ineffectual.[439] It is more than a little ironic, therefore, that in the passage referring to possible changes in the Orion nebula quoted above, Robinson had begun to appreciate the limitations of the Leviathan and had come to accept that the Birr Castle telescope did not necessarily represent the "instrumental means as powerful as the existing condition of optical art is able to furnish."[440]

It must have occurred at some point to Robinson that the superior light gathering power of the Leviathan might also be capable of establishing whether the universe had limits (in both time and space) and thus resolve an uncertainty which had occasionally also exercised Nichol; is the cosmos infinite in extent and therefore by implication also in time? He and Rosse did not, however, discover any perceptible limit to creation even at the telescope's highest magnification and at distances which were vast by preceding standards. Why was there no end to the universe and where, if anywhere, did

[438] Schaffer, 'Leviathan', pp. 190 - 191.
[439] J. F. W. Herschel, 'Sir John Herschel's reply to Dr. Robinson', *The Athenaeum*; Nov 4, 1843; 836; pp. 983 – 984.
[440] Robinson to Herschel, 21 October 1849, Royal Society Herschel MSS HS 14.375.

God reside? It was not possible, even with the most powerful instrument thus far developed "to behold the beauty of the Lord," although that very act, if feasible, would have been fraught with a danger which would also have been well-known to students of the Old Testament.[441]

Although the suggestion that Robinson might have held out such an exotic expectation for the newly constructed telescope might seem *a priori* unlikely, we should bear in mind some of the elegiac verses with which he ushered it into the world:

> Welcome to thy new existence,
> Child of Intellect and Might!
> Welcome to thy wide Dominions,
> Lord of Ether and of Light!
>
> Thou shalt lead us on in triumphs,
> Yet to mortal power unknown;
> Realms, which Angels only visit,
> Shall yield homage at thy throne.[442]

It is also worth pointing out that one rarely discussed feature of the Leviathan episode is the way in which both variants of the nebular hypothesis were deemed by a number of commentators to critically turn on a single point of evidence; the resolvability of the Orion nebula.[443] Astronomers had at that time only recently succeeded in measuring the parallax (and hence the distance) of two nearby stars.[444] The nearer of the two, α C*entauri*, had been found to lie at least three light years away from the solar system (a suggested measure of sidereal distances expressed in units of time popularised by Herschel in his *Treatise on Astronomy*), implying that all other stars must be even further away from the earth and presumably similarly distant from each other.[445] Hence it was clear, as noted earlier, to

[441] Psalm 27:4. Exodus, 33:20. "And he said, Thou canst not see my face: for there shall no man see me, and live."
[442] Bennett, *Church*, p. 107.
[443] Schaffer, Leviathan', pp. 199 – 200.
[444] 61 *Cygni* and *α Centauri* – the measurements were made by Friedrich William Bessel (1784 - 1846) and Thomas James Henderson (1798 - 1844) respectively.
[445] Herschel, *Treatise*, pp. 377 – 379 and J. F. W. Herschel, *Outlines of Astronomy* (Philadelphia, 1849), pp. 506 – 513. See also Dick, *Sidereal*, pp. 68 – 71.

Nichol's friend De Quincey that the Orion nebula had in place of a mouth "a horrid chasm, a ravine, a shaft, that many centuries would not traverse;"[446]

It should therefore have been evident to most astronomers that the scale of the totemic Orion nebula, which contains a number of clearly resolved stars in its central region, is very much larger than any single planetary system. If, in fact, the apparently gaseous clouds in the nebula are formed of a veritable mass of stars which are individually almost too faint to be resolved by the world's most powerful telescope, then the nebula must be very distant indeed; a thought which was subsequently to be exploited by Nichol.[447] Rosse and Robinson, on the other hand, seem to have, deliberately or otherwise, overlooked such vast variations in scale so that the resolution of Orion could also be used to support the refutation of the planetary evolution hypothesis employed by the author of *Vestiges*.

In the context of the different political and theological viewpoints which were at that time entangled with the verifiability of the nebular hypothesis, it is perhaps surprising that the first person to have had an opportunity to view the Orion nebula through the six-foot reflector had been Nichol who was a particularly enthusiastic advocate of developmental cosmogony. Nichol by now had an apparently amicable relationship with Lord Rosse, to the extent that he had previously courted controversy within the University of Glasgow by agreeing to loan equipment originally intended for use in the university's own observatory to Rosse.[448] The unintended consequences of this action included, in due course, significant problems in his relationship with his employer and personal financial failure.[449] His 'generosity' seems particularly surprising when viewed in the light of his earlier quite trenchant views on the iniquitous behaviour of some members of the protestant ruling class in Ireland and on the use of tithes to support the established churches (which would also have put him in opposition to Robinson whose post at Armagh was partially funded by such tithes).[450]

---

[446] De Quincey, 'System', p. 571.
[447] In 1848, Robinson reported seeing 8 stars in the trapezium of Orion. See Robinson, 'Present Condition'.
[448] Coutts, *History*, pp. 388 -389.
[449] Schaffer, 'nebular', p. 141.
[450] Bennett, *Church*, pp. 80, 87.

Nichol was clearly also at odds with Robinson's requirement for a religiously founded 'static' cosmology. That Robinson was strongly opposed to Nichol's "zeal for Nebular Cosmogony" can be inferred from comments made in an 1841 letter to Rosse, who "often had to serve as a mediator" between the two rivals. Robinson's flattering comparison, in which he imagined Nichol being "in despair of what he hears you have done", also provided a pointer to some practical difficulties which duly arose in the Glasgow observatory:

> … Nichol, professor of Astronomy at Glasgow University, the author of a catchpenny book which you may have seen called "The Architecture of the Heavens". He seems in despair of what he hears you have done, for in his zeal for Nebular Cosmogony, he had acquired a mirror by Ramage of 2 feet aperture and 50 feet focus! with which he has to do wonders.[451]

Nichol in due course became aware of the unsuitability of the Ramage mirror "with which he has to do wonders" and he was probably therefore keen to better understand the impressive new technology about to be deployed in Ireland.[452] His donation of astronomical apparatus helpfully altered his status *vis-à-vis* the Irish project to that of sponsor, thus facilitating access to the newly completed telescope. Nichol was presumably also motivated by a conviction that the observations to be made by the Leviathan would provide confirmatory evidence in favour of his preferred cosmogony. And, as we have seen, Nichol appears to have been quite adept at fitting his persona to the requirements of the various contrasting, and sometimes conflicting, emotional communities in which he found himself.

The ambiguous nature of the relationship between Nichol and Rosse also illustrates the complexity of the interaction between academic and aristocratic authority in the mid-nineteenth century, especially given the traditional overlap between these two groups. Rosse appeared to accept at least a partial equivalence in Nichol's structural status following his donations, permitting a level of rapprochement between these two astronomical rivals. Nichol was in due course invited to Birr Castle and offered

[451] Robinson to Rosse, 7th April 1841, Birr Castle MSS K 5.4. Steinicke, *Observing*, p. 105.
[452] His son's account of the difficulties encountered in using the 50-foot telescope and its subsequent destruction in a storm can be found in: Knight, *Memoir*, pp. 33 – 35.

the opportunity to view the Orion nebula in December 1845. Following his night of observation, as we saw in Chapter 1, Nichol declared that he was unable to resolve the nebula into individual stars.[453]

On receiving a subsequent report, in a letter from Rosse, of its potential resolvability, which he interpreted as actual resolution, Nichol publicly accepted the word of a gentleman with respect to this new evidence; an acceptance which reflects the practical impossibility of challenging the veracity of a peer of the realm.[454] A second factor which may have played a role in Nichol's surprisingly ready acquiescence to the Rosse interpretation of the observations of Orion, was another unintended outcome of his significant but problematic material support for the project. Having by then returned to Glasgow he probably did not want to engage in further discussion of the extent or utility of his ill-advised equipment 'loans'.[455]

The reported resolvability of the Orion nebula clearly was, at least initially, a set-back for Nichol and other supporters of the nebular hypothesis. One contemporary commentator observed that "Without doubt then, the nebular hypothesis must be abandoned." relying in part on the news that Nichol had himself written to the editor of the *Glasgow Argus* to report that the concept "is no longer tenable."[456] Despite his apparent concurrence with the Irish observers, however, Nichol was unwilling to give up the idea of a developing cosmos. He employed his ability to connect with the audiences for his popularisations of current astronomical thinking to promote new variants of his previously stated positions.

In 1846 he published *Thoughts*; a major statement of his continuing belief in evolutionary hypotheses. The book began with apparently fulsome praise for the achievements of Lord Rosse together with a concession that the sidereal nursery component of nebular cosmogony might now be a 'dead letter':

> In the first place, the action, although only begun, of the great telescopes which Science owes to the genius and labour of the Earl of Rosse have somewhat altered the views I formerly gave to the public, […] witness the extraordinary revelations regarding the shapes and internal constitution of the Stellar clusters, which, through the kindness of that

[453] Nichol, *Architecture*, pp. 113 – 114.
[454] Schaffer, 'nebular', pp. 141 – 142. Also see Secord, *Sensation*, pp. 403 – 410 for a discussion of the role of gentlemen in science.
[455] Coutts, *History*, pp. 388 – 389.
[456] 'Journal of Science, Inventions, and improvements', *The Critic*,1844-1847; Apr 11, 1846; 3, 67; p. 405.

> Noble Earl, I am enabled very fully to present: but, in regard of one special and very important point, his Lordship has wholly subverted the opinion of his illustrious predecessor [William Herschel].[457]

This approach is a further example of a nineteenth-century literary device which he had previously employed in several debates, including his animadversions against Chalmers, that of hyperbolic flattery followed by subtler demolition. In this instance, following the laudatory introduction, he subsequently proceeded to undermine the inference drawn by Robinson and Rosse that the nebular hypothesis had been totally disproved. A small but important point which was implicit in the preceding quotation is that whereas he [Nichol] was not in a position to challenge the word of a gentleman, that word had nonetheless to be viewed in the light of prior observations and statements made by Herschel; who, despite his modest beginnings, had eventually enjoyed royal patronage and who could posthumously be considered to be a gentleman and an accepted authority:

> Herschel was created a Knight of the Hanoverian Guelphic Order in 1816, and in 1821 he became the first President of the Royal Astronomical Society,[458]

As his arguments unfolded he gradually challenged the solidity of the Irish observations and the conclusions drawn therefrom by means of contrary evidence such as Herschel senior's 'planetary' nebulae, the persistent un-resolvability of the Andromeda nebula, the mysterious zodiacal light and, more generally, the continued applicability of Laplace's separate idea of planetary formation. By the end of Chapter II (and its accompanying Appendix) the reader had been informed that the idea of a nebular origin for the solar system was still applicable and was well prepared for the subsequent rehash of some of the geological and biological developmental ideas which had also featured prominently in *Vestiges*.[459]

The reviewer of *Thoughts* in *The Spectator* concurred that "La Place's theory of the formation of our solar system;" still stood, that one could only speak of an "alleged dissolution" of the nebular

---

[457] Nichol, *Thoughts*, pp. v – vii.
[458] A M. Clerke, *A Popular History of Astronomy during the Nineteenth Century* (Edinburgh, 1887), p. 17.
[459] Nichol, *Thoughts*, pp. 39 – 47, 56 – 86.

hypothesis and rather generously credited Nichol's defence of his own ideas as an attempt to exonerate William Herschel "from any suspicion of rashness in forming his speculation,"[460]

But the key argument which Nichol deployed at this point, and subsequently repeated in a series of public lectures delivered at such varying locations as the Athenaeum, the Manchester Royal Institution and the Mercantile Library Association of New York, was a rather ingenious re-framing of the Orion nebula observations to support his views regarding the scale and age of the universe.[461] To summarise his argument as succinctly as possible, Nichol held that if the previously unresolved nebulae consist ultimately of clusters of stars which are only just resolved by the Leviathan, then the distance of these stars is considerably greater than previously supposed to the extent that the Orion nebula must be at least 60,000 light years away and correspondingly massive in scale as noted by De Quincey. He asserted that the furthest visible objects contained in Orion and elsewhere in the sky are clusters which appear to us as points of light. They are therefore perhaps thirty million light years away (and ago); a point which did not escape the reporter from the *Manchester Guardian*; "About 5,000 of these clusters had been observed, from some of which the light occupied 30 million years in coming to us."[462]

In making this assertion, Nichol was also, after Herschel senior, one of the first people to suggest that our own galaxy was just one, perhaps typical, representative of the clusters of stars which are repeated right across the cosmos; a significant expansion of the scale and age of the universe, implying a further negative step change for the relative importance of the inhabitants of any individual planet. Not only is the earth not the centre of the solar system, nor is the sun a particularly special star but, according to Nichol, the Milky Way may be just one of many such "superb groups or galaxies":

> … separated from each other by gulfs so awful, that they surpass the distances which divide star from star, even as far as these transcend the spans which, as our terrestrial

[460] 'Dr. Nichol on the system of the world (Book Review)', *The Spectator*, 12 September 1846; 19, 950, pp. 882-883, p. 882.
[461] The lecture series at the Athenaeum was reported by *The Manchester Guardian* editions of 12, 15, 22 and 26 May 1847. The lectures in Manchester were similarly covered by the same journal in its 10 and 24 September 1851 editions. The series delivered in New York was published in book form as: J. P. Nichol, *Views of Astronomy: seven lectures delivered before the Mercantile Library Association of New York in the months of January and February 1848* (New York, 1848).
[462] 'Professor Nichol's lectures on recent astronomical discoveries' *The Manchester Guardian*, 12 May 1847.

> units, enable us to survey the magnitudes that concern us on the surface of our own abode.[463]

Nichol had executed a classic Morton's fork; if the Orion nebula is unresolvable then Herschel's developmental hypothesis had been confirmed but, if not, the universe is far older and more extensive than anyone had previously thought. In either case, the planetary speculation of Laplace was not in his view, and that of some reviewers, disproved by the findings of the Irish astronomers.[464]

Nichol's novel suggestion for how the possible resolutions of nebulae were to be interpreted allowed him to reclaim his astronomical authority in a series of public pronouncements. He was now able to restate his prior positions on development and progression and also to significantly enlarge the known universe. This rescaling of the cosmos was, moreover, broadly consistent with the apparent ages of the rocks in the earth's crust. Thus Nichol neatly contrived to turn the evidence which had initially seemed to destroy the nebular hypothesis into yet another leg of support for theories of cosmogony and geology which also pointed to ideas of change and progression in the spheres of biology and society.

That this was indeed Nichol's intention can be seen in his expositions of the duration and complexity of both terrestrial and extraterrestrial geological developments in *Thoughts* and his lecture series. The implied connections between distance and time and the links to developmental hypotheses were also clearly perceptible to his audiences. As *The Spectator* commented:

> The enormous duration of the system, measured by our notions of time – the state of continual change which is everywhere traceable – and the evident progress of such part of creation as we can submit to any test - are the main topics. In the course of their discussion, Dr. Nichol brings together some of the more striking facts both of astronomy and geology, making them his own by applying them to his exposition of Earth's cosmogony: but in looking at the vastness and duration of the material world, he does not forget the dignity of the moral.[465]

---

[463] Nichol, *Stellar*, p. 59.
[464] A Morton's Fork is a specious piece of reasoning in which contradictory arguments lead to the same (unpleasant) conclusion. It is said to originate with the collecting of taxes by John Morton, Archbishop of Canterbury in the late 15th century, who held that a man living modestly must be saving money and could therefore afford to pay taxes, whereas if he was living extravagantly then he was obviously rich and could definitely afford them. J. Ayto, (ed.), *Oxford Dictionary of English Idioms*, 3rd Edn. (Oxford, 2009) pp. 232 – 233.
[465] 'Dr. Nichol', *The Spectator*, p. 883.

Or as Gilfillan, with a characteristic injection of anthropomorphic theology, put it:

> … for now we have been taught, in a manner most impressive, the immense age of the universe, whose orbs seem hoary in their splendour, and have thus formed a new measure for computing our knowledge, or rather for more accurately estimating our ignorance of the days, of the years, of the right hand of Him that is the Most High.[466]

It is evident from both reviews that Nichol continued to couch his arguments in a context which provided a linkage to the sort of designing and creating deity posited by natural theologians, without being overly specific about the nature or role of such a divinity. A more overtly materialist treatment of astronomy and geology would have been too dislocating for some audience members and could have attracted censure from those "saints" whom Chambers had felt it necessary to assuage.

Nichol's motivation for conducting his extensive lecture series seems to have not only been an intellectual crusade designed to persuade a wider audience of the validity of his views on the nature of the universe; he was also actuated by the need to recoup the financial losses brought about by the over-liberal investment in the Glasgow observatory (and thence into Rosse's telescope) which had "sent him into irretrievable debt;".[467] His pursuit of both of these objectives was greatly assisted by his ability as a public performer "with the power of an accomplished orator." Nichol's "lectures were works of art, calculated at once to exercise and enlighten the intellect, quicken the imagination, and move the heart."; aptitudes which he had exhibited from an early age.[468]

A perhaps slightly surprising attribute of his lecturing self was that he suffered from a slight speech impediment or "hesitation", possibly a stammer. This was apparently an endearing attribute which actually enhanced his performance and was positively received when he engaged in "extempore speech":

> Both in the study and the lecture-room, he [Professor Nichol] is the same clear expounder, vivid describer, and tempered enthusiast. His manner, without detracting aught from, adds little or nothing to, the impression of his thought or style, of which it is simply the medium. Its principal quality is ease - an ease not materially impaired by a

[466] Gilfillan, *Second Gallery,* p. 235. In this passage, Gilfillan was paraphrasing Psalms 77:10.
[467] Schaffer, 'nebular', p. 150.
[468] MacLehose, *Memoirs,* p. 250.

> certain hesitation. Hesitation, we need scarcely say, has often a great charm. [...] And we know some popular divines who have stammered themselves into pulpit celebrity, […] Dr. Nichol's hesitation is not great, is confined to his extempore speech, and seems rather to spring from an excess than a deficiency of matter or words. Every little while, too, he resorts to his notes, and reads his fine passages with much gusto and effect. We must, say, however, that we prefer him when carrying on his conversations - so lively, explicit, and entertaining - with his hearers.

Gilfillan, in the course of this effusive eulogy, extolled Nichol's ability to "uncase science from its mummy confinements, and to make it walk abroad as a free and living thing." This striking analogy, which would have been understood by his readership, derived from the contemporary vogue for Egyptomania and referred to the "intoxicating experience" of "mummy unwrapping spectacles [which] allowed bandages and trinkets from the body to be inspected, touched and smelled,".[469]

Nichol's son John confirmed that it was the combination of his father's imaginative language and the "power" of his speech which were the keys to his performance and which he contrasted favourably with his own more modest efforts:

> I was familiar with most of those facts and theories concerning the earth, and moon, and stars, which a large audience came to learn, for twenty successive weeks, in the Merchants' Hall. Without that power which could at will arrest and make wonder the eyes of his hearers; without that grace which gave to his speaking the charm of a perfect actor; without that fire of eloquence which raised me into another world every time I heard it, I could have delivered most, as I was once constrained to deliver one, of my father's lectures to a disappointed audience.[470]

Two interesting points emerge from Nichol junior's comments. Firstly, we gain an impression of how popular his father's lectures were, attracting "a large audience" which "came to learn, for twenty successive weeks". Secondly, and even allowing for a little exaggeration on his son's part, it is also evident that his talks were as much appreciated for their affect; "that fire of eloquence which raised me into another world every time I heard it," as for his "facts and theories".

---

[469] Gilfillan, *Second Gallery,* p. 254. Mummy unwrapping parties took place from the early nineteenth century onwards but surged in popularity in the 1830s when a number of such events were hosted by a London surgeon called Thomas Joseph "Mummy" Pettigrew (1791 - 1865). See E. Tapp, 'The Unwrapping of a Mummy' in A. R. David (ed.), *Manchester Museum Mummy Project: Multidisciplinary Research on Ancient Egyptian Mummified Remains* (Manchester, 1979) pp. 83 – 94. E. Dobson, 'Literature and Culture in the Golden Age of Egyptology', PhD Thesis submitted to the University of Birmingham, November 2016, p. 31.
[470] Knight, *Memoir,* p 70.

It was also a characteristic of Nichol's public lectures that he deployed large (and more conceptual than detailed) illustrations to accompany his sweeping statements and grandiloquent claims; audience-pleasing techniques subsequently adopted by Proctor. His effusive style and hyperbolic statements, however, also drew some criticism from his peers:

> Several critics found Nichol's 'gorgeous style, gigantic diagrams and enthusiasm' rather suspect, both politically and morally. His 'very liberal and very unconsidered use of such words as inconceivable, infinite, eternal' simply deprives them of all such power, and at last for the infinite we mentally substitute greater than earth and for eternal, longer than the earthly lifetime of man'. [471]

Nichol was, of course, not the only astronomical performer in circulation at that time nor was he atypical of the "commercial but sublime" segment of the market for popular science. As Hsiang-Fu Huang has pointed out, in addition to a few established professionals "there were far more private showmen who engaged in the business of popular astronomy lecturing," earning a satisfactory stipend with their itinerant, theatrical performances, similarly accompanied by "beautiful visual representations" and purpose-built demonstration equipment. The sublime component of their output consisted, as did Nichol's, of interspersed allusions to the tenets of natural theology, references to the scope of the cosmos and the impressive capabilities of the creator which stimulated a sense of affective awe.

Their audiences were composed of people of varying ages, class backgrounds, religious beliefs, and political inclinations who consumed astronomical lectures for reasons which were many and varied, including moral instruction, religious inspiration, pursuit of knowledge and entertainment:

> Juveniles, women and parents, were particularly important target audiences in the market. This tendency accorded with the conventional emphasis on the educational value of astronomy in Enlightenment polite science culture. It also reflected the attitude that astronomy was deemed to be a suitable and beneficial science by accommodating didactic moral and religious teachings. Nevertheless, the motivations and reactions of audiences varied. Contemporaries might attend lectures to follow fashion, seeking knowledgeable instruction, to indulge in plain amusement, and so forth.[472]

---

[471] Schaffer, 'nebular', p. 150. The embedded quotations are from Gilfillan, *Second Gallery*, p. 255 and 'Recent Astronomy', *British Quarterly Review*, (6 Aug. 1847) pp. 1 - 40, p. 26.

[472] H-F. Huang, 'Commercial and Sublime: Popular Astronomy Lectures in Nineteenth Century Britain', PhD Thesis submitted to University College London, 9 March 2015, pp. 17 – 21, 275 – 276.

Clearly the heterogeneous mixture of people who attended the lectures of Nichol and other popularisers would not have had a singular response to the material presented and their impressions of these productions would depend to a great extent on cultural context and personal subjectivities. Their reactions did not necessarily correspond to essentialist narratives of Victorian mentalities and the now outdated discourse of a long and steady decline in nineteenth-century religiosity.[473] As the previously quoted reports from *The Manchester Guardian* have demonstrated, reviewers, at least those of a theologically liberal bent, were inclined to report Nichol's words and conclusions with little or no evidence of dissent either in their authorial voice or in terms of audience reaction. The fact that four of the lectures in question took place at the Athenaeum is, *ipso facto*, evidence of their acceptability in more conservative circles, presumably assisted by his occasional genuflections to a generic deity.

Another evident outcome of the oratorical capabilities evinced by Nichol was his ability to convince less scientifically aware audiences to adopt a more or less uncritical acceptance of his arguments and evidence, however tentative the latter may have been in practice. Thus, for example, Edgar Allan Poe (1809 - 1849) was able to interpret the work of "Dr. Nichols" as having both established the truth of his [Nichol's] own ideas but also to have validated the earlier imaginings of Epicurus; "the vague guesses of that noble Greek had met with confirmation in the late nebular cosmogony."[474]

One question which must arise from a consideration of the history of the nebular hypothesis and the interpretation presented by Nichol to his publics on the resolvability of Orion and its consequences for stellar distances is why there was so little overt challenge to his restatement of the problem in his own terms. A probable factor identified by both Schaffer and Huang is that early Victorian audiences had begun to segment themselves more clearly than had their predecessors and it is therefore not realistic to assume the existence of a homogenous population who interpreted astronomical information and the debates it engendered via a uniform 'filter' or a single communication channel. It is evident that

[473] For an extensive reinterpretation of earlier hypotheses of nineteenth-century secularisation see: C. Brown, *The Death of Christian Britain: Understanding Secularisation, 1800-2000* (New York, 2001).
[474] E. A. Poe, 'The Murders in the Rue Morgue', *Tales* (London, 1846), pp. 116 - 150, pp. 122 – 123.

the audience's reception of these concepts was influenced by their own belief systems and their propensity to accept or reject positivist arguments which contradicted traditional theologies; bearing in mind that a paying public must by definition be a self-selecting sample of the population as a whole.

Readers were exposed to different views of the observations made at Birr depending on which periodical they favoured with their patronage ranging from the more conservative organs such as *The Times* and *The Athenaeum* to *Chambers' Edinburgh Journal* and other more progressive publications. Perhaps the most surprising reaction was that of the Catholic *Dublin Review* which "expressed the same careful scepticism towards the news from Parsonstown." It also compared the images of two nebulae produced by Rosse with pictures of the same objects originating from Herschel's observations and noted that "the observations hitherto made upon nebulae are too imperfect to form a safe foundation for any hypothesis."[475]

In 1848 Nichol published yet another popular astronomy text entitled *The Stellar Universe* which was intended to be a more affordable rehash of his previous works aimed particularly at "younger Intelligences", by which he seems to have meant both children and women.[476] *Tait's Edinburgh Magazine* concurred with this view, describing the work as being of "*mignon* prettiness" which "is perhaps, however, more a lady's than a gentleman's' book and may make many Mrs. Somervilles."[477]

This publication, aimed at a wider audience than any of his previous output, and in keeping with the juvenile nature of at least part of the intended audience for both his lectures and his books, contained a rare exception to his apparent unwritten rule, in the form of an apparent nod towards Trinitarianism:

> God being known by the immediate insight of him 'who doeth the will of the Father;' God being known, of the child of God, in and through the affiliative act of genuine worship, the unfathomable and resplendent abyss of Space in Time is simultaneously converted into an illuminated commentary upon the transcending attributes of Jehovah.[478]

[475] Schaffer 'Leviathan', pp. 215 – 217.
[476] Nichol, *Stellar*, p. viii.
[477] 'Professor Nichol's new works', Tait's Edinburgh magazine; Mar 1848; 15, 171; p. 200.
[478] Nichol, *Stellar*, p. 226.

His approach here was deliberately ambiguous. References to "him 'who doeth the will of the father'" and "the child of God" would be read by many of his audience as being Trinitarian but can alternately be understood as terms which describe ordinary human beings.[479]

Stellar Universe was in fact somewhat of a wolf in sheep's clothing, as Nichol made full use of the opportunity it provided to revisit his calculations, based on the seeing power of Lord Rosse's telescope, to further expand both astronomical and geological timescales. To emphasize the great age implied by this update, he reintroduced an idea which he had earlier credited to John Herschel.[480] He invited the readers, as stellar observers, to contemplate a novel cosmological point of view in which they came to understand that the arrangement of constellations in the sky has not been fixed since the dawn of time, a natural assumption based on the limited duration of a single lifetime or even the entirety of documented astronomy, but must have changed gradually due to the solar system's motion through space:

> Free, then, from fear, let us rise far higher; and assuming that Bessel's Star indicates the average distance of the nearest Orbs, we infer the Sun would require no more than 500,000 years to reach that extremest verge at which the eye can descry a single Star; nay, it could reach that remotest distance to which Lord Rosse's telescope can pierce, in about TWO HUNDRED AND FIFTY MILLIONS OF YEARS; and so far is even this stupendous period from sounding all the working time of nature, that many of the mountains of our Earth may, through its whole duration, have been in being, rearing their peaks towards different constellations, and surviving, in their littleness and fragility, even these immense transitions![481]

Nichol had derived this newly minted and impressive age of the universe by calculating the time it would take the sun, at its current rate of movement towards a point in Hercules, to travel to the most distant stars apparently visible through Lord Rosse's telescope. In other words, it was in fact a highly speculative number which might not bear any real relationship to cosmic chronology.

---

[479] Nichol has paraphrased Matthew 7:21, substituting the word "the" for the word "my" in the phrase "who doeth the will of my Father" thus turning a reported saying of Jesus into a more generic exhortation.
[480] Nichol, *Thoughts*, p. 180.
[481] Nichol, *Stellar*, pp. 196 – 197. Emphasis in original.

The idea that the appearance of the constellations would change and evolve over very long periods of time was, however, a highly affective trope which found further employment in H. G. Wells' *The Time Machine:*

> Above me shone the stars, for the night was very clear. I felt a certain sense of friendly comfort in their twinkling. All the old constellations had gone from the sky, however: that slow movement which is imperceptible in a hundred human lifetimes, had long since rearranged them in unfamiliar groupings.[482]

This implication of the potential consequences of deep time was no doubt welcome to contemporary geologists whilst at the same time recalibrating the chronological 'set points' of his audience and promoting the likelihood of the cosmic timescales required by developmental hypotheses in general.

At this juncture it is appropriate to briefly revisit the evolving views of William Whewell, the man who originally coined the term 'nebular hypothesis'. In 1853 he anonymously published *Of the Plurality of Worlds: an essay,* in which, for the reasons related earlier, he put forward a number of theological and cosmological doubts concerning the possibility of life on other planets.[483] In one of his supporting arguments he deployed an uncritical acceptance of the gaseous nature of nebulae, based largely on John Herschel's observations of the heterogeneous structure of the Magellanic Clouds, thus neatly disposing of the idea that nebulae are in fact clusters of stars which might in turn play host to extra-solar planets.[484] In adopting this new point of view Whewell had to diplomatically negate the observations made at Birr Castle. Without anywhere overtly stating that Lord Rosse was wrong he nonetheless proceeded to accept the 'minimalist' leg of Nichol's fork and to claim that the nebulae are in fact "vast masses of incoherent or gaseous matter, of immense tenuity,".[485]

Whewell either chose to ignore, or perhaps didn't appreciate, the 'inconvenient truth' that the logical corollary of his acceptance of true nebulosity on the scale which could be observed in both M.42 and the *Nubeculae* was that William Herschel's sidereal evolution hypothesis could easily come back into play, thus expanding the potential future stellar and biological populations of the universe. Whewell

---

[482] Wells, *Time Machine,* pp. 143 – 144.
[483] See Chapter 2 for a detailed discussion of the purposes and contents of this publication.
[484] Crowe, *extraterrestrial,* pp. 285 – 286. For further discussion see Chapter 2.
[485] Whewell, *Essay,* p. 138.

had, for his own purposes, managed to reshape a belief in Tennyson's "fluid haze" into support for a form of traditional religion. In the mid-nineteenth century the evidence for or against either of the nebular hypotheses seems to have been quite malleable in the minds of both observers and commentators.

Despite his repeated illnesses Nichol survived until September 1859; long enough to have perhaps appreciated a spirited defence of the nebular hypothesis and its applicability to planetary development penned by Herbert Spencer (1820 - 1903), a fellow sufferer from a series of ailments, real or imagined. Spencer enjoyed ill-heath for a significant portion of his life and "was what later periods would call hypochondriac". He "luxuriated in his illnesses" which included fatigue and insomnia. Spencer attributed his constant state of unhappiness to his "Christian upbringing, which had emphasized self-denial and virtuous industry." As a result of sleeplessness, he, like Nichol, indulged in opiates, which in turn aggravated his "minor ageing debilities". [486]

Spencer's metaphysical position can be summarised as a belief that whilst many, if not all, aspects of natural law can be discovered by man, some key elements of the universe will forever remain unknown and which he therefore attributed to a relatively undefined prime mover whom he labelled 'The Unknowable'.[487] This uninvolved and emotionally neutral 'deity' must have been at least in part a reaction to what he felt to be an excessively puritan upbringing. Spencer also held the view, as did Richard Proctor, that the Universe as a whole was subject to a law of general progress which he chose to name "evolution".[488] As part of his suggested law of evolution, Spencer in *First Principles of a System of Philosophy* proposed that "*if* the Nebular hypothesis be true, the genesis of the solar system supplies one illustration of this law,"[489]

[486] M. Francis, *Herbert Spencer and the Invention of Modern Life* (New York, 2007) pp. 106, 7, 101 - 102.
[487] See, for example, H. Spencer, *First Principles of a new system of Philosophy* (New York, 1865) pp. 98 – 123.
[488] See discussion of Proctor's religious and metaphysical views in Chapter 2.
[489] Spencer, *First Principles*, pp. 148 - 149.

Prior to the original publication of *First Principles*, Spencer had already composed a lengthy apologetic for the nebular hypothesis which was published in the *Westminster Review* of July 1858.[490] In this article Spencer, like Nichol, did not directly dispute the Birr Castle observations of the Orion nebula, they being founded on the authority of an aristocrat. He positioned them instead as potentially irrelevant on the grounds that sidereal development within nebulae may now have ceased throughout the universe and he then restated the planetary cosmogony of Laplace in his own words. One of his more speculative points, the supposition that the earth's core must be gaseous (to explain the observed rate of precession), had to be retracted in a subsequent (1865) reprint of the article and a few other calculations were found to be based on faulty assumptions, but on the whole his thesis stood the test of time better than might have been expected given his essentially amateur status as an astronomer. [491]

In the 1865 reprint, Spencer was seemingly unaware of the recent discovery by William Huggins (1824 - 1910) of the gaseous state of the nebula in Draco which was assumed by many to demonstrate the existence of William Herschel's 'shining fluid' and to be clinching evidence in favour of the nebular hypothesis.[492] Even the Birr Castle team accepted that spectroscopy had swung the argument decisively in favour of true nebulosity and devoted some of their telescope time to attempts to capture the spectra of additional non-stellar objects.[493] As a consequence of this shift to general acceptance of nebular cosmogony an 1890 review of a further reprint of Spencer's article was willing to concede that the passage of time had increased the acceptability of his arguments and that further calculations and measurements had provided significant evidence in favour of the "nebular hypothesis, or theory as it is now more commonly called."[494]

This chapter has primarily examined some of the contextual and cultural influences which affected the main participants in the nebular hypothesis debate in order to study their mentalities and motivations.

---

[490] Francis, *Herbert Spencer*, p. 155. H. Spencer, 'Recent astronomy, and the nebular hypothesis', *Westminster Review*, Jan. 1852 - Jan. 1914; July 1858; 70, 137; pp. 185 – 225.
[491] H. Spencer, 'Recent astronomy, and the nebular hypothesis' in *Illustrations of Universal Progress; a Series of Discussions* (New York, 1865) pp. 239 – 299. See, in particular, the footnotes on pp. 275, 279, and 291.
[492] Based on spectroscopic evidence. See A. Henchman, '"The Globe we groan in": Astronomical Distance and Stellar Decay in In Memoriam' *Victorian Poetry*, 41, 1, Spring 2003, pp. 29 – 45, p. 36. Also see Clerke, *Popular History*, p. 437 for her vindication of Herschel.
[493] Steinicke, 'Birr Castle', pp. 259 – 260.
[494] 'Astronomical Notes', *The Athenaeum*; Mar 1, 1890; 3253; p. 279.

Perhaps the most obvious and unsurprising conclusion which suggests itself is the correlation between the theological and political avocations of key participants and their attitudes to the topic of nebular cosmogony. These relationships do in most instances appear to be much clearer than was the case with pluralism, where a belief in extraterrestrial plenitude was capable of being deployed both for and against traditional theology.

There was a broad variety of religious opinion amongst the main actors in the nebular cosmogony debate, including two members of the Church of Ireland, a mainstream Anglican and the heterodox (and rather unstable) beliefs of Nichol. It could have been argued *a priori* that such a diversity of views should correlate generally with the subjects' comparative antipathy to, or enthusiasm for, sidereal and terrestrial development. Whilst such a simplistic inferred relationship between religion and cosmology initially appears to be borne out by the available sources, and one could proceed to raise a superstructure of speculation on the back of it, there are other ways to look at the evidence and other causations which come into play.

Confessional alignment, for example, was clearly correlated to a significant extent with geographic location and cultural background. In this context it is relevant that the two individuals who lived in the heterogeneous and contested religious environment of Ireland appeared to be the most wedded to traditional theology and cosmology. Robinson and Rosse, in different ways, experienced significant difficulties in their relationships with the other inhabitants of the island, either in managing religious dissent, political opposition, famine and unemployment (Rosse) or in the confrontations engendered by the process of collecting tithes from his parishioners (Robinson).

Rosse's *Weltbild* contained a pragmatic political self as evidenced by his ability to 'trim' his political views and lend his support to a Whig party with which he was not in general agreement, but which suited his purposes for the moment. He clearly also incorporated an engineering self who succeeded in overcoming technical hurdles which would have defeated many of his predecessors and peers. This bent for practical projects was passed on to the next generation and became the future source of

industrial incomes for a family which, like many Tories, had built their original success and had acquired privileged status on the basis of their British and Irish landholdings.

Rosse's father had endeavoured to foster a level of religious tolerance within the Birr demesne but his intentions were frustrated by the high levels of sectarian and political conflict which were occurring across the whole country at that time. Indeed, it could be argued that his ecumenical efforts were a possible cause of the unusual occurrence of a schism within the local Catholic community. William Parsons made very few statements about his personal religious beliefs, perhaps because he was conscious of the tensions which existed in the local area. His potential spiritual self was sublimated within a more practical self who engaged in extended projects of telescope construction. These engineering endeavours were also inspired by his father's interest in nebular cosmology; an interest which had become much more evident after the early death of his younger brother and the emergence of his father's consolation-seeking religious persona.

Although the Birr telescopes began life with a loosely attached theological purpose, that of negating the nebular hypothesis, the original key objective subsequently mutated into a desire to evince mastery of the required technologies by means of demonstrations of their effectiveness. The initial focus on the questionable observations of nebulae seems to have been superseded by the promotion of an illustration of the enigmatic spiral nebula M. 51. It had been produced as a result of the superior light collecting powers of the Leviathan and could be favourably compared with the earlier engravings of the object made by Sir John Herschel, an acknowledged expert in the field. As such, M.51 and subsequent spiral nebulae were adopted as even better proofs of the technical power of the giant reflector than the doubtful resolutions of nebulae.[495]

The key person who was responsible for the original mission of the Leviathan was Thomas Romney Robinson. As a younger man he had clearly echoed several of Nichol's characteristics, possessing romantic and poetic selves which, informed by his Ulster Episcopalian background, produced a

[495] T. C. Weekes, 'The Nineteenth-Century Spiral Nebula Whodunit', *Physics in Perspective*, 12 (2010) pp. 146 – 162.

Weltbild capable of performing expansive speeches similarly inflected by hyperbole. Robinson was very protective of the interests of the Church of Ireland which, whilst operating in a hostile political and religious environment, was also his main source of income, particularly when one notes that his professional position at the Armagh Observatory was in the gift of the Primate of All Ireland. He viewed Rosse as having the status of being an additional patron, encouraging the aristocrat to invest large amounts of his wife's money into a potentially nugatory project. In return he acted as Lord Rosse's mouthpiece when speaking to Dublin audiences; speeches which were subsequently transformed into published papers in which he lavishly praised his patron's technical abilities whilst attempting to deprecate the prior truth claims of the Herschels.

Although given a nominally 'scientific' role as an important Irish astronomer he shared with many of his contemporaries a tendency to wear his heart on his sleeve when discoursing about matters astronomical; another trope which he clearly shared with Nichol. Scientific objectivity for Robinson was epistemologically subservient to the truths revealed by religion and so he predictably succeeded in interpreting the available evidence from Lord Rosse's telescopes as support for his expected conclusions. The nebular hypothesis was, in Robinson's mind, an attack on the church as evidenced by its use in the first section of *Vestiges*. Once he felt that he had achieved the desired results, however, he began to entertain doubts about his own evidence and the 'truth' of his claims. The importance of the apparent victory over nebular cosmogony faded quite rapidly during the widespread famine of the late 1840s and both Rosse and Robinson were content to let things lie; their claims of nebular resolution had by then been made and heard by the wider world. Although opposing views became gradually more evident the situation was one where the public, due to the availability and heterogeneity of the press, free to fall on whichever side of the nebular divide suited their subjectivities.

In contrast with the two 'Irishmen', the theological views of the two Englishmen here surveyed were of a more liberal bent. John Herschel had had a reasonably privileged upbringing and his father moved in court circles, so he clearly qualified as upper middle-class; indeed he was in due course knighted by William IV and so, like his father, could legitimately rank himself as being amongst the

minor gentry.[496] Herschel was offered further positions of authority in recognition of his acknowledged authority and must have been considered politically to be a safe pair of hands. He accepted several posts which required him to act as the figurehead of a scientific body, including the presidencies of the Royal Society and the Royal Astronomical Society. In due course he was appointed to a job previously held (and this may well have been part of the attraction) by Sir Isaac Newton, that of Master of the Mint (1850 – 1855).[497] His theological views moved from youthful scepticism through a complex crisis into an acceptance of broad theism under the influence of his wife, but his latitudinarian religious belief had limited apparent impact on his scientific research work. Like Nichol he in effect made God somehow less relevant to, or having less immediate impact on, the work of astronomers by imagining the deity as all-pervasive.

Despite the animosity of some of Robinson's interactions with and comments about John Herschel in the early 1840s, it is apparent that he was viewed as the great authority of the day on sidereal and nebular observations and his views carried great weight with the Irish 'grand amateurs' as well as the wider scientific establishment.[498] His grasp of the issues involved in the nebular hypothesis was aided by his close relationship to the progenitor of the 'shining fluid' who had also driven his son's continuation of the 'family business' during the very stressful period of his fatal illness. He had also benefited from by his comprehensive experience of practical observations and the difficulties of learning to 'see'.

Herschel understood that there was, in fact, a clear demarcation in terms of both scale and implication for the two concepts contained within the broad term 'nebular hypothesis'. On the one hand, he was unwilling to publicly contradict the authority of Lord Rosse's gentlemanly claims of the potential resolvability of many nebulae, whilst on the other retaining his father's view that many objects in the

---

[496] A. Hanham and M.A. Hoskin, 'The Herschel Knighthoods: Facts and Fiction', *Journal for the History of Astronomy*, xliv (2013), pp. 149 – 164, p. 159.
[497] M. J. Crowe, 'Herschel, Sir John Frederick William, first baronet (1792–1871)', *Oxford Dictionary of National Biography*. www.oxforddnb.com/view/article/13101, (accessed 5 Nov 2015).
[498] For a discussion of the Irish 'grand amateurs' and their astronomical work see, for example, A. Chapman, 'William Parsons and the Irish nineteenth-century tradition of independent astronomical research' in Mollan (ed.), *Parsons*, pp. 271 – 297. Herschel's career and his contribution to astronomy is documented in Buttman, t*elescope*.

universe are not formed solely from stars. He was somewhat sceptical about the verifiability and the dynamics of the Laplacian version of the "nebulous hypothesis", but nonetheless appeared to keep an open mind on the topic. His speech to the British Association at Cambridge in 1845, for example, reflected genuine uncertainty as to where the 'truth' then lay.[499] As a result of his standing as an *eminence grise* in matters astronomical he was, as we have seen, the elder statesman who Robinson later called on for assistance when doubts surfaced in his own mind about the stability of the Orion nebula.

Herschel's contemporary at Cambridge, William Whewell, came from a lower-class background but was identified at school as an exceptional scholar.[500] Whewell's attitudes to religion and politics have been covered at some length in Chapter 2. In one of his books, written primarily as a refutation of the claims of *Vestiges*, Whewell had taken a reflexive approach to the changing dynamic of the interaction between religion and science. He foresaw and understood both the perils of the 'god of the gaps' paradigm and the relativistic approach that would most likely be taken by future generations to pundits who conservatively clung to outdated hypotheses of creation and development (it seems likely that Whewell had in mind here the conventional discourse of the interaction between Galileo and the Inquisition):

> … we may observe that those who thus adhere tenaciously to the traditionary or arbitrary mode of understanding Scriptural expressions of physical events, are always strongly condemned by succeeding generations. […] how weak and vain is the attempt to get rid of the difficulty by merely denouncing the new tenets as inconsistent with religious belief, and by visiting the promulgators of them with severity such as the state of opinions and institutions may allow.[501]

Nichol would no doubt have concurred with Whewell's conclusion. During the course of a relatively few years, between 1836 and 1848, it had become apparent to him, and, perhaps more importantly, to the audiences whom he addressed during the latter part of this period, that the universe was almost unimaginably larger and implicitly far older than anyone had previously supposed. The Bible still

---

[499] Herschel, 'Address', pp. 659 – 668.
[500] Stair Douglas, *Whewell*, pp. ix, 1 – 2. See Chapter 2 for a more detailed discussion of Whewell's intellectual and emotional development.
[501] Whewell, *Indications*, pp. 51 – 52.

acted as a source of moral authority, but the early chapters of Genesis had limited claims to historical accuracy. Like Robinson and Chalmers before him, Nichol had developed a taste for poetic self-expression at an early age, fuelled by a fertile imagination; attributes which were rewarded by the positive responses he received from his peers and pupils. He had also been a radical in his earlier years and, following the severe illness which caused a significant shift in his *Weltbild* and his resignation from the established church, evidently continued to hold unorthodox views on both religion and politics into later life.

Although Nichol had been appointed as Professor of Astronomy at Glasgow University in 1836, he proved to be a rather poor administrator. He significantly mismanaged the finances of the proposed new observatory and was consequently compelled by circumstances to become a public performer, a role at which he excelled. By 1850 Nichol had succeeded in carving a niche as a preacher of the new 'religion' of astronomy and the political inclinations of the older man were perhaps sated, or at least blunted, by the recent successes of other would be reformers in Britain, which could be contrasted with the repetition of the dangers of revolutionary fervour represented by recent uprisings in France and elsewhere in Europe.

Based on his many published works it would be reasonable to state that Nichol's version of the creator was only very loosely entangled with the fate of humanity. This vision of a disinterested and uninvolved deity appears at first sight to be at odds with the views of his obituarist in the *Scottish Review* and his friend Gilfillan who both attributed a form of occasionalism to him; an unusual interpretation of God's presence, clearly influenced by an unconventional but charismatic chemist, which was not reiterated in Nichol's later *oeuvres*. It is likely, however, that they were both recycling a quotation from one of his mid-career publications which had never been formally or publicly revoked. Nichol also developed a dependency on a cocktail of opiates and other drugs at about this time. It is interesting to note this potential relationship between his success as a public speaker and the

onset of his consumption of these psychotropic substances which he described as producing a state of ecstatic passivity "neither dreamful nor yet wholly unconscious".[502]

The final key point which can be fruitfully extracted from the history of the nebular hypothesis is the elusiveness of objectivity in the making of cosmogonies. Robinson and Nichol both managed the gathering of data and the deployment of argumentation in ways which bolstered their preferred metaphysical and theological positions. Robinson, for the reasons argued above, was driven by confirmation bias and had already determined in 1840 that the nebulae were all going to be resolvable. He was thus easily able to interpret subsequent observational evidence as support for his diagnosis. Such was his enthusiasm that, even in his absence, Lord Rosse was almost able to resolve the great nebula in Orion and thus validate his own engineering efforts as well as Robinson's convictions.[503] Nichol, faced with aristocratic certainty and the potential embarrassment of his unauthorised contributions of *materiel* for a project for which he held out rather different hopes, nonetheless managed to snatch a certain kind of victory from the jaws of potential defeat by his subsequent reinterpretation of resolution and thence the promotion of an expanding and progressive universe.

---

[502] Nichol, *Ben Rhydding*, p. 4. Thomas Brown (1778 - 1820) "the thin theist" was responsible for promoting the concept and use of the word 'emotions' which became more widespread from 1820 onwards. T. Dixon, 'The Psychology of the Emotions in Britain and America in the Nineteenth Century: The Role of Religious and Antireligious Commitments', *Osiris*, 16, Science in Theistic Contexts: Cognitive Dimensions (2001), pp. 288-320, pp 295 – 303.

[503] Robinson's "publicity campaign" was also successful in persuading at least one other astronomer to 'resolve' the Orion nebula as proof of the efficacy of his own telescope. See: Schaffer, 'nebular, p. 140.

Chapter 4. "And murmurs from the dying sun": thermodynamics, theology and the North Britons.

O Sorrow, cruel fellowship,
O Priestess in the vaults of Death,
O sweet and bitter in a breath,
What whispers from thy lying lip?

'The stars,' she whispers, 'blindly run;
A web is wov'n across the sky;
From out our waste places comes a cry,
And murmurs from the dying sun:

Alfred Lord Tennyson, *'In Memoriam A. H. H.'*, III[504]

Roughly fifty years after the near-fatal malady which was recounted at the beginning of Chapter 2 another Scot experienced an extended period of recuperation during which he was confined to a bedroom for many weeks and treated with analgesics to dull the pain. On this occasion, however, the man in question was not a cleric by profession and his injury was not necessarily life threatening. The patient was the Glaswegian academic William Thomson who had already earned a considerable reputation in a variety of fields associated with astronomy and the physical sciences, including being credited with having had a significant hand in the discovery of the laws of thermodynamics. He had also been profitably engaged in such practical engineering matters as the laying of submarine telegraph cables.

One Saturday in December 1860, whilst staying with friends on the west coast of Scotland, he had decided to engage in his favourite 'pastime of "curling" on the ice'. In an unfortunate accident he fell in such a way and experienced so much pain that it appeared he might have fractured his leg. He had indeed broken the bone, but this important diagnosis was not delivered until the following Friday and only after the engagement of a second opinion. The leg was duly reset successfully, but the pain which he suffered in the intervening period had been considerable and Thomson had of necessity been treated with "continual opiates".

His wife was particularly worried about the possible long-term consequences of the injury to his left leg; "It was found to be an inch and a half shorter than the other, and had to be stretched out to the

[504] A. L. Tennyson, 'In Memoriam A. H. H.' in Hodder (ed.), *Works* (London, 1994), pp. 305 – 389, p. 311.

same length. Our chief anxiety is as to whether bad effects will be left."[505] His recovery from this distressing event was very slow. "I begin to fear that he will not be able to return to his work this Session. He eats and sleeps pretty well, but is exceedingly thin, and is easily fatigued by any mental exertion." He was indeed unable to deliver his lectures at the University of Glasgow during the ensuing term.

Because of the delay in setting the bone, his wife's fears for his future mobility were duly realised and he was left with a shortened leg which caused him to walk with a distinctive limp for the rest of his life so that he lost the ability to undertake the strenuous walks which he had previously enjoyed:

> The injury left him permanently lame. He used to walk fast, limping along with his left hand pressed against the hip. When in the summer they returned to their favourite resort at Kilmichael, in Glen Cloy, Arran, he wistfully remarked that he would never again be able to climb Goatfell and he never did,[506]

Unlike the account composed by William Hanna which presented his father-in-law's period of convalescence in the form of a conversion narrative, featuring Thomas Chalmers as a latter-day Paul, there is no parallel narrative of Thomson having 'seen the light' or of having experienced a significant shift in his theological thinking during this time, despite the severity of the injury and the permanence of its after-effects, which left him with plenty of time to reflect on the brevity of life and the entropic 'running down of the clock'. His serious injury and long recuperation must have seemed to him to have been an ironic illustration that the dissipation of the universe which he had portrayed in his thermodynamics also applied personally and eventually fatally to the individual subject. Time does not extend indefinitely for either heavenly or human bodies.

He did possess, both before and after the accident, a devout but relatively non-doctrinal religious belief. His niece, Agnes Gardner King (1856 – 1929), reported in a biography of her uncle that the future peer was a firm believer in the principle of 'Intelligent Design' and that:

---

[505] S. P. Thompson, *The Life of William Thomson: Baron Kelvin of Largs*, vol I (London, 1910) pp. 411 – 413.
[506] Ibid., pp. 414 – 417.

> All through life Lord Kelvin […] had a simple, childlike faith which pervaded his whole being. The deeper he delved into Science and the more he studied its mysteries, the greater his veneration for the Maker of all.[507]

A similar "definite belief in a Creator" is contained in the performance of a broadly theistic religious self which can be found in the comments he made many years later at a meeting of the Christian Evidence Society:

> I have long felt that there was a general impression in the non-scientific world, that the scientific world believes Science has discovered ways of explaining all the facts of Nature without adopting any definite belief in a Creator. I have never doubted that that impression was utterly groundless.[508]

It would not be surprising to discover that Thomson's *Weltbild* had been significantly impacted during the painful episode which caused him to be laid up in Largs for a lengthy period. The subsequent flow of events is indeed quite suggestive of a meaningful shift in priorities which was contingent on this injury and perhaps on the pharmaceutical treatment which accompanied it. Even if, like Chalmers, the combination of pain, enforced idleness and pain-killing drugs stimulated him to cogitate on the nature of time and the brevity of life, he subsequently continued to primarily perform the identity of a practical 'man of science'. Rather than openly cogitating on theology he sought refuge in thermodynamical attacks on materialist timescales.

Later that year Thomson delivered by proxy (he was not well enough to attend in person) a paper at the British Association meeting in Manchester in which returned to a temporal theme that he had last visited seven years previously.[509] To a casual reader it might have appeared that the main purpose of his argument in *Physical Considerations regarding The Possible Age of the Sun's Heat* was to suggest a new mechanism by which the sun's heat output could be maintained for a long, but not indefinite, period of time. The article was also intended to challenge the extended timescales proposed by

---

[507] A. G. King, *Kelvin the man* (London, 1925) pp. 99, 28.
[508] The speech to the Christian Evidence Society is reprinted in J. Munro, *Heroes of the Telegraph* (London, 1891) pp. 110 – 111.
[509] W. Thomson, 'On the Mechanical Energies of the Solar System.' *Edinburgh Royal Society Proceedings* [read 17 April 1854] vol III (1857) pp. 241 – 244. 'Appendix on the Age of the Sun', added 15 August 15 1854; *Edinburgh Royal Society Transactions* vol XXI. (1857) pp. 63 - 80. Smith and Wise, *Energy,* p. 525.

uniformitarian geologists during which the sun had presumably been a stable source of energy.[510] Towards the end of his paper, however, it became clear that he was also tilting at the windmill of the lengthy evolutionary timescales recently proposed by Darwin, whom he specifically mentioned, motivated by a desire to reserve a fundamental role in the development of life for a prime mover. His final sentence constituted an almost forlorn appeal to such a creative deity whose "great storehouse" he hoped might be the locus of "sources" of energy "now unknown to us" which would somehow enable a longer continuation of life on earth, or perhaps in the hereafter, than could then be foreseen.[511]

From mid-century onwards there had been a clear existential element to be considered in thinking about the duration of time. The known, or assumed, quantity of time during which the universe would be able to survive in its present state faced a considerable challenge from the apparently inexorable logic of energy physics, foreshadowed in the epigraph at the head of this chapter which equated the loss of Tennyson's close friend Arthur Henry Hallam (1811 – 1833) to the fate of "the dying sun.". If the cosmos has a finite lifetime, then the question of how eternity is to be reconciled with thermodynamics had to be addressed by an appeal to some as yet undiscovered salvationary mechanism. Such a schema, of course, might well turn out to be to some extent consistent with revealed religion.

We shall, in due course, pursue the main theme of this thesis by examining the cases of several members of the North British group who helped to develop the science of energetics. Their efforts were intended, at least in part, to create an antidote to lengthening geological and biological chronologies. Like Thomson, several of them will also be shown to have undergone noticeable changes in epistemological emphasis which may be contingent on preceding crises. A second key thread which connects this group of scientists was the question of where and when in the universe, or

[510] Thompson, *Life*, p. 537.
[511] W. Thomson, 'On the age of the sun's heat', *Macmillan's Magazine*, 5 (1862) pp. 388 – 393.

even outside the universe as we know it, is the locus of those supposed components of sentience which we variously refer to as free will, consciousness and the soul?

This question must be set against the background, exemplified by the controversy surrounding John Tyndall's *Belfast Address* in 1874, of the contemporary vogue for materialistic explanations of the invisible phenomena which underlie the visible universe. The parallel rise of spiritualism and other heterodox forms of belief can be seen to have been another response to scientific naturalism, particularly at a time when steam-driven machinery and the electric telegraph could be read as being analogous with, if not identical to, the musculoskeletal and nervous systems of the human body. For a scientist who wished to retain a role in the world for a theistic deity, there had to be both a space and a time in which such an entity could continue to intervene in human destiny. And if the mind, acting as a proxy for the soul, has an existence separate from the physical body then it also had to have a location and a mode of operation which allowed it to interact with the physical world.

The main subjects of this discussion were all trained primarily in the physical sciences and had been exposed to significant 'Scottish' influences during their upbringing. Of course, it should be noted that the question of how Scottish identity was constructed at this period is itself somewhat problematic. The concept of national consciousness had generally grown in importance in western Europe following the French Revolution; "According to [Benedict] Anderson, nationalism was not a result of self-conscious ideologies" but of the dissolution of preceding communities such as those defined by religion or dynasty. Scotland at that time, however, was not a nation state in its own right, although it had, during the first half of the nineteenth century, experienced an evocation of a romanticised Highland past, as evidenced in the writings of Walter Scott (1771 - 1832) and the proliferation of newly invented tribal tartans, which provided a sense of shared cultural affect for lowland and expatriate Scots.[512] 'Scottishness' for our subjects may in fact have been about the adoption of a self

[512] Gunn, *History*, pp. 136 – 137. H. Trevor-Roper, 'The Invention of Tradition: The Highland Tradition of Scotland', in E. Hobsbawm and T. Ranger, *The Invention of Tradition* (Cambridge, 2012) pp. 15 – 42.

which was in part defined by its broad opposition to the English metropolitan other, rather than being a simple adherence to a not yet fully-formed national identity.

Another key influence on these individuals, at least from the point of view of several historians, is that the spaces which they inhabited as children and adolescents frequently brought them into intimate contact with the evangelical strain of Calvinism known as Presbyterianism. Because of their membership of the shared emotional community of the Church of Scotland they are asserted to have held convergent convictions about the role of a deity in the creation and ongoing management of the universe. Given the reasonable assumption that they were inhabited by performative selves derived from shared culture, language, religion and avocation they are, as noted above, often referred to collectively and retrospectively as the North British group of physicists:

> Thanks to the scholarly efforts of P. M. Heimann, Paul Theerman, Norton Wise, David Wilson, and Crosbie Smith, we now know a great deal about Victorian physicists whose science was structured by religious ideas. Bearing the impress of Scottish presbyterianism and linked to the industrialists of northern Britain, energy physics was founded by a "North British" group [513]

The work of Smith, in particular, has been invaluable in identifying the theological drivers which underlay much of the scientific work of Thomson and his colleagues. This frequent grouping together, based on the religious and ideological similarities of several of the subjects, under such catch-all descriptions as "the more socially conservative and Presbyterian North British physicists" needs to be approached with some care, however. We shall in due course unpick some of this apparent homogeneity by examining their individual stories in greater detail.[514]

As with the preceding cases of Chalmers, Nichol and others, most of these subjects tended to entangle ideas of science with religious themes and motifs during their lifetime; convergences which have already been documented by the group of historians identified in Lightman's comment. The key intervention which this thesis is making is to additionally to point out that some identifiable changes in emphasis and occasionally novel directions in which the thoughts of these individuals carried them

[513] Lightman, 'Victorian Sciences', p. 352.
[514] D. Brown, *The Poetry of Victorian Scientists: Style, Science and Nonsense* (Cambridge, 2013) p. 104.

were preceded by significant life events which, it will be argued, were amongst the factors which caused them to rethink and 'refeel' their preceding positions. It is as though the opportunities thus provided to mentally re-frame during unplanned periods of 'out of phase' space and time allowed them to pause and reflect on deeper questions of metaphysics and theology. This discussion of the potential impact of somatic events on overtly intellectual themes will provide further evidence of the inseparability of the various elements of *Weltbild*.

In addition to the relevant interventions made by William Thomson we shall also be examining the contributions of four other scientists who have often been collocated in time, space and creed as members of the North British group. They include his colleague and occasional co-author Percy Guthrie Tait (1831 - 1901) as well as the theoretical physicist Maxwell, the meteorologist and physicist Balfour Stewart and Fleeming Jenkin (1833 - 1885). Jenkin, in particular, can reasonably be regarded as a polymath, having variously functioned as a physicist, an electrical engineer, literary critic and political economist.[515]

Before proceeding to examine in detail the mental and emotional journeys undertaken by these actors, it is worth pausing to revisit what seems to be a fairly obvious question; what were the factors which caused the appearance in Scotland during the second half of the nineteenth century of a number of physical scientists who appeared to hold shared metaphysical views and who were, wittingly or unwittingly, also engaged in the ongoing professionalisation of science? The answers to this question are not as clear as might at first appear.

One evident shared element in their backgrounds was their exposure to the Scottish education system. It has been asserted by a number of historians that education was highly valued and consequently of relatively high quality in Scotland from the time of the Reformation onwards, initially under the aegis of John Knox (1513 - 1572), the founder of Presbyterianism.[516] Although of the five people under

[515] S. Checkland and O. Checkland, *Industry and Ethos: Scotland 1832 – 1914* (London, 1984) p. 150.
[516] T. M. Devine, *The Scottish nation: 1700 – 2000* (London, 1999) pp. 390 – 391.

review, two (Thomson and Jenkin) were not born in Scotland, all of them spent a significant portion of their formative years in Scottish educational institutions.

At first sight it appears that a private school founded in 1824, the Edinburgh Academy, might have been the source of a shared interest in the physical sciences for several of our subjects:

> The Cumming Class of the following year was even more remarkable. From it came P. G. Tait, a friend of Maxwell and Professor of Natural Philosophy at Edinburgh and Fleeming Jenkin later to be Professor of Engineering at Edinburgh, - he collaborated closely with William Thomson (Lord Kelvin) in the profitable venture of laying telegraphic cables, and also worked closely with Maxwell in standardising the measurements of electrical quantities - and his forceful criticism of the Theory of Evolution drove Darwin into Lamarckianism.[517]

Despite this interesting connection, however, it is also evident that the core curriculum of the Academy revolved mainly around classics and that the physical sciences were taught poorly, as reported by Maxwell's classmate, and future biographer, Lewis Campbell (1830 - 1908):

> … it was thought desirable that we should have lessons in "Physical Science." So one of the classical masters gave them out of a text-book. The sixth and seventh classes were taught together; and the only thing I distinctly remember about these hours is that Maxwell and P. G. Tait seemed to know much more about the subject than our teacher did.

In the same biography we find that the interest in scientific subjects exhibited by Maxwell and his peers was primarily stimulated by their parents, their own reading and their access to the other cultural and academic resources to be found in post-Enlightenment Edinburgh. As an example of the latter, Campbell reported that "earlier in the same year" as the disappointing physics lessons, Maxwell had attended a lecture on the discovery of the planet Neptune which "was also connected with his subsequent labours, and must have impressed him not a little at the time." The lecturer in question was John Pringle Nichol, who had on a previous occasion encouraged Maxwell's interest in optics.[518]

---

[517] M. Goldman, *The Demon in the Aether, The Story of James Clerk Maxwell* (Edinburgh, 1983) p. 31.
[518] L. Campbell and W. Garnett, *The Life of James Clerk Maxwell* (London, 1882) pp. 84 – 86. Lewis Campbell made it clear in the preface that he was the author of this section of the biography.

One subject did not have an early exposure to the scientifically stimulating influence of the Edinburgh environment. The relatively less-privileged William Thomson did, however, have the alternative advantage of being taught by his father James Thomson (1786 - 1849), the Professor of Mathematics at the University of Glasgow, and also by Nichol.[519] Thomson's subsequent education took place at the University of Cambridge, an institution which provides an additional, but partial, bridge between our actors as Maxwell and Tait spent at least part of their careers there. A similar claim can be made for Edinburgh University which acted as a conduit to Cambridge for Maxwell and Tait and as an employer for Stewart prior to his lengthy stint as director of the Kew Observatory. The University of Cambridge also provides an intellectual link back to one of our earlier subjects in that it was William Whewell who, amongst others, was responsible for modernising its mathematics curriculum during the 1820s thus setting the academic agenda for some of the future North Britons.[520]

An interesting dichotomy has been suggested by Sydney and Olive Checkland; that amongst the Scottish universities in the early nineteenth century Edinburgh "had a strong Cartesian character, running in terms of pure theory," whereas Glasgow was far more focussed on "linking the academic world with that of industry". As examples of this divergence they suggest the work of William Thomson as "an applied scientist" whereas "Maxwell's work had nothing of the practical, but was deeply philosophical,". Both men had "had to go to Cambridge for their pure mathematics,", an environment where they would have encountered a broader range of both philosophical and religious views.[521]

This east-west division in terms of Scottish educational institutions should be borne in mind as we proceed to examine the topics on which our subjects were later to focus in terms of metaphysics and the defence of religion. Thomson and his supporters tended to combine their theoretical work with more practical matters such as the laying of telegraph cables. Maxwell, who was less financially dependent on his profession, and Stewart were much more inclined to 'thought experiments' which

[519] King, *Kelvin*, pp. 4 – 8.
[520] E. Leedham-Green, *A concise history of the University of Cambridge* (Cambridge, 1996) p. 125.
[521] Checkland and Checkland, *Industry*, pp. 146 – 147. Crosbie Smith notes that Maxwell took some interest in practical crafts which aided him in his subsequent experimental work: Smith, *Science*, p. 115.

investigated such abstract topics as free will and the location of an eternity which was then seen to be threatened by the finite lifetime of the visible universe.[522]

A frequently cited influence on the five subjects which is of great interest in the present context is that of religion. It was asserted earlier that they were all, to a greater or lesser extent, adherents of Presbyterianism. The North British group were, however, more theologically diverse and less enthusiastic than some commentators have assumed. Thomson's approach to religion was broadly ecumenical, whilst Jenkin remained relatively open-minded until he was close to death. In fact, other than the conversion event experienced by Maxwell (to be discussed below), none of the other four scientists in question exhibited significant religiosity in their public selves.

Their relative passivity in matters theological should be set against the parallel, and febrile, events in the Church of Scotland which underwent a major schism in 1843, instigated by Thomas Chalmers, resulting in the creation of the Free Church. Scottish Presbyterianism was thereby split into two major factions, although both halves continued to host a significant proportion of evangelists like Chalmers who "took the view that faith was a matter of the heart rather than the mind and was a gift from God through revelation and conversion." Revelation for a Scottish Calvinist was believed to include the demonstration of the thrifty husbanding of the resources provided by God as well as personal responsibility, which was often read as successful entrepreneurism and the production of technological advances such as those made by Thomson and Tait.[523]

Several scholars, including Max Weber (1864 - 1920) and Robert Merton (1910 - 2003), have argued that the self-actualisation ethos which is strongly associated with Calvinism led to a belief in the values of education and a striving for material success as an indication of being counted amongst 'the Elect'. The idea that there was a strong connection between a specific doctrinal strain of Christianity and the motivation to develop scientific skills and to succeed in utilitarian engineering projects is,

[522] Maxwell inherited an estate at Glenlair following his father's death in 1856. Campbell and Garnett, *Life*, pp. 247, 257. See further discussion below of Maxwell and Stewart's more speculative ideas.
[523] Devine, *Scottish*, pp. 370 – 378. Checkland and Checkland, *Industry*, pp. 12 – 13.

however, too essentialist in character. As other historians have pointed out, 'Merton's thesis' is based on a generalisation which overlooks other, equally salient, factors such as context and culture.[524]

Nonetheless, although the North Britons may have held relatively relaxed views about Calvinist doctrine, it can be argued that early exposure to Presbyterian soteriology, together with the other cultural constructions which they had absorbed as young members of the shared emotional communities to which middle-class mid-nineteenth century Scots belonged, would have been powerful influences on their future endeavours in the field of physical science. In a general sense the North British group, although they did not have a pre-conceived or clear project of 'theological science', did from time to time cohere around a loosely defined objective of finding ways in which the universe could be interpreted as having some causal connection with a theistic creator, despite the apparent evidence to the contrary which had emerged from the ground and the study of life on planet earth.

The developmental ideas of geologists, to which were added in due course a Darwinian concept of evolution, were promoted during the 1850s and 1860s by individuals who might be loosely grouped as scientific naturalists, several also being members of the X-Club. Their broad claim was that the current corpus of physical and biological science was sufficient to explain the observed state of the earth and the existence of life upon it, with no requirement for divine intervention. As several historians, including Lightman, Smith and Ruth Barton have observed, these assertions of authority were often made in magazines and journals which circulated amongst a popular audience who were not subject specialists in their own right.[525]

To oppose the certainty posited by these southern, metropolitan and broadly agnostic 'experts', several members of the North British group at various times and in different ways sought counter-

[524] R. K. Merton, 'Science, Technology and Society in Seventeenth Century England' in *Osiris*, 4 2 (1938), pp. 360 - 632. For critiques of Merton's thesis see the essays in: I. Bernard Cohen et al. (eds.), *Puritanism and the rise of Modern Science: The Merton Thesis,* (New Brunswick, 1990) and S. Shapin, 'Understanding the Merton Thesis', *Isis*, 79, 4 (1988), pp. 594 - 605.

[525] See, for example, R. Barton, 'Scientific Authority and Scientific Controversy in *Nature*: North Britain against the X Club', in L. Henson *et al*. (Eds), *Culture and science in the nineteenth-century media* (Aldershot, 2004) pp. 223 – 235 and Lightman, 'Victorian Sciences'. Both authors refer extensively to Smith, *Science*.

evidence from the more conceptual and therefore contestable spheres which lay within their own competence i.e. science at both the very large scale and at the very small. The nascent science of energy carried important implications for the life stories of both the cosmos as a whole and for its smallest components; the apparently indivisible atoms. Refuge was therefore sought by this alternative group of scientists in invisible forces and forms of matter which they hoped would sooner or later provide proofs of what Whewell had earlier called *Indications of the Creator*.[526]

The most evident and easily comprehensible (to a wider audience) line of enquiry about the cosmos with which several of our actors engaged was the question of its age. Both the age and the scale of the universe had long been subjects of quantitative debate, particularly since Ole Rømer's calculation of a finite speed of light in 1676 which in turn led to estimates of the age of the universe.[527] In the second half of the nineteenth century, however, an increasing concern arose as a consequence of the evidence of ongoing change suggested by the gradually solidifying nebular hypothesis and the unveiling of the second law of thermodynamics; that alongside birth and growth there also must be decay and death. The universe, or at least the local components thereof, was no longer a clockwork machine, like an automaton, set in motion by its creator to run indefinitely into the future, it contained the seeds of its own demise – a figurative running down of the spring which also implied a starting point which may not have been as far in the past as some supporters of developmental theories had theorised.

The age of the earth, in particular, became a subject of intense discussion in the 1860s. An upward trend in the planet's longevity which had been driven by the conclusions of geologists and astronomers had been further encouraged by the work of naturalists who were seeking to understand the causes of the many apparent creations and destructions of living things and how these might have dove-tailed into the hypothesized catastrophic or uniformitarian formation processes suggested as explanations for the record in the ground. These drivers for longer chronologies had been aided and

[526] Whewell, *Indications*.
[527] L. Bobis and J. Lequeux, 'Cassini, Rømer and the speed of light' in *Journal of Astronomical History and Heritage*, 11(2), 2008, pp. 97 - 105.

abetted by the needs of the emergent concept of biological evolution by natural selection introduced into the public sphere by the publication of Darwin's *On the Origin of Species* in 1859.[528]

This hypothesis was identified by early proponents of the 'conflict theory' as a significant milestone in the alleged war between science and religion, even though similar ideas, in nascent or precursory forms, had in fact been in circulation for a considerable time, having been proposed by Erasmus Darwin (1731 – 1802) and Jean-Baptiste Lamarck (1744 - 1829).[529] The general idea of transmutation of species had been popularised, for which also read made notorious, by the publication of *Vestiges* in 1844. Natural selection, however, was a relatively new explanation for the diversity of living and extinct species and it was understood by Darwin, and his critics, to require considerable periods of time to carry out its shaping influences.

In an endeavour to find sufficient depth of time to satisfy the requirements of his biological theory, Darwin, who had read and admired the work of Charles Lyell (1797 – 1875), resorted to an argument founded on his understanding of the physical geography of a specific locale:

> Hence, under ordinary circumstances, I should infer that for a cliff 500 feet in height, a denudation of one inch per century for the whole length would be a sufficient allowance. At this rate, on the above data, the denudation of the Weald must have required 306,662,400 years; or say three hundred million years. But perhaps it would be safer to allow two or three inches per century, and this would reduce the number of years to one hundred and fifty or one hundred million years.[530]

It is interesting to note in passing that Darwin's less frequently quoted third sentence already represented a recognition that his estimate might clash with the findings of other scientists, a threat which came to fruition in due course. Privately, and in the form of a footnote not found in the London original but added to the first New York edition, he speculated that his "one inch per century" estimate was probably overstated and might be subject to challenge. In fact, he did not have long to wait for counter arguments to be posited against his more ambitious timescale as he himself acknowledged in

---

[528] C. Darwin, *On the Origin of Species by means of Natural Selection, or the Preservation of Favoured Races in the struggle for life* (London, 1859).
[529] See, for example, Elliott, 'Erasmus Darwin'.
[530] D. Alexander, *Rebuilding the Matrix: Science and Faith in the 21st Century* (Oxford, 2002) p. 181. C. Darwin, *Origin*, pp. 286 - 287. See also Smith and Wise, *Energy*, p. 524.

the same footnote; "but I confess that an able and justly severe article, since published in the *Saturday Review* (Dec. 24th, 1859), shows that I have been rash." [531]

In addition to critical attacks originating from geologists mainly founded on discussions of erosion rates, a new form of chronological critique arose in the form of two papers published in *Macmillan's Magazine* in 1862. These articles were entitled *On the age of the sun's heat* and *On the secular cooling of the earth.* As we have seen, a version of the first of these papers had previously been read at the British Association meeting in Manchester by a speaker who stood-in for an indisposed William Thomson. In the second article Thomson embarked on a determined attack on the values for the age of the earth which had been suggested by the slow-running processes lying behind both contemporary ideas of uniformitarian geology and by evolutionary biology. His opposition was motivated by a combination of doubts arising from his own findings in the field of thermodynamics and a concern to preserve the role of God as the director of creation for both animate and inanimate entities.[532]

William Thomson had been born in Belfast and raised as a Presbyterian by his father, James, a university lecturer who in due course took up a post in Glasgow. Throughout his life William continued to be a regular church attender, but his exposure to both strands of Presbyterianism in Scotland, the Anglican liturgy in England and his brother James' Unitarianism meant that he developed a latitudinarian approach to the varying strains of religion he encountered:

> I am quite sure that he was sincerely religious: I would say he was a sincere Christian (meaning by Christianity the religion taught by Christ rather than the religion taught by the churches). I believe he looked deep into essentials, and that he regarded differences of sects as mere matters of form, and looked on the distinctions between Episcopalians, Presbyterians, Quakers, and Unitarians with supreme indifference.[533]

Thomson established, at a relatively early age, a reputation as a competent astronomer and physicist and was appointed professor of natural philosophy at Glasgow in 1846. The dissertation which he had to write as part of the application process for this post was on a topic probably chosen by himself;

---

[531] C. Darwin, *On the Origin of Species by means of Natural Selection, or the Preservation of Favoured Races in the struggle for life* (New York, 1860) footnote on p.252.
[532] Smith and Wise, *Energy*, pp. 530 – 533.
[533] Thompson, *Life*, vol II, pp. 1086 – 1088. His biographer is here quoting an unnamed family friend.

'Age of the Earth and its Limitation as determined from the Distribution and Movement of Heat within it.' This was of course a foreshadowing of the controversy with which he was to engage in the future.[534]

In due course Thomson began to take an interest in the novel concepts and conclusions originating from the work of several other physicists including Sadie Carnot (1796 - 1832), Julius Clausius (1822 -1888), James Joule (1818 - 1889) and fellow Scot William John Macquorn Rankine (1820 - 1872). His contemplation of their results, which had arisen from studies of the efficiency of heat engines, led him to a conclusion which ultimately became his personal version of the second law of thermodynamics, although stated in a rather different form than is generally found in more recent texts; "it is impossible by means of inanimate material agency, to derive mechanical effect from any portion of matter by cooling it below the temperature of the coldest of the surrounding objects."[535]

With this rather dry statement, couched in the language of physics rather than natural theology, Thomson was, according to Smith and Wise, announcing his markedly changed understanding of a long running dispute between two major influences in his earlier life; Chalmers and Nichol. Throughout the 1840s he had endeavoured to reconcile their competing cosmologies. On the one hand there was a long-standing world view of dynamically stable universe which had been suggested by Laplace's assertion of the solar system as a smoothly running and potentially eternal engine. This cosmology supported the concept of collocation, an idea which had been promoted in a more theological and voluntarist form by Chalmers, whose church services Thomson had attended on several occasions. Nichol, for his part, was convinced of the progressive nature of the universe and that the development of different states of matter could only be interpreted in the light of a unidirectional arrow of time which separates the past from the future. Thomson's work on thermodynamics had introduced the fundamental concept of entropy which in turn provided clear evidence of the existence of such an arrow. [536]

---

[534] Thompson, *Life*, vol I, pp. 161 – 189.
[535] W. Thomson, *Mathematical and Physical Papers*, vol 1 (Cambridge, 1882) p. 179.
[536] Smith and Wise, *Energy*, pp. 84 – 99, 317 – 331.

It was in 1851 that Thomson had first arrived at his acceptance of a putative law which would also lead, in due course, to his postulating an inevitable 'heat death'; a possibly misleading title since what was actually being envisioned was a future state in which the "universal dissipation of energy" would inevitably lead to "cessation of motion, and exhaustion of potential energy throughout the material universe".[537] He did not, however, vigorously promote his view of the inevitably negative consequences of increasing entropy until 1862, at the time when he was also endeavouring to constrain the elapsed time between the formation of the sun and the present day in order to undermine Darwin's "three hundred million years." That this was his intention can easily be divined from some of the comments made in his essay:

> What then are we to think of such geological estimates as 300,000,000 years for the "denudation of the Weald?" Whether it is more probable that the physical conditions of the sun's matter differ 1,000 times more than dynamics compel us to suppose they differ from those of matter in our laboratories; or that a stormy sea, with possible channel tides of extreme violence, should encroach on a chalk cliff 1,000 times more rapidly than Mr. Darwin's estimate of one inch per century?[538]

Although the debate about the rate of erosion of the Kent coast is clearly conjectural on the parts of both protagonists, Thomson felt that he had derived from physical science a much stronger, possibly irrefutable, argument against great longevity for the solar system. Having accepted, in the light of the recent findings of thermodynamics, both the interconversion of forms of energy and the impossibility of 'gaining something from nothing', he was unable to identify a likely source of the sun's power which would account for an elapsed time since its birth of any more than a hundred million years and that its future timespan would seem to be even more constrained unless the looming decease of the system could be rescued by some form of divine intervention:

> It seems, therefore, on the whole most probable that the sun has not illuminated the earth for 100,000,000 years, and almost certain that he has not done so for 500,000,000 years. As for the future, we may say, with equal certainty, that the inhabitants of the earth cannot continue to enjoy the light and heat essential to their life, for many million years longer, unless sources now unknown to us are prepared in the great storehouse of creation.[539]

---

[537] Smith and Wise, *Energy*, p. 500.
[538] Thomson, 'On the age', pp. 391 – 392.
[539] Ibid., p. 393.

In the parallel paper on the age of the earth, Thomson used some assumptions about its original temperature and its rate of "secular cooling" in order to limit the possible timescale in which the actions of geology, particularly the uniformitarian version promulgated by Lyell, and those of evolutionary biology were able to take place.[540] Given this objective, however, he seemed unable to avoid giving the impression that his confidence in his own findings was fairly weak. Allowing an 'error bar' of five times his datum point provided a great deal of room for manoeuvre and opened up plenty of temporal space into which counter-attacks from a Darwinian perspective could be inserted by Thomas Huxley and others.[541] Thomson's arguments were subsequently to be supported by two North British physicists who for the most part reiterated Thomson's arguments as they attempted to close this over-wide gap.

It is of course interesting, in the context of the lengthy discussion in Chapter 3, that Thomson's paper on the age of the earth implicitly accepted and acknowledged the assumptions made by French philosophers, Laplace and Fourier in particular, about the formation of the solar system from a hot gaseous cloud in a manner which had subsequently been publicised in Britain by Nichol. The work of Fourier on the rate at which the earth had cooled based on observations of its current temperatures was seen by Thomson as being more empirically founded and more consistent with his understanding of the dynamic changes which the planet must have experienced than Lyell's neglect of the "essential principles of thermodynamics."[542]

Although the writing of these two essays may well have been in part motivated by theological considerations, in the case of the origins of the sun's energy he was working with the best available hypotheses concerning the possible sources of solar fuel. He endeavoured to deal objectively with the two contemporary favourites; a continuous in-falling of meteorites and the conversion of potential to

---

[540] W. Thomson, 'On the Secular Cooling of the Earth', *Transactions of the Royal Society of Edinburgh*, [Read 28 April 1862], vol XXIII (1864) pp. 167- 169. Reprinted in W. Thomson, *Mathematical and Physical Papers*, vol III, (London, 1890) pp. 295 – 311. See also Thompson, *Life*, pp. 538 – 539.
[541] Smith and Wise, *Energy*, p. 538.
[542] See Smith and Wise, *Energy*, pp. 520 – 523 for a discussion of how Thomson adapted existing nebular theory to conform with his own continuum theory of gravity. He was also in agreement with Nichol about the eventual fate of the Earth. Thomson's views of the relative reliability of Fourier and Lyell on thermodynamics is discussed, *inter alia*, on pp. 566 – 567 of the same volume.

kinetic energy as the sun contracts under the influence of gravity.[543] It is also of relevance to note that astronomers at this time had been somewhat taken aback by the apparent resistance to motion encountered by the short period comet Encke which led to a change of paradigm from empty interplanetary space to a cosmos permeated by a mysterious and resistive medium; "(or aether, as some call it)".[544] The implication of the latter idea, of course, was that the orbits of planets and other bodies must inevitably also decay and spiral inward thus foreshadowing at least two possible deaths for the inhabitants of the earth; a cold death caused by eventual total loss of the sun's energy, or a fatal contraction of the earth's orbit leading it into the fiery embrace of the sun.

As Gillian Beer and others have shown, this new-found limitation of terrestrial longevity had a significant effect on Victorian minds, already conditioned to a greater extent than is now normal (at least for the global north) to an anticipation of mortality.[545] Thomson had particular cause to have shared these thoughts and their related concerns with the survival of the soul. As we shall shortly see, in addition to his own recent injury he had lost several close family members and his wife was severely ill at the time when he wrote his two 'chronology' papers.

Thomson's mother had died when he was only six years old and his father then took on the role of both parents. James Thomson raised William and his siblings in a 'firm but fair' environment; initially in Ballynahinch, County Down and subsequently in Glasgow; "As a father, Professor Thomson was admirable. Although a strict disciplinarian, he never alienated the affection of his children."[546] When the family first moved to Glasgow, his father was paid a limited salary by the university (much of it went instead to his predecessor) and he had to support the family by giving lectures in astronomy and geography which were deemed suitable subjects for ladies.[547] Conditions in their relatively inexpensive lodgings were unhealthy due to the marshy miasma which abounded in the vicinity of the old college buildings meaning that:

---

[543] Smith and Wise, *Energy*, pp. 526 – 533.
[544] Ibid., pp. 91 - 92. Thompson, *Life*, vol 1, p. 440.
[545] Beer, 'Death', pp. 159 – 180.
[546] A. Russell, *Lord Kelvin: his life and work* (London, 1912) p. 12.
[547] Smith and Wise, *Energy*, p. 32.

> The thick fogs which sometimes occurred in the wintertime in the neighbourhood of the Old College often made it necessary to have the gas burning indoors all day. This and the cold east winds in the spring made climatic conditions very unfavourable to the delicate.[548]

There are distinct clues that William's health had been significantly compromised during his younger days in this harsh environment. When he took up rowing at Cambridge, his sister, Anna, wrote to him expressing their father's concerns about his health:

> … it has a little of the same spirit as gambling, he thinks, and also you will be very likely to get so much excited by the racing as to injure your health instead of improving it, which you know was the cause for which papa allowed you to get the boat.[549]

These concerns were echoed in a subsequent letter from his father on the topic of preparing to take his degree:

> I am always afraid some unknown or little heard of opponent may arise. Recollect, too, that you might be thrown back by illness, and that you ought therefore to be in advance with your preparation. Above all, however, take care of your health.[550]

His father in due course succumbed to a bout of cholera (his second) and died on the 12th of January 1849 at just about the time that twenty-four-year-old William was beginning to formulate his version of the second law of thermodynamics.[551]

In the summer of 1852 Thomson married Margaret Crum whom he had known since childhood and who was; "Well educated, well read, possessed of a lively imagination and a poetic fancy, she was also of a deeply religious nature and of great earnestness of purpose."[552] It soon became evident that at the relatively youthful age of twenty-two, six years younger than her husband, Margaret's constitution was even less stable than William's. Earlier comments made by his sister Ann and William himself suggest that evidence of Margaret's ill-health first surfaced in 1844, at about the same time as had Cordelia Whewell's:

---

[548] Russell, *Kelvin*, p. 18.
[549] Thompson, *Life*, vol 1, p. 65.
[550] J. Thomson to W. Thomson, 9 April 1843 in Thompson, *Life*, vol 1, p. 53.
[551] Ibid., p. 209. Smith and Wise, *Energy*, pp. 317 -318.
[552] Thompson, *Life*, vol 1, p. 232.

> On July 4th Aunt Gall writes to tell William that the family has gone down to Gourock for summer quarters, and adds, good soul, "I hear Margaret Crum is home and quite well, and looking well." His fair cousin's health seems to have been not without interest.[553]

It is possible, as noted in Chapter 1, that the symptoms of tuberculosis accounted for both the frailty and the 'fairness' of William's new bride. In any event the fatiguing experience of an "extended tour around the Mediterranean" following the marriage proved to be the beginning of a lengthy period of illness and an ultimately childless marriage which similarly seems to echo that of Cordelia, although there is just a touch of cynicism, and perhaps jealousy, in King's commentary ; "she never recovered, and all the rest of her life was a great sufferer."[554]

Thomson's correspondence over the next eighteen years contained occasional rather optimistic (or so it might appear to the reader) reports of her intermittent improvements, as evidenced by this excerpt from a letter written in 1854:

> Margaret has not advanced as I had hoped and expected she wd. have done by this time, and it has been very disappointing to feel so little improvement with so much of the summer passed. She is, however, doing somewhat better now, and I think has really advanced during the last three weeks, certainly has suffered less. She looks much better and in some respects is much better than when you saw her last, but she has not at all advanced in walking power. I always carry her up and down stairs, and often from one room to another.[555]

In 1855 William was advised to take Margaret on what turned out to be the first of several visits to the spa town of Kreuznach in Germany; the location for therapeutic treatment which had occasionally hosted the Whewells from 1851 to 1853. It was not a particularly enjoyable or successful visit:

> As she is not allowed to ride, or to walk more than a few minutes every day, I take her out in a Bath-chair, between which, and a balcony on which she sits a great deal reading or working, she gets a good deal of the open air.
>
> This is a very dull place, and the scenery gives us very poor compensation for our favourite Arran, which we are losing.[556]

---

[553] Thompson, *Life*, vol 1, pp. 66, 81.
[554] King, *Kelvin*, p. 32.
[555] W. Thomson to E. T. King (his sister), August 1854 in Thompson, *Life*, vol 1, p. 305.
[556] W. Thomson to E. T. King (his sister), 23 July 1855 in Thompson, *Life*, vol 1, p. 308.

William Whewell, as noted above and as discussed at some length in Chapter 2, had experienced a similar set of family bereavements prior to the lengthy, intermittent and ultimately fatal illness of his wife. In the case of the Thomsons, Margaret's ill-health continued for eighteen years until her death in 1870. In a recognisable parallel with Whewell's emotional turmoil and sense of impending loss, we can readily detect a similar need for the consolation of religious belief in a letter written to his sister shortly after Margaret's death:

> Yet I know too well how insufficient even the surest conviction that the loved one is happy, and the firmest hope of a transcendently happy meeting to come, are to mitigate the bitterness of the present grief.[557]

We have already observed that a less life-threatening (at least with the benefit of hindsight) injury impacted Thomson prior to the formulation of the thermodynamical objection which he had delivered in due course to the extended timescales of geologists and naturalists. He suffered the fall described at the beginning of this chapter in December 1860. It resulted in a very painful fractured thighbone which necessitated an extended period of recovery during which he was bed-ridden for several pensive months. During this period he was exposed to "very large doses" of chloroform intended to dull the pain.:

> He never showed any tendency to fever, but suffered much from the effects of the chloroform, of which it required very large doses to make him insensible. He suffers much uneasiness and considerable pain. The pain caused by setting the limb was very great.[558]

The use of chloroform as an anaesthetic was a relatively recent development; its potential utility having been established in 1847 by the Scottish obstetrician James Young Simpson (1811 – 1870) who initially exposed himself and several guests to it as a post-dinner entertainment. One young lady who volunteered to try it, "a Miss Petrie", subsequently 'fell asleep crying "I'm an angel. Oh, I'm an angel"!'[559] Given the experience of the Simpson party it can be concluded that Thomson's substantial

[557] W. Thomson to E. T. King (his sister), August 1870 in Thompson, *Life*, vol 1, p. 534.
[558] M. Thomson (wife of William) to H. von Helmholtz, 11 January 1861 in Thompson, *Life*, vol 1, p. 413.
[559] H. Laing Gordon, *Sir James Young Simpson and Chloroform (1811 – 1870)*, (London, 1897) pp. 106 – 108.

doses of chloroform must also have produced quite disorienting affects and altered states of mind which he may have freighted with religious significance.

Thomson had also been treated with opiates during the earliest and most traumatic period of his injury. As has already been noted in the cases of De Quincey and Coleridge, the users of extracts from *Papaver somniferum*, especially during the earlier phases of consumption, generally experience vivid 'opium dreams' during which they are exposed to dramatically altered perceptions of time and space. This linkage is clearly of significance when seeking the root causes of Thomson's renewed focus on questions of cosmic chronology which became evident shortly after his convalescence. As with the other interactions between injury and ideology documented in this thesis there is an arguable case for a connection between Thomson's lengthy recuperation, which had afforded him an opportunity for reflection, potentially including drug-induced reveries, and his subsequent focus on a topic which allowed him to bring his fire to bear on what he regarded as the negative consequences of Darwin's evolutionary theory, or as Joule expressed it on his behalf; "some of the rubbish which has been thrust on the public lately".[560]

It has to be said, of course, that a significant component of Thomson's ire was reserved for what he felt to be the ascientific and doubtful, in his view, conclusions and timescales arrived at by uniformitarian geologists in particular who he felt were pursuing theses based more on subjective 'feel' than on the basis of empirical evidence which he adduced in support of his argument.[561] But it is also clear that his objection to Darwinism was rooted in a theological distaste, very similar to that expressed earlier by Whewell, for any suggestion that life is not to be distinguished from non-life and that it may not have been the result of a special creative event as revealed by the 'good book' of Trinitarian faith.

In a logical parallel with his deep concern about the timescales postulated by some naturalists, Thomson also maintained throughout his career a belief that life could not spontaneously arise from

[560] Smith and Wise, *Energy*, pp. 524 – 525.
[561] Ibid., pp. 566 – 568.

non-life and that Darwin's theory of evolution had done nothing to address this fundamental transformation. As President of the British Association in 1871 he promoted the idea that the biology of planet earth might in fact have had an extraterrestrial origin; seeded by a meteor or other interplanetary traveller arriving from outer space. Whilst at first glance this might appear to be a convenient way out of some elements of the evolutionary debate, Thomson recognised that all he had done with this suggestion was to relocate a first cause in both space and time and that an act of creation was still required at the point of initiation.[562]

One of Thomson's most vocal supporters in the chronology debate was Fleeming Jenkin, the Regius Professor of Engineering at the University of Edinburgh. Jenkin had been born in Kent but was educated in Scotland, firstly at Jedburgh School and then at the Edinburgh Academy. At the latter seat of learning he had encountered two other future participants in thermodynamic and temporal debates; James Clerk Maxwell and Peter Guthrie Tait.[563]

Although brought up originally in the Church of Scotland, Jenkin seems to have preferred a relatively open-minded approach to religion, evincing a "fine spirit of piety" but eschewing "dogma". His slightly sceptical but nonetheless receptive stance is perhaps best captured in a single sentence from a letter which was quoted in a biographical *Memoir* written by his friend Robert Louis Stevenson (1850 - 1894):

> I cannot conceive that any single proposition whatever in religion is true in the scientific sense; and yet all the while I think the religious view of the world is the most true view.[564]

This statement, which neatly encapsulates Jenkin's understanding of the epistemic relationship between science and religion, would appear to place him in a slightly different metaphysical frame than some of his collaborators in the North British group.

Stevenson was significantly younger than Jenkin and, as a self-defined "youthful atheist", he found the older man's more complex and less rigid views on theological alignment both intellectually

---

[562] King, *Kelvin*, pp. 30, 98 – 99.
[563] R. L. Stevenson, 'Memoir' in S. Colvin and J. A. Ewing (eds.), *Papers, Literary, Scientific etc. by the late Fleeming Jenkin, F.R.S., LL.D*. vol 1 (London, 1887) pp. xi – cliv, p. xxix.
[564] Ibid., pp. cxxxiv – cxxxvii.

challenging and refreshing. As time went on, we are told, Jenkin's "conformity to the church in which he was born grew more complete, and his views drew nearer the conventional." Stevenson went on to describe Jenkin's broad *rapprochement* with the beliefs of the Church of Scotland towards the end of his life, a perhaps not unexpected development:

> 'The longer I live, my dear Louis,' he wrote but a few months before his death, 'the more convinced I become of a direct care by God - which is reasonably impossible - but there it is.' And in his last year he took the communion. [565]

The *Memoir* also contains a detailed account of Jenkin's earlier years which turn out to have been unusually variegated, including an extended 'exile', brought about by his father's fall into comparative poverty. During a sojourn in France, which lasted until early 1848, his family "whose politics were Liberal" witnessed some of the events of the 'February Revolution'. Jenkin was an initially sympathetic bystander who observed and commented on the ongoing upheaval. He provided light-hearted, almost insouciant, descriptions of the events in letters written "to influence his friend Frank, an incipient Tory". Jenkin continued to be present on the streets as the barricades went up and he experienced at first hand the protest marches, the violence of state suppression and the subsequent fighting which led to "the insurrection":

> 'The Revolution,' writes Fleeming to Frank Scott, 'was quite delightful: getting popped at and run at by horses, and giving sous [coins] for the wounded into little boxes guarded by the raggedest, picturesquest, delightfullest, sentinels; but the insurrection! ugh, I shudder to think at [sic] it.'

The increasingly volatile situation brought about by the second wave of uprising which was of a more proletarian nature than the preceding, primarily bourgeois, 'revolution' was judged to be too dangerous by his parents. They escaped from Paris and made their way to Genoa where they experienced further episodes of popular uprising.[566] It is interesting to note, particularly in the light of some of the dramatic theological conversion narratives which affected some of the subjects of this thesis, that Jenkin's early exposure to some of the most violent contemporary instances of the

[565] Stevenson, 'Memoir', p. cxxxv.
[566] Ibid., pp. xxxi – xli.

suppression of revolutionary movements did not seem to have brought about any significant change in his political ideology either at that time or subsequently.

His youthful experiences did, however, appear to act as a spur to his later engagement with some slightly unexpected topics, including trade union law and economic theory, as he developed an unusually wide range of interests when compared with his peers. His five papers on political economics, written from a Liberal perspective, began with 'Trade Unions: how far legitimate', published in 1868. This was followed by further work which included the introduction of graphical methods into economics and the first formulation of modern wage theory. His significant contributions to the discipline were subsequently recognised by Joseph Schumpeter (1883 - 1950) who asserted that Jenkin was "an economist of major importance, whose main papers […] form an obvious stepping stone between J. S. Mill and [Alfred] Marshall"[567]

From the point of view of the main theme of this thesis it is potentially significant that two years prior to his first intervention in the chronology and evolution debates, and their associated religious sub-text, Jenkin suffered a double misfortune. According to Stevenson's *Memoir*:

> In September of the next year [1865], with the birth of the second [child], Charles Frewen, there befell Fleeming a terrible alarm and what proved to be a lifelong misfortune. Mrs. Jenkin was taken suddenly and alarmingly ill; Fleeming ran a matter of two miles to fetch the doctor, and drenched with sweat as he was, returned with him at once in an open gig.

As a consequence of this event and a night spent "crouching on the floor in the draught, and not daring to move lest he should wake the sleeper." Jenkin himself succumbed to a combination of disabling conditions:

> … the result of that night's exposure was flying rheumatism varied by settled sciatica. Sometimes it quite disabled him, sometimes it was less acute; but he was rarely free from it until his death, [568]

[567] J. A. Schumpeter, *History of economic analysis* (New York, 1954) p. 837 n10. All five papers can be found in S. Colvin and J. A. Ewing (eds.), *Papers, Literary, Scientific etc. by the late Fleeming Jenkin, F.R.S, LL.D*. vol 2 (London, 1887) pp. 3 - 154.
[568] Stevenson, 'Memoir', p. lxxii.

There are again no reports that suggest that there was any immediate change in Jenkin's theological, scientific or metaphysical stances following this trauma. It was clearly not a life-threatening event (at least not from Fleeming's point of view, although he may well have feared for the lives of his wife and child). The onset of rheumatism and sciatica, as described by Stevenson, represented chronic rather than acute conditions which from time to time "quite disabled him" but did not represent an existential threat. Nonetheless, there is a plausible thread which connects the events of the night in question and Jenkin's subsequent decision to weigh in on the side of his colleague and mentor, William Thomson, on the subject of evolutionary timescales and their claimed improbability as well as being one of the drivers, especially when combined with the approach of death, of his gradual adoption of a more conventional religious self, culminating in his eventual resolution with the faith of his childhood.

Jenkin had collaborated with William Thomson from 1859 onwards, having worked on submarine cable projects with which the more experienced physicist had already been engaged for several years. Their joint activities subsequently extended to several other spheres, including his "partnership with Sir William Thomson and Mr. Varley in many ingenious patents".[569] It is therefore unsurprising that Jenkin, sharing similar intellectual, theological and professional perspectives, as well as the experience of impaired physical abilities, eventually chose to support his colleague's thermodynamical assault on long chronologies as well as making a contribution to a non-material explanation of the operation of free will.

In 1867 he wrote a review of Darwin's *Origin of Species* in the *North British Review* which strongly supported the position posited by Thomson five years earlier. In this article Jenkin assembled several arguments which he felt rendered Darwin's hypothesis of development unlikely or improbable, including Thomson's demonstrations that the ages of both the sun and earth are far from infinite and most likely too short to permit Darwin's processes of natural selection to work through as claimed. He built what he felt to be a solid and reflexive case in which he assumed that posteriority would

[569] Stevenson, 'Memoir', p. lxvii.

"look back with […] admiration" on Darwin's "ingenious and plausible speculation" in a fashion similar to the bemused tolerance extended by his contemporaries to "the atoms of Lucretius, or the crystal spheres of Eudoxus":

> A plausible theory should not be accepted while unproven; and if the arguments of this essay be admitted, Darwin's theory of the origin of species is not only without sufficient support from evidence, but is proved false by accumulative proof. [570]

Although Jenkin demurred from identifying a specific duration during which life on earth had been feasible from an energetic perspective, he nonetheless asserted that the "age of the inhabited world is proved to have been limited to a period wholly inconsistent with Darwin's views."[571] His case for long chronologies was made with such power that Darwin himself was moved to acknowledge the influence of Jenkin's writing; "Fleeming Jenkin has given me much trouble, but has been of more real use to me than any other essay or review."[572]

Peter Tait, on the other hand, was much less reticent about declaring fixed limits for the ages of the earth and sun. He had been another classmate of Jenkin at the Edinburgh Academy but, unlike his peer, he was a convinced Trinitarian. "His reverence for the undoubted essentials of the Christian Faith was deep and unmovable; and nothing pained him so much as a flippant use of a quotation from the Gospel writings." Tait's general approval of the "rational claim on our belief" and the democratic and universalist nature of Christianity, as he understood it, can easily be detected in this excerpt from an article which he wrote in 1878:

> … it would appear that the only religion which can have a rational claim on our belief must be one suited equally to the admitted necessities of the peasant and of the philosopher. And this is one specially distinguishing feature of Christianity. While almost all other religious creeds involve an outer sense for the uneducated masses and an inner sense for the more learned and therefore dominant priesthood, the system of Christianity appeals alike to the belief of all;

Tait thus acts as the base case or conservative hypothesis against whom the other North Britons can be compared, the 'exception which proves the rule'. Given a consistent and convinced belief in

---

[570] Colvin and Ewing (eds.), *Fleeming Jenkin,* vol 1, p. 263.
[571] Ibid, p. 248.
[572] C. Darwin to J. D. Hooker, 16 January 1869, reprinted in F. Darwin and A. C. Seward, (eds.), *More Letters of Charles Darwin*, vol II (London, 1903) pp. 378 -379.

Trinitarian theology he had no need of a *Weltbild* crisis to motivate his inclination to support Thomson's arguments against long chronologies and scientific naturalism when the occasion arose, as we shall shortly see. [573]

Tait eventually became Professor of Natural Philosophy at the University of Edinburgh in which role he collaborated closely with Thomson who held the same chair at the University of Glasgow. They jointly commenced the writing of a series of books under the umbrella title of *A Treatise on Natural Philosophy*. This collection, more popularly known as 'Thomson and Tait' or sometimes just 'T & T', was intended to be a comprehensive survey of the physical sciences. It was, unfortunately, never completed in totality; the first two volumes were published in 1867 but the planned series eventually ground to a halt as the co-authors were diverted by other projects.[574]

Tait "the bulldog of the North British circle" had engaged in debates on the topics which divided the North British group from their metropolitan counterparts both before and after Tyndall's intervention in 1874.[575] In part he seemed to have been motivated by jealousy of Tyndall's popularity and commercial success.[576] But it is also evident that Tyndall had for a long time been one of the chief targets of Thomson and Tait's opposition to "so-called naturalism" and materialism:

> By 1862, Thomson's convictions had become sufficiently developed for him to present, along with Tait, a popular account of his cosmos, directed principally against John Tyndall (1820-93), in the Presbyterian magazine *Good Words*. Tyndall's so-called naturalism, which assigned no role to God, and which placed all things (including mind) under the rule of deterministic, materialistic law, regularly provoked the wrath of his Scottish contemporaries …[577]

In order to support Thomson's chronological revisionism, Tait submitted a discussion of 'Geological Time' which was published in the *North British Review* (1869). This was followed seven years later by an essay on thermodynamics contained in a larger volume entitled *Some Recent Advances in*

---

[573] C. G. Knott, *Life and Scientific Work of Peter Guthrie Tait* (Cambridge, 1911), pp. 35 – 37. On p. 36 Knott quoted from P. G. Tait, 'Does Humanity demand a New Revelation', *International Review* (November 1878).
[574] Thompson, *Life*, vol I, pp. 477 – 479.
[575] Barton, 'Scientific Authority', p. 230.
[576] Nall, *News from Mars*.
[577] Smith and Wise, *Energy*, p. 535.

Physical Sciences (1876).[578] In both publications he was prepared to argue for a much shorter duration of life on earth than that implied by any of Thomson's earlier estimates.

In 1869 Tait appeared to have been personally offended by the attitude of Thomas Huxley, who had been recently appointed as president of the Geological Society. In his inaugural address, as recollected by Tait, Huxley had asserted that "I am as incompetent to judge the evidence on which *you* go as you are to judge *ours*." Tait interpreted this statement as being "equivalent to telling mathematicians and natural philosophers, [to] mind their own business, and let other folk be." Being, like several of his colleagues, "fundamentally conservative", Tait responded by comparing the style and content of Huxley's uncompromising and, to him, both peremptory and irrational rejection of the northern physicists' reduced timescales, with the perceived anarchy of recent industrial disputes; "those most objectionable theories and practices of the Trades-Unionists which have recently been held up to public execration."[579] Tait's detailed response in 'Geological Time' seems, therefore, to have been prompted by a combination of support for his co-writer and a negative reaction to Huxley's comments, as well as his conventional religious conviction.

Before proceeding to examine the contents of Tait's argument for long chronologies it is worth turning briefly aside to examine the wellsprings of Huxley's adherence to agnostic materialism. Thomas Huxley suffered throughout most of his life from bouts of depression. There appears to have been a hereditary element to this affliction. His father and brother, both named George, were prone to extreme states of mental anxiety and his daughter Marian ('Mady', 1859 – 1887) suffered "a total mental collapse" prior to her death. "Like a typical depressive, Huxley was unable to cope with it in his daughter."[580]

---

[578] P. G. Tait, 'Geological Time', *North British Review* 50 (1869) pp. 406 – 439. P. G. Tait, *Lectures on some recent advances in physical science*, 2nd Edition (London, 1876) pp. 160 - 175. Smith and Wise, *Energy*, footnote on page 602 suggest that Tait's Lectures were published in 1867 but this appears to be a transposition error as the preface to the first edition, dated February 1876, states that the lectures in question were delivered in "spring of 1874" (p. xv).

[579] Tait, 'Geological', pp. 406 – 407. Knott, *Tait*, p. 37.

[580] A. Desmond, *Huxley: from Devil's Disciple to Evolution's High Priest* (London, 1998) pp. 178 – 179, 197 – 198, 522 – 523, 537, 557 – 558.

Huxley's own condition seems to have been 'awakened' by witnessing the post-mortem dissection of a corpse at the age of thirteen when he was living with his parents in Coventry, the city in which "the future George Eliot lost her Puritan faith" and which had similarly "exposed Tom to a biting sectarianism". The course of his reaction to mortality contains distinct similarities to Chalmers' earlier conversion narrative, albeit he was driven to a quite different conclusion:

> He fell into a strange lethargy. For weeks he deteriorated, 'poisoned' somehow, until he looked 'thin and ill'. […] He began questioning the meaning of evil and death. How did it square with God's beneficence? It did not according to Southwood Smith's *Divine Government*, that Unitarian bible which Tom read at George May's [a Coventry businessman and Dissenter].[581]

For an agnostic like Huxley, as had earlier been the case for Darwin, the death of a beloved child was both hard to bear and particularly difficult to endow with a positive purpose. Following the loss of Mady, Huxley refused to cancel a planned talk to the manufacturers of Manchester which had had a working title of 'Programme of Industrial Development'. The content of the lecture he went on to deliver, which he retitled 'The Struggle for Existence in Human Society', was, however, considerably altered. The rationalist Darwinian 'bulldog' was replaced by a grieving and depressive self, who began the talk with a terminally pessimistic rumination on the blind workings of evolution and the inevitability of universal thermodynamic death:

> On the evolutionist side, on the other hand, we are told to take comfort from the reflection that the terrible struggle for existence tends to final good, and that the suffering of the ancestor is paid for by the increased perfection of the progeny. […] And, again, it is an error to imagine that evolution signifies a constant tendency to increased perfection. […] Retrogressive is as practicable as progressive metamorphosis. If what the physical philosophers tell us, that our globe has been in a state of fusion, and, like the sun, is gradually cooling down, is true; then the time must come when evolution will mean adaptation to an universal winter, and all forms of life will die out, …[582]

In summary, the narrative arc of Huxley's life included an episode in which youthful exposure to an unsettling and traumatic event influenced his future theological views. His pessimistic theodicy in

---

[581] Desmond, *Huxley*, pp. 8 – 10.
[582] Ibid., pp. 557 – 561 esp. footnote 68 on p. 559. The "toned-down essay" was in due course published as: T. H. Huxley, 'The Struggle for Existence: A Programme', *Nineteenth Century*, Number CXXXII, February 1888, pp. 161 – 180, p. 163.

turn determined, at least in part, the direction and content of his scientific researches and prognostications. He adopted a sceptical stance on the likelihood of divine intervention in the formation of extinct and extant species and moved to a belief in the probability of biological evolution by natural selection.

Tait's 1869 article on geological time was clearly intended as a riposte to what he saw as Huxley's attacks on Thomson by means of "venomous but absurd attempts at smartness".[583] In both this paper and his 1876 book, Tait decided to tighten the window during which life could have existed to a level at which Darwin would have great difficulty in demonstrating that the process of natural selection could have operated in the way he had described. This approach was, of course, not well received by committed evolutionists. As the English physicist Joseph David Everett (1831 – 1904) put it in a letter to Nature:

> Prof. Tait, in his "Recent Advances in Physical Science," recapitulates these [Sir W. Thomson's] arguments, but with a different conclusion. He states the limit of age to be about *ten* million years. As the subject is of immense interest, may I ask Prof. Tait to explain this change of conclusion?[584]

Everett was here being a little disingenuous, or had not read the book closely, as Tait did in fact adduce three arguments, which had previously been aired in the 1869 article, to support his conclusions. Of these, the second argument is perhaps the most interesting as it involved a re-imagining of time in a way which would have been familiar to a Victorian astronomer but quite novel to the average reader. Building on the earlier conclusions of Laplace, Kant, John Couch Adams (1819 - 1892) and Thomson himself, Tait observed that the rate of the earth's rotation is slowing and the moon's orbital period is increasing (technically known as the secular acceleration of the moon's mean motion) such that, say, a billion years ago the earth would have turned on its axis in twelve rather than twenty-four hours. His article pointed out that this diminution of the length of a day is an indication of the relativity of chronology and the impermanence of the universe as we now see it. Since the

[583] Tait, 'Geological', p. 439.
[584] J. D. Everett, Letter, to *Nature*, 20 April 1876, p. 486.

earth's 'figure' was not as distorted as required, in Tait's view, to support a great speed of rotation he concluded that it cannot have been solid for a long period of time:

> We say then, that because the earth is so little flattened it must have been rotating at very nearly the same rate as it is now rotating, when it became solid. Therefore […] it cannot have been many millions of years back when it became solid, […] That argument, […] probably reduces the possible period which can be allowed to geologists to something less than ten millions of years.[585]

The tone of Tait's comments here, in common with some of his other key points, was rather forced. He was performing an apparently detached scientific self whilst advocating an evidently subjective point of view. Without in any way showing his detailed working he confidently postulated a timescale which he believed to be impossibly short for either uniformitarian geology or Darwin's hypothesis to be feasible, to the evident frustration of fellow physicist Everett.[586] George Howard Darwin (1845 – 1912), the son of Charles, was willing to accept the valuable contribution to the definition of geological time made by Thomson but argued with some vigour in his 1886 Presidential address to the British Association that Tait's revamped timeline was based on uncertain estimates in which the margin of error was "far too great to justify us in accepting such a narrowing of the conclusions".[587]

In his own endeavours to undermine longer chronologies, Thomson had invoked the ideas of thermodynamics to demonstrate that both the past and the future longevity of the portion of the universe inhabited by man must, of necessity, be limited. Living things, despite their ability to organise matter and evidence of volition, did not represent an exception to the general principle of increasing entropy; "Thomson held that living creatures and dead matter were distinguished by the former's privileged possession of free will, a will which enabled them to direct the energies of nature in accordance with the dissipation principle."[588]

---

[585] Thompson, *Life*, vol 1, pp. 540 – 543. Tait, *Lectures*, p. 174.
[586] Ibid, p. 167 (and footnote) makes it clear that Tait's target in this essay was still the three hundred million years posited originally by Darwin.
[587] Smith & Wise, *Energy*, p. 602. The quotation comes from George Darwin's Presidential Address to the British Association for the Advancement of Science 56 (1886), pp. 511 – 518.
[588] Ibid., p. 612.

Thomson's elucidation of the second law of thermodynamics had, however, provided further ammunition for people like Huxley and Spencer who were attempting to portray living things as purely deterministic entities subject to the same physical and chemical processes as inorganic matter and devoid of any spiritual processes which might be termed 'life' or 'free will'.[589] And if life was not a special attribute of living things but simply an emergent property of known or knowable rules identified by the sciences, then the more tenuous concept of 'consciousness' must itself be a physiological process which does not require any component which can exist independently outside the physical confines of the body or the temporal bounds of its lifespan.

Thomson was concerned by these mechanistic viewpoints but was not readily able to refute them. By adhering to the logic of his own work he found it difficult to speculate, except in very abstract terms, about novel mechanisms which might help to identify a space in which free will or consciousness could operate. The production of ripostes to the metropolitan materialists he unconsciously delegated to those Caledonian colleagues and fellow travellers who shared Thomson's conviction that, despite recent advances in biology, physiology and an emerging physicalist science of emotions, there nonetheless remained essential differences between living and non-living entities.[590]

James Clerk Maxwell made several attempts to assist Thomson by explaining the operation of free will. Maxwell was born in Edinburgh, was initially educated at the Edinburgh Academy and then at the University in the same city.[591] His 'theological career' was in some ways comparable to the direction of travel followed earlier by Thomas Chalmers. He had been exposed to both Anglican and Presbyterian liturgies as a boy which meant that on his subsequent entry to the University of Cambridge he performed an ecumenical and apparently rationalist self when faced with questions of religion as demonstrated by the lightness of touch and slightly quirky sense of humour displayed in

[589] The mechanical paradigm had become so dominant in metropolitan circles by 1865 that John Herschel felt the need to seek and obtain theological 'absolution' from the Bishop of Kingston for attempting to discuss the spiritual origin of force in two articles which he complained had been censored by the editor of the *Fortnightly Review*. Herschel to the Bishop of Kingston, 14 July 1865, Royal Society Herschel MSS HS 24.118.
[590] Thomson's thoughts on the energetics of free will are summarised, for example, in: Thompson, *Life*, vol I, pp. 229 – 230 and Smith and Wise, *Energy*, pp. 612 – 618. For the history of physicalist theories of emotions in this period see: Dixon, *Passions*, pp. 135 – 146.
[591] Campbell and Garnett, *Life*, pp. 2, 47, 105.

some of the essays which he wrote as a member of the 'Apostles'; "an elite literary and philosophical discussion group".[592] His broad church approach was also epitomised in a letter written in 1852 to his friend Campbell in which he contrasted the lack of taboo topics of discussion in mainstream Christianity with the "the territory of the Scoffer, the Pantheist, the Quietist, Formalist, Dogmatist, Sensualist, and the rest,":

> Christianity that is, the religion of the Bible is the only scheme or form of belief which disavows any possessions on such a tenure. Here alone all is free. You may fly to the ends of the world and find no God but the Author of Salvation. You may search the Scriptures and not find a text to stop you in your explorations.[593]

At a critical period in his academic career, at the age of 22 and just prior to his third-year examinations, however, Maxwell suffered a lengthy illness whilst he was staying at the house of the uncle of one of his fellow students, the Reverend Charles Benjamin Tayler (1797 – 1875), an evangelical Anglican who was an ardent opponent of the more formulaic approach of the Tractarians.[594] As a consequence of his illness and the subsequent period of convalescence in the minister's house, Maxwell's religious views were significantly intensified. This episode had a profound effect on his future thinking on the relative epistemic and emotional weights which should be accorded to "Love" and "Knowledge". His friend reported the experience as "having given him a new perception of the Love of God.":

> The illness is described by Mr. Tayler [the Reverend Tayler's nephew] as a sort of brain fever, and he was disabled by it for more than a month. The Taylers nursed him as they would have nursed a son of their own, and Maxwell, in whom the smallest kindnesses awakened lasting gratitude, was profoundly moved by this. He referred to it long afterwards as having given him a new perception of the Love of God. One of his strongest convictions thenceforward was that "Love abideth, though Knowledge vanish away." And this came to him at the very height of the intellectual struggle.[595]

---

[592] P. Theerman, 'James Clerk Maxwell and religion', *American Journal of Physics* 54, 312 (1986), pp. 312 – 317, p. 312. See Campbell and Garnett, *Life*, pp. 223 – 246 for excerpts from some of Maxwell's essays for the Apostles.
[593] Ibid., p. 179.
[594] C. B. Tayler, *Sermons for all seasons, chiefly on the subject of Tractarian error* (London, 1850) pp. vii – xiii.
[595] Campbell and Garnett, *Life*, p. 170.

The impact which the interactions with the evangelical cleric had on the young student's religiosity were later recollected by the nephew, who eventually became the Reverend G.W. H. Tayler, in a letter to Maxwell's biographers:

> It was on his recovery from that illness that I seemed to know him better than ever. It was then that my uncle's conversation seemed to make such a deep impression on his mind. He had always been a regular attendant at the services of God's house, and a regular communicant in our College Chapel. Also he had thought and read much on religious subjects. But at this time (as it appears from his own account of the matter) his religious views were greatly deepened and strengthened."[596]

It is clear from this evidence that the impact of the period of illness and recovery was fundamental in shaping Maxwell's future attitude to religion. Tayler's narrative shapes the incident in the form of an existing archetype in which Maxwell's 'conversion' consisted of a significant shift, of a kind which had been urged by the evangelical movement from the late eighteenth century onwards, away from his earlier broad intellectual appreciation of religion in general, and Christianity in particular, to the deeper and more emotional connection with the spiritual core of his chosen faith "as grace flooded into the empty vessel of his soul".[597] This transition can also be seen as a tribute to the affective influence of the uncle who had spoken at some length with Maxwell during his convalescence.

Campbell and William Garnett (1850 – 1932) also noted that "in his half-speculative, half-emotional way" Maxwell had contrasted his experience in the "large and united English family" which he had found in the Tayler household with his own upbringing as the only child of a widowed father, his mother having died in 1839. It would be reasonable to conjecture, as his biographers seemed to suggest, that, at a time when his mental and physical resources were at a distinctly low ebb, the sense of belonging to a larger and more cohesive family group which he had recently experienced became associated in his *Weltbild* with the far larger fraternity of the evangelist communion. [598]

It should also be noted that two further significant life events provided a post-conversion Maxwell with some closure in respect to his early family life and access to alternative models of emotional

[596] Campbell and Garnett, *Life*, p. 173.
[597] Hilton, *Atonement*, pp. 26 – 28.
[598] Campbell and Garnett, *Life*, pp. 170 – 173, 32.

attachment and community as well as a high degree of financial independence. His father died peacefully, to Maxwell's evident relief, in April 1856, leaving the estate at Glenlair to James. In June 1859 he married Katherine Mary Dewar (1824 - 1886) and embarked on "a married life which can only be spoken of as one of unexampled devotion." In due course he became an elder of the kirk and the "liberality" of his donations to the church "was very great". [599]

As Matthew Stanley has pointed out, a significant consequence of Maxwell's "conversion experience" and his subsequent approach to theology, as discussed in a letter to Charles Tayler written shortly afterwards, concerned the role of free will in the acceptance of God's grace by the individual; "The ability to choose to trust God was a critical element in [F. D.] Maurice's scheme, and was also an important aspect of Maxwell's own understanding of his conversion experience."[600] It is therefore unsurprising that Maxwell's key intervention in the project of the North British physicists to find a scientific basis for the less tangible phenomena of life was an attempt to demonstrate that the exercise of free will does not require the consumption of energy. A purely biochemical basis for thought would mean that consciousness is a process which could be expected to run down and eventually fade to zero. Maxwell's preferred solution was a human body in which; "Food is the mover, and perishes in the using, which the soul does not.", thus enabling the soul to continue to exist beyond physical death.[601]

Maxwell in due course began to build on the idea of 'directing power', which had previously been suggested by William Thomson's lectures during 1852-3, as an immaterial solution to the question of conscious action. In 1862, when Thomson had recently begun his chronological assault on the geologists and evolutionists, his own thoughts on this topic were reignited by a letter from his brother James Thomson (1822 - 1892) who sought a possible method by which "the mysterious influence of spirit, life or the vital principle" might be exercised whilst not being subject to the normal rules of

[599] Campbell and Garnett, *Life*, pp. 253 – 257, 276, 371.
[600] M. Stanley, 'The Pointsman: Maxwell's Demon, Victorian Free Will, and The Boundaries of Science', *Journal of the History of Ideas*, 69, 3, July 2008, pp. 467 - 491, p. 471. The letter from which this evidence is derived was written by Maxwell to C. B. Tayler on 8 July 1853. It can be found on pp. 188 – 189 of Campbell and Garnett, *Life*. See also: Smith, *Science*, pp. 215 – 217.
[601] Maxwell to Campbell, 21 April 1862, in Campbell and Garnett, *Life*, p. 336.

thermodynamics.[602] At almost the same time that Thomson was composing a reply to his brother's enquiry, and in response to the materialist and deterministic work of Hermann von Helmholtz (1821 - 1894), Alexander Bain (1810 - 1877), Henry Thomas Buckle (1821 - 1862) and William Benjamin Carpenter (1813 - 1885), Maxwell introduced the ideas of the shooting of a gun and the actions of a railway pointsman as analogies for the supervisory actions of the mind:

> There is action and reaction between body and soul, but it is not of a kind in which energy passes from one to the other, - as when a man pulls a trigger it is the gunpowder which projects the bullet, or when a pointsman shunts a train it is the rails that bear the thrust. But the constitution of our nature is not explained by finding out what it is not. It is well that it will go, and that we remain in possession, though we do not understand it.[603]

These two analogies provided Maxwell with starting points for thinking about ways in which free will might be exercised without requiring a significant increase in entropy. He recognised, of course, that the examples he had chosen were not entirely satisfactory; however small the directing action required to release a much greater store of energy it could not realistically be argued to be zero. The same objection could also be raised with respect to perhaps his most well-known example of a directing power; 'Maxwell's demon'. This miniscule and imaginary character was the subject of a thought experiment which he had described in an 1867 letter to Tait. Thomson, who read and annotated the letter, was responsible for giving the name 'demon' to the fictitious director of gas molecules and possessor of free will which Maxwell had envisioned.[604]

A further attempt to explain the exercise of free will whilst minimising or removing the requirement for the dissipation of energy took the form of a paper entitled *The place of life in a universe of energy* which was published as the second half of a two-part article on *The Sun as type of the material universe* in *Macmillan's Magazine* in May 1868. The authors were Balfour Stewart and Joseph Norman Lockyer (1836 – 1920).[605]

---

[602] James Thomson to William Thomson, 7 April 1862, quoted in Smith and Wise, *Energy*, p. 619.
[603] Stanley, 'Pointsman', pp. 473 - 474. Maxwell to Campbell, 21 April 1862, in Campbell and Garnett, *Life*, p. 336.
[604] Smith and Wise, *Energy*, pp. 621 – 622.
[605] B. Stewart and J. N. Lockyer, 'The Sun as a Type of the Material Universe: Part II The Place of Life in a Universe of Energy', *Macmillan's Magazine*, 1 May 1868; pp. 319 - .327.

Stewart was a Scottish physicist and astronomer most noted for his work in radiant heat and his observation of the 'Stewart Super Flare' in 1861 while he was the director of the Kew Observatory. He was educated at and subsequently employed by the University of Edinburgh and was a devoted churchman who eventually became a supporter of psychical research and spiritualism.[606] Tait's obituary for his former colleague highlighted a significant incident, in some ways reminiscent of Thomson's curling accident, which befell Stewart in 1870, shortly after taking up the post of Professor of Physics at Owens College in Manchester, when he was one of several casualties of "the terrible railway accident at Harrow":

> About twenty years ago Stewart met with a frightful railway accident, from the effects of which he did not fully recover. He was permanently lamed, and sustained severe injury to his constitution. From the vigorous activity of the prime of life he passed, in a few months, to grey-headed old age.[607]

This calamity preceded by five years the co-writing by Tait and Stewart of a highly speculative but nonetheless entertaining discussion of the possible existence of eternity which will be discussed in due course. Given the nature of the argument previously advanced concerning the emotional springs of intellectual currents it can be argued that this near fatal accident accelerated the development of his incipient spiritual ideas, as illustrated by his work with Lockyer, culminating in his later collaboration with Tait.

There is a near contemporary parallel, which illustrates the significant psychological impact of such a traumatic event, to be found in the case of Charles Dickens who "narrowly escaped death" when he was involved in a railway accident in 1865. He was subsequently afflicted by a variety of symptoms associated with psychological trauma such as irrational fears, uncontrolled shaking and mental flashbacks, particularly during train journeys:

---

[606] 'Memoir of the late Professor Balfour Stewart, LL.D., F.R.S. By Professor A. Schuster, Ph.D., F.R.S., F.R.A.S.,' in *Memoirs and Proceedings of the Manchester Literary & Philosophical Society*, Fourth Series, vol 1 (Manchester, 1888) pp. 253 – 272, p. 265. P. Charbonneau, 'Stewart, Balfour' in T. Hockey (ed.), *Biographical Encyclopedia of Astronomers* (New York, 2014) pp. 2057 – 2059.

[607] 'Terrible Railway Accident at Harrow', *The Western Mail*, Monday, 28 November 1870, p. 2. A. Schuster, *Biographical Fragments* (London, 1932) p. 206. P. G. Tait, 'Dr. Balfour Stewart, F.R.S.', *Nature*, 29 December 1887, pp. 202 – 203.

> His son Henry recalled that he got into a state of panic at the slightest jolt; Mamie [Dickens' daughter] attested that her father's nerves were never really the same again: he "would fall into a paroxysm of fear, tremble all over and clutch the arms of the railway carriage." An uncanny repetition also characterizes his death, falling as it did on the anniversary of the accident five years later.[608]

Further indications of Dickens' frame of mind in the period after the Staplehurst crash can be found in the two notable publications which he worked on prior to his death. One was a short story with supernatural overtones featuring a spectral figure whose appearances preceded a series of railway accidents (*The Signal-Man*, 1866). His final, unfinished, novel was pervaded with foreboding and (almost titular) dread, its plot being based on opium addiction, sexual obsession and murder (*The Mystery of Edwin Drood*).[609] Dickens couched his post-crash existential fears in the form of gothic horror fiction whereas Stewart was later to resort to imagined universes which he argued were nonetheless consistent with the tenets of physical science.

Lockyer was an amateur astronomer and civil servant from the English midlands who eventually became both an astrophysicist and an author of popular science books. He is credited with the discovery of the element helium but is probably best known as the editor of the journal *Nature* from 1869 to 1919. He had been, as a younger man, a broad church Anglican and a Christian Socialist. His first foray into scientific journalism had occurred at a relatively early age; "In 1862 his Wimbledon neighbour Thomas Hughes (1822 - 1896), a well-known Christian Socialist, had recruited Lockyer to help him establish a new journal called *Reader* that would allow for uninhibited discussion of British science, religion and art."[610] He was at that time seen to be close to the X-Club, whose members published a number of articles in early editions of *Nature*, but it is apparent from some of the correspondence in the columns of the journal that, at times, Lockyer had to 'hold the ring' during debates between the scientific naturalists and members of the North British group.[611]

---

[608] J. L. Matus, 'Trauma, Memory, and Railway Disaster: The Dickensian Connection', *Victorian Studies*, 43, 3 (Spring, 2001) pp. 413 – 436, pp. 413 – 414.
[609] Only six of the planned twelve instalments were completed before Dickens dearth in 1870.
[610] M. Baldwin, 'The shifting ground of *Nature*: establishing an organ of scientific communication in Britain, 1800 – 1900', *Hist. Sci.* 1 (2012) pp. 125 – 152, p. 128. *Reader* was published from 1862 until 1867. A. J. Meadows, *Science and controversy: a biography of Sir Norman Lockyer* (London, 1977) p. 9.
[611] Barton, 'Scientific Authority'.

Lockyer suffered several bouts of illness during the mid-1860s, culminating in "a more prolonged one in the middle of 1868." Following this last malady, which may have been related to what amounted to a significant set-back to his career at the War Office, he took a lengthy convalescence which included a walking tour in Switzerland.[612] This affliction, followed by a long break, provided the space and perhaps the motivation for co-writing with Stewart a paper in which *inter alia* they attempted to identify an underlying basis for free will which remained consistent with the principle of dissipation.

Some of the points discussed by Stewart and Lockyer in *The place of life* echoed earlier arguments made by Thomson. Although energy cannot be created it can be transformed and the nature and timing of such organisational change can, in principle, be managed by an infinitesimally tiny quantity of consciously directed energy. The particular example used in the Stewart and Lockyer article was the employment of "less than any assignable amount" of energy in the mind of an actor who pulls the trigger of a gun, the end result of which might be that "if well pointed, it may explode a magazine, - nay, even win an empire."[613] They proposed "two hypotheses of the action of life" which they declined to choose between:

> The first of these is the materialistic hypothesis, which denies the existence of life as a principle apart from matter; while the other allows the existence of an independent principle, but assumes its action to take place through the medium of a machine of infinite delicacy, so that by a primordial impulse of less than any assignable amount a finite and visible outcome is produced. These are two alternatives, and it is not within our province to attempt to decide between them. The battle must be fought in other pages than ours, and by other weapons than those which we can produce.[614]

The rather tautological argument in which the discharge of a small, but not quite zero, quantum of energy acts as a sort of proxy for free will and consciousness must have seemed rather unsatisfactory even to its authors, hence their refusal to positively endorse it although it was clearly their preferred solution.

---

[612] Meadows, *Science*, pp. 10 – 12.
[613] Stewart and Lockyer, 'The Sun', p. 324.
[614] Ibid., p. 326.

Stewart and Lockyer's approach was evidently a continuation of Maxwell's earlier contribution and was rather more cautious than that of Fleeming Jenkin who "offered a plausibility argument" in the same year to the effect that if the will acted continually at right angles to an object that it wished to influence then no energy would be lost in the process.[615] This ongoing dilemma of the operation of the will without the consumption of a finite amount of energy was almost, but not quite, resolved at a later date by the work of a French hydrodynamicist called Joseph Boussinesq (1842 – 1929) who was endeavouring to demonstrate the indeterminacy of fluid flows in relation to the vortex atoms on which Thomson and Stewart had also been working:

> In most of the former methods, Dr. Balfour Stewart's &c. there was a certain small but finite amount of travail decrochant or trigger-work for the will to do. Boussinesq has managed to reduce this to mathematical zero, but at the expense of having to restrict certain of the arbitrary constants of the motion to mathematically definite values, and this I think will be found in the long run very expensive.[616]

As it happened, this letter from Maxwell to Francis Galton (1822 – 1911), in which he saw the glimmerings of a solution to his quandaries about the existence of non-dissipating psychic components of the soul, including the elusive but essential property of free will, was written just before he had "begun to be troubled by difficulties in swallowing – the first significant symptom of the disease which was to prove fatal." He died in November 1879, after several months of this serious illness which was accompanied by severe pain.

He was visited daily by his parish priest who subsequently described the performance of the firmness of his faith and composure in the face of death which were stimulated by his reading of the religious writers who had provided spiritual sustenance for his continued allegiance to evangelical Christianity; "Milton, Keble, Newman, Wesley, George Herbert the latter his chief favourite;". The cleric reported that Maxwell continued to subscribe whole-heartedly to the primary tenets of his chosen faith, spurred no doubt by awareness of his forthcoming demise:

---

[615] Smith and Wise, *Energy*, p. 628. F. Jenkin, 'Lucretius and the atomic theory', in Colvin and Ewing, *Fleeming Jenkin*, vol 1, pp. 177 – 214, pp. 192 – 194.
[616] Maxwell to Francis Galton, 26 February 1879, Francis Galton Papers, The Library, University College London, quoted in Smith and Wise, *Energy*, p. 632.

> … his illness drew out the whole heart and soul and spirit of the man; his firm and undoubting faith in the Incarnation and all its results; in the full sufficiency of the Atonement; in the work of the Holy Spirit. He had gauged and fathomed all the schemes and systems of philosophy, and had found them utterly empty and unsatisfying - "unworkable" was his own word about them - and he turned with simple faith to the Gospel of the Saviour.[617]

Maxwell's letter to Galton had been intended in part as a riposte to the 1874 *Belfast Address* in which John Tyndall had asserted, amongst several other claims, that psychical phenomena were just as subject to the physical laws of causes and effect and the constraints provided by the laws of thermodynamics as were the mechanistic processes of inanimate matter. Although this was a view which had been held for some time by members of the X-Club and other scientific naturalists it was, of course, not an opinion shared by some of their more northerly peers. As Stanley has pointed out, this debate was not merely a matter of life and death; "For Maxwell, the stakes were even higher: the existence of the soul and the progress of science."[618]

One interesting side-effect of Tyndall's *Address* was the impetus it gave to a relatively recent revival of interest in Lucretius as the standard bearer of the Epicurean philosophy of atomism. This revival had its origins, according to Turner, in the appearance of H. A. J. Munro's English translation of '*De Rerum Natura'* in 1864, followed by two significant contributions published in 1868; the poem *'Lucretius'* by Alfred Lord Tennyson and an article on *'The Atomic Theory of Lucretius'* by Jenkin.[619]

Following Tyndall's intervention, a number of "expressly Christian commentaries" by "John Veitch, John Masson, W. H. Mallock and others" engaged in dialectic processes of resurrecting and then refuting the views of the Roman philosopher on the grounds of scientific inaccuracy.[620] In many ways this was an exercise in futility, the intellectual equivalent of a Quixotean tilting at windmills, since it is apparent from any reasonably close reading of Tyndall's speech that Lucretius was not being engaged as the ultimate authority in the cause of atomism but was instead employed as a literary

---

[617] Campbell and Garnett, *Life*, pp. 411 – 416.
[618] Stanley, 'Pointsman', p. 491.
[619] F. M. Turner, 'Lucretius among the Victorians', *Victorian Studies*, 16, 3 (March 1973) pp. 329 - 348, pp. 334 – 335. Jenkin, 'Lucretius'.
[620] J. Holmes, 'Lucretius at the Fin de Siècle: Science, Religion and Poetry', *English Literature in Transition*, 1880-1920, 51, 3, 2008, pp. 266 - 280, p. 267. Turner, 'Lucretius', pp. 340 – 348.

device. His role was to provide a mouthpiece for a particular thesis, to which Bishop Butler was the antithesis, from which Tyndall drew a Hegelian synthesis in support of his broadly pantheistic conclusions.[621]

Nonetheless, renewed interest in Lucretius' version of atomic theory coincided neatly with a parallel debate amongst scientists about the true nature of atoms. This debate had extensive roots in another ongoing disagreement between protagonists who posited a universe composed entirely of matter and those who maintained, with Thomson, that there was still room, or even a requirement, for the existence of immaterial entities such as mind or spirit. Over time Thomson had developed a view which held that atoms are in fact miniature whirlpools originating within the "perfect fluid all through space" i.e. the ether. In 1867 he asserted that such fundamental building blocks of matter are "indestructible" and that therefore "they had the additional advantage that only God could create them". This idea, which had been supported by his recent correspondence with Helmholtz and subsequent experiments with smoke rings, was further supported by Jenkin in his essay on Lucretius.[622]

Thomson's hypothesis suggested as a corollary that if atoms are not interconvertible, but are in fact indestructible, then they must all have been created by some transcendent power and the total stock could not now be increased or decreased by human effort; a conviction which helps to explain his subsequent rejection of the idea that radioactivity could be the source of the sun's energy.[623] His motivation for continuing to support the 'vortex atoms' theory against the possibility of radioactive decay was also likely to have included a distaste for having much of his earlier work on this topic deprecated.[624]

Maxwell similarly supported the idea of indestructible matter, claiming no less an authority than that of John Herschel for his assertion that molecules had "the exact quality of a manufactured article"

---

[621] Turner, 'Lucretius', pp. 336 – 337. R. Barton, ''John Tyndall, Pantheist: A Rereading of the Belfast Address', *Osiris*, 2nd Series, 3 (1987), pp. 111 - 134.
[622] Smith and Wise, *Energy*, pp. 417 – 419. Jenkin, 'Lucretius', pp. 185 – 188.
[623] Smith and Wise, *Energy*, pp. 549 – 551, 607 – 611.
[624] Thompson, *Life*, vol 1, pp. 510 – 519. Thompson, *Life*, vol 2, p. 1190.

rather than having in some way evolved from precursory ingredients as had been claimed by Spencer, Tyndall and others.[625] He observed that the universal nature of matter had been recently demonstrated by the discovery of the spectra of "stars so distant that no material thing can ever have passed from one to another":

> Each molecule, therefore, throughout the universe, bears on it the stamp of a metric system as distinctly as does the metre of that Archives at Paris, or the double royal meter of the Temple of Karnac.[626]

This evidence appears to have been adduced partially in support of his disagreement with the claims made by Charles Piazzi-Smyth (1819 - 1900) of ancient British connections with the metrology of the Great Pyramid, but it was clearly also a building brick in his vision of a cosmos in which there is "a *collocation*, to use the expression of Dr. Chalmers" of matter whose dimensions, locations and motion had been determined by an omnipotent architect; "Him Who in the beginning created not only the heaven and earth, but the materials of which heaven and earth consist."[627]

As has been noted in Chapter 2, the reception of Tyndall's *Address* by the commentariat can be divided into two camps, broadly characterised as progressive and conservative respectively. Tyndall, as a representative of the progressives, was convinced that the debates relating to long chronologies for geological formation processes and the two major developmental hypotheses, the nebular origin of the solar system and the origin of species, were effectively done and dusted.[628] In forming this conclusion he was, of course, at considerable variance with most of the North British group who were much more inclined to accept a shorter (but clearly longer than biblical) chronology based on calculations of the longevity of the solar luminary derived primarily from consideration of the first

[625] Smith and Wise, *Energy*, pp. 535, 645. Stanley, 'Maxwell', pp. 476 – 477.
[626] J. C. Maxwell, 'Molecules', *Nature*, 8, 25 September 1873, pp. 437 – 441, p. 441.
[627] S. Schaffer, 'Celestial Eccentric', *Nature*, 333, 2 June 1988, pp. 405 - 406. E. M. Reisenauer, '"The battle of the standards": Great Pyramid metrology and British identity', 1850 -1890, *The Historian,* 65 (2003) pp. 931 – 978. Maxwell, 'Molecules'.
[628] Tyndall, 'Apology', pp. 205 – 206.

and second laws of thermodynamics.[629] Tyndall's standpoint also conflicted with Maxwell's theistic molecular speculations.[630]

A somewhat more reflective strand of criticism and debate in relation to the *Address* originated with the well-known Unitarian author and minister, the Reverend James Martineau (1805 – 1900). In a speech given in October 1874 Martineau devoted significant space to the abstruse question of whether atoms (which he saw as forming the totality of Tyndall's materialist universe - inherited from Democritus and Epicurus via Lucretius) are all of a similar kind i.e. homogenous in nature but capable of being combined into different external elements and molecules, or whether they are heterogeneous i.e. a hydrogen atom is qualitatively different from a carbon atom.[631] Martineau claimed that if the latter case holds true, atoms cannot be the underlying explanation of things spiritual as well as physical. In support of his argument he pointed out to the North British physicists that their vortex hypothesis of atomic structure "raises as many questions as it answers, and wholly unfits it for offering to the human mind a point of ultimate rest."[632]

It is interesting to observe, however, that Martineau's published version of the debate also conveyed an undercurrent of concern as to whether the materialist case, if accepted by the general public, would weaken the foundation structures which, in his opinion, underpin the principles and practices of moral behaviour. In Martineau's view it was important that:

> … religious positions are not undermined by natural science, they are traced to their real seat in human nature, and treated as postulates involved in the very existence of the reason and conscience. […] and further, that our nature in respect of its higher affections, compassion, self–forgetfulness, moral obligation, is constructed in harmony with a world Divinely ruled,[633]

[629] Gregory, 'Intersections', pp. 42 - 43.
[630] Turner, 'Victorian Conflict', p. 369.
[631] This speech is paraphrased in Martineau, 'Materialism'. Tyndall provided his own summary of the speech in: J. Tyndall, 'The Reverend James Martineau and the Belfast Address' in J. Tyndall, *Fragments of Science: a series of detached essays, addresses and reviews*, vol II (New York, 1892) pp. 224 - 250. J. Tyndall, *Address delivered before the British Association assembled at Belfast* (London, 1874) pp. 1 – 10.
[632] Martineau, 'Materialism', pp. 340 – 341.
[633] Ibid., p. 324.

Despite the concern expressed by William Francis Barry (1849 - 1930) that publications like the "*Fortnightly Review*, the *Westminster* and the *Contemporary*" had become the new "sacred texts" for the "masters of contemporary thought" the views expressed by Martineau on the relationship between science and morality in the third of these journals would not have looked much out of place in the *Dublin Review* to which Barry was a frequent contributor.[634]

Martineau also shared with the Irish Catholic commentator a concern that Tyndall has been overly influenced by the siren voices of German philosophy, including the "eminent Berlin Professor" Emil du Bois-Reymond (1818 – 1896).[635] Tyndall was in fact quite open in his address about the intellectual debt owed to such luminaries of idealist philosophy as Friedrich Albert Lange (1828 – 1875) and Johann Gottlieb Fichte (1762 – 1814), or as Barry put it:

> Mr Tyndall is even proud to make known his obligations to Fichte who died a generation ago, and to Lange, who died the other day.

This somewhat xenophobic criticism, which almost luxuriates in the deaths of the two luminaries, also extended to the potential dangers of alternative spiritual strands such as Buddhism which "teaches the philosopher a stoical morality (which degenerates into materialism amongst the people …)".[636]

Thus, we can perhaps discern a second dichotomy or fault line in the reception of Tyndall's *Address*. In addition to the somewhat essentialist characterisation of the debate as being 'modern science' versus 'traditional religion', there was also an indication of a division based broadly on class. What Martineau and other liberal theologians appeared to hold in common with the more conservative elements of the church (including Catholicism), as well as the North British physicists, is that the 'lower orders' may not be capable of being trusted to behave morally if the traditional props of revealed religion are to be replaced by the amoral conclusions of scientific naturalism. This nascent middle-class moral panic provides an additional, if unconscious, motivation for the criticism levelled at Tyndall's thesis, underlying the surface

[634] Barry, 'Mr. Tyndall', p. 444.
[635] Martineau, 'Materialism', p. 339.
[636] W. F. Barry, 'Recent German thought – its influence on Mr. Tyndall.', *The Dublin Review*, 1836 - 1910; Oct 1877; 29, 58, pp. 469 – 487, pp. 470 – 471.

appearance of being a debate about epistemological authority and a struggle for influence between the proponents of science and the pillars of religion.

Another reaction emanating from the North British group which can clearly be seen as having been triggered by the *Address* was the attempt by Balfour Stewart and Peter Tait to pose a spiritual alternative to what they saw as Tyndall's materialist manifesto. Tait and Stewart jointly wrote a book called *Unseen Universe or Physical Speculations on a Future State* which first saw the light of day in 1875. One of Stewart's colleagues, Arthur Schuster (1851 - 1934), was firmly of the opinion that most of the content in the first edition had originated from Stewart. Tait's initial contribution was limited to a preface which "was almost entirely taken up with an attack on John Tyndall," and had to be completely rewritten.[637]

Stewart and Tait's objective was to combine the temporally limited visible universe, which had been sentenced to both a finite past and a future death by thermodynamics, with an infinite but invisible creation designed and built by a "Supreme Governor" or "Absolute One" who happened to also be the God of Revelation. They thereby endeavoured to reconcile the new ideas promulgated by science with pre-existing beliefs derived from religious texts:

> The truth is, that science and religion neither are nor can be two fields of knowledge with no possible communication between them. Such a hypothesis is simply absurd. There is undoubtedly an avenue leading from the one to the other, but this avenue is through the unseen universe,[638]

Christianity, in their view, was unique in that it possessed texts and revelations which demonstrated a greater understanding of the true nature of the universe than do the other religions which they had briefly and somewhat partially surveyed in their early chapters:

> If then we regard the universe from this point of view we are led to a scientific conception of it which is, we have seen, strikingly analogous to the system which is presented to us in the Christian religion. For not only are the nebulous beginning and fiery termination of the present visible universe indicated in the Christian records, but a constitution and

[637] Schuster, *Biographical*, p.214.
[638] B. Stewart and P. G. Tait, *The Unseen Universe: or Physical Speculations on a Future State*, (London, 1875), pp. 60, 168, 211.

> power are therein assigned to the Unseen Universe strikingly analogous to those at which we arrive by a legitimate scientific process.[639]

Their rationale for interconnecting an infinite, external and invisible universe with the more mundane construct which is all that limited human senses can perceive was derived somewhat adventitiously from the first law of thermodynamics which they rebranded as the "Principle of Continuity" and which they claimed meant that matter and energy cannot be created *ex nihilo* but must always have existed and will continue to exist into the future. The continuing existence of everything which had ever existed was in turn the mechanism by means of which they managed to justify the parallel concept of immortality for sentient beings. In their expanded cosmos the seen and unseen universes are connected via the medium of the ether which is responsible for the transmission of thoughts from the former to latter thus creating and maintaining a set of 'shadow' souls in this invisible place.

This perfectly preserved parallel universe which provides a 'safe harbour' for the soul can also be read as an otherworldly embodiment of the right-wing political views of Tait whose "general outlook upon human affairs was fundamentally conservative." Despite his vehement opposition to Tyndall's materialism he would have in other respects concurred with his opponent on some more mundane topics, including having "had a deep distrust of Mr Gladstone as statesman and legislator."[640] Tyndall's parallel rejection of "the evil genius Gladstone" and his policy on Irish Home Rule were later evidenced by his donation of £100 to the Ulster cause, as reported in the New York Times of 1892 with the following comment:

> Prof. Tyndall predicts that the first Loyalist blood shed in Ulster […] will rouse a feeling that will sweep Gladstone's Irish policy to perdition.[641]

In one section of *Unseen Universe,* Stewart and Tait expanded the scope of their thesis significantly by alluding to the work of Thomas Young (1773 - 1829) who had proposed the existence of a series of further invisible universes:

---

[639] Stewart and Tait, *Unseen*., p. 210.
[640] Knott, *Tait*, p. 37.
[641] 'Gladstone's Home Rule', *The New York Times,* 25 June 1892.

> It seems therefore natural to believe that the analogy may be continued still further, until it rises into existences absolutely immaterial and spiritual. We know not but that thousands of spiritual worlds may exist unseen for ever by human eyes; nor have we any reason to suppose that even the presence of matter, in a given spot, necessarily excludes these existences from it.[642]

Tait and Stewart's later versions borrowed from the concept of Young's 'Russian doll' by hypothesizing that our three-dimensional universe sits within a higher order four-dimensional universe. The invisible fourth dimension was then supposed to exist within a five-dimensional cosmos and so on; presumably *ad infinitum*. As a logical consequence of the supposed additional dimensions and also in response to a somewhat negative review by William Kingdon Clifford (1845 - 1879), they then adduced the idea that higher order universes could intrude themselves into lower order entities "- so the matter of our present universe may be regarded as produced by mere rents or cracks in that of the Unseen."[643]

These openings in the surface of our world were supposed to give rise to portals into the invisible sphere which the authors also equated with heaven in much the same way as lakes and ponds were regarded in Celtic mythology as gateways into the underworld.[644] The authors endeavoured to base this speculation on a biblical source by alluding to the apostle Paul and his vision of a "third heaven".[645] They proceeded to employ such 'magic doors' to account for prophecies and miraculous events in the Bible, thus countering earlier challenges to the credibility of such narratives; "Therefore miracles were not discontinuities or examples of special providence but subject to law."[646]

The idea of connecting doors between dimensions would have particularly appealed to Stewart, whose interest in spiritualism was to lead to him becoming a founder of the Society for Psychical Research (SPR), eventually taking on the role of President. Despite Schuster's observation that Stewart's attitude was one of "impartial and philosophical inquiry, and that no subject is beneath the attention of scientific men.", it is not difficult to trace a connection between his close brush with death and his

---

[642] B. Stewart and P. G. Tait, *The Unseen Universe: or Physical Speculations on a Future State*, (London, 1886) pp. 160 - 161.
[643] W. K. Clifford, 'The Unseen Universe', *Fortnightly Review*, May 1865 - June 1934; Jun 1875; 17, 102; pp. 776 – 793. Stewart and Tait, *Unseen*, 1886, p. 221.
[644] J. T. Koch, *Celtic Culture: A Historical Encyclopedia*, (Santa Barbara CA, 2006), p. 1671.
[645] Stewart and Tait, *Unseen*, 1886, p. 221. The original Pauline reference is 2 Corinthians 14:2 – 4.
[646] Hilton, *Atonement*, p. 367.

subsequent engagements with both *The Unseen Universe* and "the many new deaths discovered in the practices of spiritualism and psychical research".[647]

It was evident that Stewart and Tait had, at least to their own satisfaction, successfully defended many of the tenets of the Christian faith, including most crucially an eternal heaven in which the immortal souls of believers could survive, from two contemporary threats. The first of these was the attempt by agnostic materialists to remove all requirements for divine management from the developmental laws and processes which shape the world as we now see it. The second, somewhat ironically, was the threat to infinite time which had arisen from the ruminations of astronomers and physicists, some of whom professed the Christian faith, who had pronounced a doom on the visible universe by the introduction of the inevitability of entropic decay. Or as Darwin put it in his autobiography:

> With respect to immortality, nothing shows me how strong and almost instinctive a belief it is, as the consideration of the view now held by most physicists, namely that the sun with all the planets will in time grow too cold for life, unless indeed some great body dashes into the sun and thus gives it fresh life.—Believing as I do that man in the distant future will be a far more perfect creature than he now is, it is an intolerable thought that he and all other sentient beings are doomed to complete annihilation after such long-continued slow progress.[648]

The book turned out to be rather more popular than presumably even its authors had anticipated, eventually running to four editions and nine reprints. It was still in print in 1890.[649] One presumably welcome consequence of the success of *Unseen Universe* was its adoption as a kind of spiritual 'call to action' by the psychologist William James, who had reviewed the book shortly after its initial appearance. Prompted by the optimistic tone of Stewart and Tait's work and its apparently elegant resolution of the potentially conflicting findings of religion and science, James concluded that there was "a 'duty' to believe, holding that belief in a transcendent realm was not only permissible but something which one may be duty bound to hold if it would, for the believer, be a source of commendable action or peace of mind."[650] He went on to turn this uncritical acceptance of some of

---

[647] Schuster, 'Memoir', p. 265. Hayward, *Resisting*, p. 21.
[648] N. Barlow, *The autobiography of Charles Darwin 1809-1882. With the original omissions restored. Edited and with appendix and notes by his grand-daughter, Nora Barlow.* (London, 1958).
[649] Knott, *Tait*, p. 365.
[650] W. James, 'Review of *The Unseen Universe'*, *Nation*, 20 (1875) pp. 366 – 367. H. Brown, *William James on Radical Empiricism and Religion* (Toronto, 2000) p. 29.

the core tenets of the book into the fundamental thesis of a much later lecture and book entitled *The Will to Believe* in which he argued that religious belief in the absence of evidential support is permissible in certain circumstances.[651] This interpretation would have been somewhat at odds with the views of the original authors in that they seem to have convinced themselves that sufficient evidence existed for their proposed regression of universes as the underpinning of faith.

The main argument made in this thesis has been the contingency of changes in theological, philosophical and metaphysical perspectives which can be traced to significant, and in many cases traumatic, life events which precipitated a significant reappraisal of personal epistemologies. It is, on the basis of this discourse, unsurprising that such connections have again been found in the narrative arcs of the scientists whose stories we have surveyed in this chapter. These *Weltbild* disruptions have been culled from the biographies of a selection of subjects who shared a broadly anti-materialist position. Their religious backgrounds were primarily influenced by Scottish Presbyterianism, although it would clearly be disingenuous to too closely tie these subjects to a narrow doctrinal position. At first sight there may appear to be more than a suspicion in the cases of both northern physicists and southern biologists, that their epistemological views can be traced to their early exposure to either fundamental Calvinism on the one hand or the more reflexive strains of Anglicanism and Unitarianism on the other. As is often the case, however, if we look past the superficial evidence the picture is rather more nuanced.

As was pointed out earlier, William Thomson wrote the first in a series of papers which, in furtherance of his personal religious views and his distaste for geological and biological chronologies, argued for limited longevity of the sun and the earth at a time when he was recovering from a severe and very painful fracture. According to his niece; “It had occupied him while laid up with his broken leg, and he was not able to be present and read it himself”.[652] Thus it would be reasonable to posit a

[651] W. James, *The Will to Believe and other Essays in Popular Philosophy* (New York, 1912).
[652] King, *Kelvin*, p. 100. The letter from which she quoted was sent by W. Thomson to D. King (the father of Agnes and the author of a popular book on geology) on 8 January 1862.

causal connection, a suggestive sequence of significant stress and continuing concerns for his wife's well-being leading to speculations about solar and terrestrial death.

What is less clear is whether his mature ecumenicism, which does not bespeak a strong confessional alignment, completely overwrote the effects of an early upbringing in Belfast and then Glasgow during which evangelical Presbyterianism may have left a deeper imprint than his subsequent comments might suggest. It is of interest, for example, to note that the local church which Thomson attended as a boy in Ireland had been funded by his father and inaugurated by a well-known evangelist; "The famous Dr. Chalmers was invited to come from Scotland to open the church, and he stayed about a week with us on the occasion."[653] A reasonable response to the events of 1861-2 might be to infer that the outwardly rational latitudinarian self which was a component of his adult *Weltbild* was forced to contend, either temporarily or permanently, with an earlier and more evidently Calvinist construct.

Balfour Stewart, whose religious affiliation was originally and remained broad church, culminating in a general interest in spiritualism, had already begun to think about the nature of free will and consciousness when he co-wrote *The place of life* with a convalescent Lockyer in 1868. Two years later he had his leg broken in a serious railway accident which had also caused a number of fatalities amongst his fellow passengers.[654] This calamity, in some ways similar to the accidents which befell Thomson and Dickens, was presumably also treated with powerful pain-killing drugs. It preceded the writing by Stewart and his colleague, Peter Guthrie Tait, of their highly speculative but nonetheless entertaining tome on science, religion and immortality by approximately five years. His interest in, and pursuit of, these topics may well have been further spurred by his injury and its after-effects although it is also clear that the proximate cause of the writing of *Unseen Universe* was undoubtedly the sense of provocation caused by Tyndall's *Address*.

[653] E. T. King, *Lord Kelvin's early home* (London, 1909) p. 47.
[654] 'Railway Accident', p. 2.

Fleeming Jenkin's scientific career encompassed a variety of fields. He acted as a populariser of Thomson's work on terrestrial longevity, producing more understandable versions of the arguments which his fellow physicist had made. Jenkin was perhaps the least religiously inclined member of the North British group and his involvement in the chronology and free will debates seems to have sprung from his membership of, and loyalty to, the in-group formed by a particular professional community as much as from his theological conviction. An interesting aspect of Jenkin's interventions were that they did not follow immediately after either the publication of Darwin's thesis in 1860 or the counter-arguments which emanated from Thomson in 1862, but actually began in 1867, two years after a night of considerable trauma and the advent of his own frustrating disability which echoed those of Thomson and Stewart.

In summary, there appear to have been a number of factors which inspired the North British physicists to produce their less materialistic, and occasionally overtly religious, ruminations on the nature of life, the universe and everything. Although they mostly shared, or at least empathised with, a broadly religious perspective this was not the only factor which drove their *Weltbilder*. They had all been wholly or partly raised in Scotland and presumably felt a degree of competition with metropolitan English scientists who held broadly agnostic views. The threat of intellectual dominance in their chosen profession must also have been a cause for rivalry and a spur to competition for the Caledonian contingent. Traumatic disruptions and long-term illnesses clearly played some part in the timings of their responses; the emotive and existentialist crises which were prompted by these setbacks were, at least to some extent, the stimuli which crystallised their responses. Such events also acted as breaks from the day to day considerations of more mundane matters and an opportunity for contemplation of more abstract, and yet also quite fundamental, thoughts. Thomson's broken leg, for example, "prevented his experimenting for a whole winter."[655]

It should not be overlooked that the North British group were, in general, very successful both materially and academically; two kinds of achievement which were both compatible with and even

[655] P. G. Tait to A. Cayley, 4 February 1886 quoted in Knott, *Tait*, p. 189.

encouraged by a Calvinist upbringing. The west coast engineer William Thomson and his cosmopolitan protégé Fleeming Jenkin both received substantial incomes from their work on telegraph cables. Thomson, for example, responded to the death of his wife in 1870, after many years of delivering "loving care", with a consolatory gift to himself of a 126-ton yacht, the *Lalla Rookh*.[656] Their relatively privileged positions in society, as with James Martineau, provided additional motivation to preserve the tenets of moral behaviour which were associated with revealed religion.

James Clerk Maxwell, having less dependence on his scientific work as a means of financial support, could afford to "get fonder of metaphysics" and favour academic purity over practical application:

> I find I get fonder of metaphysics and less of calculation continually, […]
>
> Experiment furnishes us with the values of our arbitrary constants, but only suggests the form of the functions. Afterwards, when the form is not only recognised but understood scientifically, we find that it rests on precisely the same foundation as Euclid does, that is, it is simply the contradiction of an absurdity, out of which may we all get our legs at last![657]

He was subsequently acknowledged by Einstein and others as having produced some of the most important theoretical conclusions of the nineteenth century. Although there was a hiatus between his death in 1879 and the wider recognition of the validity of his work on the unity of different forms of electromagnetic radiation, the equations with which he described their behaviour remained "relativistically" valid during and after Einstein's rewriting of the existing laws of physics and led to a conclusion which was fundamentally attuned to and inspired by the desires of the North British group to displace the materialist underpinnings of the seen universe:

> ... we may say that, before Maxwell, Physical Reality, in so far as it was to represent the processes of nature, was thought of as consisting in material particles, whose variations consist only in movements governed by partial differential equations. Since Maxwell's time, Physical Reality has been thought of as represented by continuous fields, governed by partial differential equations, and not capable of any mechanical interpretation.[658]

---

[656] King, *Kelvin*, pp. 32 – 33. Smith and Wise, *Energy*, p. 733 *et seq*.
[657] J. C. Maxwell to R. B. Litchfield, 4 July 1856 reprinted in Campbell and Garnett, *Life*, p. 261.
[658] P. J. Nahim, 'Maxwell's grand unification', *IEEE Spectrum*, March 1992, p. 45. A. Einstein, 'Maxwell's influence on the development of the concept of physical reality' in *James Clerk Maxwell: A Commemoration Volume 1831 – 1931* (Cambridge, 1931) pp. 66 - 73. p. 71.

Epilogue: Charles Darwin and the subtle interactions of psyche and soma.

On the 30th of April 1851 Charles Darwin wrote a "short sketch" in order to capture the feelings of "very severe grief" he was experiencing following the recent death of his daughter as "she finally succumbed to tuberculosis." He had closely observed Annie during the last few feverish weeks of her life and he could only confide his anxiety to his pregnant wife Emma (née Wedgwood, 1808 – 1896), who had not accompanied him to Malvern, via a series of "poignant letters". His memoir was "a stunning vindication" in which "Annie appears as a type-specimen of all the highest and best in human nature."[659] Darwin recorded at some length his recollections of his daughter's *joie de vivre* prior to her illness, her performance of "angelic" stoicism and his own emotions following her undeserved death:

> From whatever point I look back at her, the main feature in her disposition which at once rises before me, is her buoyant joyousness, tempered by two other characteristics, namely, her sensitiveness, which might easily have been overlooked by a stranger, and her strong affection.
>
> […]
>
> In the last short illness, her conduct in simple truth was angelic. She never once complained; never became fretful; was ever considerate of others, and was thankful in the most gentle, pathetic manner for everything done for her. When so exhausted that she could hardly speak, she praised everything that was given her, and said some tea 'was beautifully good.' When I gave her some water, she said, 'I quite thank you;' and these, I believe, were the last precious words ever addressed by her dear lips to me.
>
> We have lost the joy of the household, and the solace of our old age. She must have known how we loved her. Oh, that she could now know how deeply, how tenderly, we do still and shall ever love her dear joyous face! Blessings on her![660]

In recent years it has become almost a historiographical given that the loss of "the joy of the household" was the final straw which confirmed Darwin's loss of faith in a Christian theodicy and perhaps further motivated his engagement with the secular processes of biological evolution. As this episode can be seen as a precedent and exemplar for some of the arguments made above, it is

[659] Barlow, *Autobiography*, pp. 97 – 98. Brooke, 'Darwin', p. 397. Moore, 'Death', p. 218.
[660] F. Darwin, (ed.). *The life and letters of Charles Darwin, including an autobiographical chapter*. vol 1 (London, 1887) pp. 132, 134.

important to note that the case of 'Darwin and Annie' suggests some notes of caution which are relevant to the histories which have been examined in this thesis.

It has always been evident from both contemporary accounts and subsequent scholarship that during his career Darwin suffered a significant lessening of belief in revealed religion. For a long time it had been assumed, based on comments made by Darwin himself, that the process of unconversion occurred, or at least began, relatively early in his career.[661] This development was not, for him, particularly dramatic or disturbing; "disbelief crept over me at a very slow rate, but was at last complete. The rate was so slow that I felt no distress, and have never since doubted even for a single second that my conclusion was correct."[662]

In an important intervention in 1989, however, James Moore argued that the timing and circumstances of Darwin's final loss of Christian faith needed to be significantly reconsidered.[663] After examining the context and sequence in which Darwin's thoughts on religion were presented in his *Autobiography*, which had not been available in unexpurgated form until 1958, Moore placed the key events in his changing relationship with religion in the period "from 1848 to 1851" when he was emotionally impacted by two important events:

> On the one hand, he had drawn the line in the first part of the section on religious belief by angrily rejecting Christianity for its 'damnable doctrine', that would put his father in hell. Dr Darwin [his father] died on 13 November 1848. […] Annie died on 23 April 1851. Two strong emotions, anger and grief, in the *Autobiography* mark off the years from 1848 to 1851 as the period when Darwin finally renounced his faith. Two deaths, and two births, lie at its extremes.[664]

Annie's death, on this interpretation, can therefore be seen as the final act in a chain of events which precipitated Darwin's terminal break with the concept of a caring and paternalist Trinitarian god.

---

[661] Moore 'Death', p. 197.
[662] Barlow, *Autobiography*, p. 87.
[663] Moore, 'Death'. This argument was further developed in A. Desmond and J. R. Moore, *Darwin* (London, 1991).
[664] Moore, 'Death', p. 209. The passage which Moore used as his source for this reading is: Barlow, *Autobiography*, pp. 85 – 98.

The episode of Darwin's loss of faith and the death of Annie illustrates two key points which are of great relevance to the present work. Firstly, we are dealing with written sources which do not easily yield a clear understanding of the writer's *Weltbild,* especially as they may have been carefully crafted by a 'diary-writing' self to present a version of the author's interiority which was deemed suitable for wider consumption. To quote Brooke:

> Darwin disliked interrogation, protesting that he could not see why his beliefs should be of interest to anyone but himself. The complication here is that his writings did contain remarks calculated to cause least offence. He knew there were things he should say and not say, particularly concerning the human mind, if he wished to retain public sympathy. […]. The upshot is that there are degrees of ambiguity in Darwin's remarks about religion that can make them difficult to interpret …[665]

Secondly, when we endeavour to untangle the complexity of the ways in which real lives are lived we need to guard against an over-determined and essentialist assumption that a temporal sequence is necessarily proof of contingency. In the case of Darwin, for example, there was a considerable period of elapsed time between the two bereavement events and the production of Darwin's first major thesis on evolution. It would also be relevant to remind ourselves that his thinking on this topic had begun far earlier, at about the time of his initial but gradual loss of belief in biblical literalism.[666] Similar gaps in time were examined in several of the case studies presented here and the associated claims of contingency have been appropriately caveated.

The story of Darwin's life also provides a further worked example of the subtle interactions of psyche and soma which have constituted the major theme of this thesis. Darwin suffered for most of his life from "mental fatigue or rather excitement" sometimes brought on by heightened emotional experiences such as "listening to the music which made him shiver." His symptoms did not improve after the move in later life to Down House and included flatulence, eczema, anxiety and headaches. His family observed that he became quite anxious about lengthy conversations with visitors and that he tended to eschew "formal ceremonies" or "scientific meetings."[667]

---

[665] Brooke, 'Darwin', p. 394.
[666] Moore, 'Death', pp. 196 – 197.
[667] R. Colp, 'More on Darwin's illness', *Hist. Sci.,* xxxviii (2000) pp. 219 – 236.

The underlying cause or causes of Darwin's illness are still very much a topic of debate amongst historians of medicine.[668] Unsurprisingly the suggested origins of his complex of neurological and gastrointestinal symptoms have varied over time in line with prevailing fashion in terms of the explanations of gastric symptoms and associated psychological perturbations.[669] Erwin Kompanje and Jelle Reumer, for example, have recently endorsed the current trend to linkages with the immune system by pointing out that Darwin's case is consistent with the known effects of Lyme disease (borreliosis). Although this hypothesis is only one possible explanation of Darwin's ailments, the pathology of borreliosis in itself provides further strong evidence of the interconnectedness of the various components of *Weltbild* which include human immunology, physiology and psychology. [670]

The important implication of such uncertain illnesses for the case being made here is that some performances of our emotional selves are evidently stimulated at least in part by underlying somatic causes, including disease, trauma and psychotropic substances. That this is indeed the case seems to be relatively well-known in medical circles, but historians have to date, with a few notable exceptions such as the case of Darwin and Annie, underweighted the importance of these factors in the formation of philosophical and scientific productions.

There has for some time been a developing and related strand within the history of philosophy and science which recognises and talks about the linkages between intellectual developments in these knowledge domains and parallel epistemologies such as politics and theology. The popular, and populist, concept of a 'war' between religion and science which prevailed for the first half of the last century has, since the 1970s, been discarded in favour of an understanding that these apparently conflicting ontologies can be viewed as being, to a greater or lesser extent, complementary. This inclusive strand of thought is well represented in the historiography of scholars like Schaffer, Brooke and Smith who have endeavoured to understand the complementarity of multiple epistemologies in

---

[668] See, for example, R. Colp, 'To Be an Invalid, Redux', *Journal of the History of Biology*, 31 (1998), pp. 211 – 240.
[669] R. Hayward, 'Busman's stomach and the embodiment of modernity', *Contemporary British History*, 31, 1 (2017) pp. 1 – 23, p. 5. doi: 10.1080/13619462.2016.1226806.
[670] E. J. O. Kompanje and J. W. F. Reumer, ''Many bad attacks of sickness' – Did Charles Darwin suffer from chronic borreliosis?', *Deinsea*, 18 (December 2018) pp. 6 – 12.

the minds of people, both present and past, as ways of seeing and knowing about the universe and the phenomena of life.

There is also, as noted in Chapter 1, an evident linkage between the ideas of those historians who see extensive connections between religious and scientific thinking in the minds of subjects and the recent turn to an understanding of how emotions are constructed by interactions between the individual and her or his physical and cultural influences. Thus the ideas generated by the history of emotions have provided significant explanatory power as we endeavour to understand, amongst many other topics, the ways in which nineteenth-century people developed their views about how their world came into being and how it operates.

This thesis has built on this emergent line of investigation by pointing to a set of stimuli which have not traditionally been as much noticed in narratives of scientific development as perhaps their importance warrants. The stimuli in question are those arising from intensely traumatic events, including serious injury, life-threatening illnesses and the potential or actual demise of a loved one. Evidence has been presented that such affects are, in some cases, closely related to relatively rapid shifts in the *Weltbild* of the subject. It is clear from the interlinking findings of several disciplines, including neuroscience and the history of emotions, that the potent feelings which arise from such incidents are both causes of and are caused by a feedback loop driven by a combination of psychological, physiological and immunological responses.

A further point which has been highlighted above is that the sites of trauma in the nineteenth century were often, mostly inadvertently, accompanied by exposure to psychotropic substances which can perhaps best be understood as externally applied analogues of the internal biochemical responses which similarly influence the emotional and cognitive responses of the mind/body system.

These arguments need, of course, to be pursued with some care. It is important to consider the available evidence ‘in the round’ when assessing the relative weightings which should be given to the various factors which may have influenced a subject’s *Weltbild*. Nonetheless, the narratives which have been presented here do provide strong evidence for adding the frequently overlooked

interrelationship between somatic shock and subsequent epistemological reformations to the armoury of the intellectual historian. Thus, for example, the cases of Thomas Chalmers and John Pringle Nichol demonstrated a clear linkage between life-threatening illnesses and religious conversion or unconversion respectively. Subsequent forays into astronomy and chronology undertaken by both subjects provides evidence of at least a partial correspondence between their emergent cosmologies and their modified theological leanings.

Some potential connections are even subtler. William Whewell's astronomical and theological reactions to his wife's terminal illness and intimations of her mortality were not instantaneous events but, like her physical decline, developed over a period of several years. It is perhaps important in Whewell's case that he was experiencing a vicarious rather than an immediate personal trauma.

Other narrative arcs, such as several of those described in Chapter 4, resemble the example of Darwin in that there were significant time lapses between affect and effect. In these cases it is more difficult to be clear that there was a strong causal link between the events in question, as opposed to the influence of the traumatic stimulus being one of several physical and cultural factors which led to a shifting set of priorities, rather than an immediate radical rethink. This less direct interplay can be argued in the cases of Fleeming Jenkin and Balfour Stewart who responded to a combination of causes, including their injuries and the assaults of 'materialists' on their theologically based science, with attacks on Darwinian chronology and Tyndall's naturalistic universe.

It has been argued throughout this thesis that the impact of an existential or emotional crisis is to drive a shift in the subject's *Weltbild*. The extent of the resulting change depended on the severity of the stimulus and the closeness of the object of an event to the individual in question; threats to the continuity of the subjects themselves being apparently the most influential. Subsequent adjustments, in some but not all cases, involved a modification of the narratives which the subject used to explain the nature of the universe and, perhaps more importantly, the probability of survival of the soul.

It is in any case difficult for humans to partition 'rational' debate from the impact of perceived challenges to the integrity of the self or even to overlook the anticipated effects of minor

inconveniences which inform the views of the subject when considering apparently neutral data. It is demonstrably difficult for us to ignore the emotional weight we place on the outcome of any series of events which have implications for our mental or physical well-being or even to objectively assess less impactful ideas which nonetheless threaten to perturb our *Weltbilder*.[671] This is not to suggest, however, that the possibility of making rational choices should be deprecated but rather that we need to ensure that the cognitive biases which frequently come into play are more widely recognised and acknowledged as key components of any knowledge-making process, including the past or present formation of scientific ideas and concepts.

In the course of studying the narratives of subjects who engaged in questions about the nature of the universe it has become clear that they and their biographers frequently referred to significant life crises which preceded important changes in their theological, metaphysical and scientific worldviews. We have reviewed many narratives of such perspective-altering life crises and interrogated the available primary sources in order to study the relationships between psyche and soma thus uncovered. Applying this mode of interpretation to the broader field of nineteenth-century scientific developments in general, we shall achieve a greater understanding of some significant and previously overlooked undercurrents which have influenced the intellectual history of that era. They are still relevant today and will continue to be so into the future.

[671] For a general review of the concept of confirmation bias see: M. E. Oswald and S. Grosjean, 'Confirmation Bias' in R. F. Pohl (ed.), *Cognitive Illusions: A Handbook on Fallacies and Biases in Thinking, Judgement and Memory* (Hove, 2004) pp. 79 – 86. Also see, as a worked example, this study which showed how existing views on the desirability of capital punishment lead to biased assimilation and attitude polarisation when subjects consider (fictional) studies which examine its deterrent efficacy: C. G. Lord, L Ross and M. R. Lepper, 'Biased Assimilation and Attitude Polarization: The Effects of Prior Theories on Subsequently Considered Evidence', *Journal of Personality and Social Psychology*, 1979, 37, 11, pp. 2098 – 2109. For a discussion of the complexity of the relationship between political orientation and belief in climate change see: D. M. Kahan and J. C. Corbin, 'A note on the perverse effects of actively open-minded thinking on climate-change polarization', *Research and Politics*, October-December 2016: pp. 1 – 5. doi: 10.1177/2053168016676705. (accessed 8 April 2019).

Bibliography of Primary Sources

Biblical references and quotations are taken from the King James Version, printed by Eyre and Spottiswoode for the British and Foreign Bible Society (London, 1857).

Correspondence between Edward Clodd and Richard Anthony Proctor can be found in the Clodd Correspondence, Brotherton Library Special Collections, Leeds University, Leeds LS2 9JT.

The correspondence of John William Frederick Herschel quoted in this thesis can be found in the library of The Royal Society, 6 – 9 Carlton House Terrace, London SW1Y 5AG.

The correspondence and pamphlets of the 3rd Earl of Rosse (William Parsons) quoted in this thesis can be found in the archives of Birr Castle, Birr, Co. Offaly, Republic of Ireland.

'Argument to prove the truth of the Christian revelation', *The Athenaeum*, 26 April 1834; 339; pp. 311 – 312.

'Astronomical Notes', *The Athenaeum*; 1 March 1890; 3253; p. 279.

'Dr. Chalmers' Posthumous works', *The Literary Gazette and Journal of the Belle Lettres, Arts, Sciences, etc.*, 20 November 1847, 1609, pp 810 – 811.

'Dr. Nichol on the system of the world (Book Review)', *The Spectator*, 12 September 1846; 19, 950, pp. 882-883.

'Dr. Nichol's Architecture of the heavens (Book Review)', *The Spectator*, 22 July 1837; 10, 473, pp. 689 – 690.

'Dr. Nichol's Lectures on Astronomy', *The Manchester Guardian*, 10 September 1851, p. 6 and 24 September 1851, p. 7.

'Gladstone's Home Rule', *The New York Times*, 25 June 1892.

'Our Weekly Gossip', *The Athenaeum*, 17 October 1846, 990, p. 1072.

'Prof. Proctor: Changed views as to Science and Religion', *Chicago Daily Tribune*, 10 November 1875, p. 7.

'Prof. Proctor: Germs of his present views in his earlier writings', *Chicago Daily Tribune*, 14 November 1875, p. 3.

'Professor Nichol', *The Scottish Review*; January 1860, pp. 1 – 17.

'Professor Nichol's lectures on astronomy', *The Manchester Guardian*, 15 May 1847, p. 4 and 22 May 1847, p. 10.

'Professor Nichol's lectures on recent astronomical discoveries', *The Manchester Guardian*, 12 May 1847, p. 6 and 26 May 1847, p. 3.

'Professor Nichol's new works', *Tait's Edinburgh magazine*; Mar 1848; 15, 171; p. 200.

'Professor Nichol's Views of the Architecture of the Heavens', *Chambers' Edinburgh journal*, 29 July 1837, pp. 210 – 211.

'Richard A. Proctor Dead', *The New York Times*, 13 September 1888, p. 1.

‘Terrible Railway Accident at Harrow’, *The Western Mail*, Monday, 28 November 1870, p. 2.

‘The Origin of Man’, *The New York Times*, 5 September 1874, pp. 1 - 4.

‘The Progress of Science’, *The New York Times*, 7 September 1874, p. 3.

‘Travels in Search of Lord Rosse’s Telescope’, *Chambers' Edinburgh Journal*, 26 December 1846; 156, pp. 401 – 404.

2nd Earl of Rosse, *An Argument to prove the Truth of the Christian Revelation* (London, 1834).

3rd Earl of Rosse, ‘A few words on the Relation of Landlord and Tenant in Ireland and in other parts of the United Kingdom’ (London, 1867).

3rd Earl of Rosse, ‘Observations on the nebulae’ in C. Parsons, *The scientific papers of William Parsons, third Earl of Rosse 1800 – 1867* (Cambridge, 2011) pp 109 – 124.

Allen, G., ‘Our Ancestors: I – The Stone Age Men’, *Knowledge*, 1, 24 February 1882, pp. 351 - 352.

Ball, R. S.., *Great Astronomers* (London, 1895).

Barlow, N., *The autobiography of Charles Darwin 1809-1882. With the original omissions restored. Edited and with appendix and notes by his grand-daughter, Nora Barlow.* (London, 1958).

Barry, W. F., ‘Mr. Tyndall and Contemporary Thought, *The Dublin review*, 1836 - 1910; Oct. 1876; 27, 54, pp. 431 – 469.

Barry, W. F., ‘Recent German thought – its influence on Mr. Tyndall.’, *The Dublin Review*, 1836 - 1910; Oct. 1877; 29, 58, pp. 469 – 487.

Brown, S., ‘The History of Science (1846)’, *Lectures on the Atomic Theory and Essays Scientific and Literary*. vol 1 (Edinburgh, 1858) pp. 299 – 344.

Butt, I., *The Irish people and the Irish land: a letter to Lord Lifford; with comments on the publications of Lord Dufferin and Lord Rosse* (Dublin, 1867).

Campbell, J. D., *Samuel Taylor Coleridge: A Narrative of the Events of his Life* (London, 1894).

Campbell, L. and W. Garnett, *The Life of James Clerk Maxwell* (London,1882).

Chalmers, T., *A Series of Discourses on the Christian Revelation in connection with the Modern Astronomy* (Edinburgh, 1817).

Chalmers, T., *On Natural Theology*, vol 1 (New York, 1857).

Chalmers, T., *On Political Economy in connection with the Moral State and Moral Prospects of Society* (Glasgow, 1832).

Chalmers, T., *On the Power, Wisdom and Goodness of God, as manifested in the adaptation of external nature to the Moral and Intellectual Constitution of Man* (Glasgow, 1839).

Chalmers, T., *The Adaptation of External Nature to the Moral and Intellectual Constitution of Man.* vol 1 (1833 repr. London, 1839).

Chambers, R., *Vestiges of the Natural History of Creation* (London, 1844).

Clark, J. W., *Old Friends at Cambridge and Elsewhere* (London, 1900).

Clerke, A. M., *A Popular History of Astronomy during the Nineteenth Century* (Edinburgh, 1887).

Clifford, W. K., 'The Unseen Universe', *Fortnightly Review*, May 1865 - June 1934; Jun 1875; 17, 102; pp. 776 – 793.

Clodd, E., 'The Birth and Growth of Myth', *Knowledge*, vol 4, 21 September 1883, pp. 182 – 184.

Clodd, E., *Memories* (London, 1916).

Clodd, E., *The Childhood of the World: a simple account of man in early times* (London, 1873).

Cobbe, F. P., *Life of Frances Power Cobbe by herself*, vol 1 (New York, 1895).

Coleridge, S. T., 'Table Talk' (February 1834) in W. G. T. Shedd, (ed.), The Complete Works of Samuel Taylor Coleridge, vol VI (New York, 1884) pp. 502 - 503.

Coleridge, S. T., *Christabel, etc.* (London, 1816).

Colvin, S and J. A. Ewing, (eds.), *Papers, Literary, Scientific etc. by the late Fleeming Jenkin, F.R.S, LL.D.*, 2 vols (London, 1887).

Conway, M. D., *The Life of Thomas Paine*, vol II (New York, 1892).

Coutts, J., *A History of the University of Glasgow; from its foundation in 1451 to 1909* (Glasgow, 1909).

Darwin, C., *On the Origin of Species by means of Natural Selection, or the Preservation of Favoured Races in the struggle for life* (London, 1859).

Darwin, C., *On the Origin of Species by means of Natural Selection, or the Preservation of Favoured Races in the struggle for life* (New York, 1860).

Darwin, E., *The Botanic Garden, Part I, The Economy of Vegetation*. (London, 1791).

Darwin, F. and A. C. Seward, (eds.), *More Letters of Charles Darwin*, vol II (London, 1903).

Darwin, F., (ed.). *The life and letters of Charles Darwin, including an autobiographical chapter*. vol 1 (London, 1887).

De Quincey, T., 'System of the heavens as revealed by Lord Rosse's telescopes', *Tait's Edinburgh magazine*, Sep 1846; 13, 153; pp. 566 – 579.

De Quincey, T., *Confessions of an English opium-eater*, Second Edition (London, 1823).

De Quincey, T., *Confessions of an English opium-eater*, Volume one in a series of De Quincey's works (Edinburgh, 1862).

Dick, T., *Celestial Scenery, or the Wonders of the Planetary System Displayed* (New York, 1838).

Dick, T., *The Philosophy of a Future State* (New York, 1829).

Dick, T., *The Practical Astronomer* (London, 1845).

Dick, T., *The Sidereal Heavens and other subjects connected with Astronomy* (New York, 1840).

Drummond, H., *The Lowell Lectures on the Ascent of Man* (New York, 1894).

Eberty, F., *The Stars and the Earth; or, Thoughts upon Space, Time and Eternity* (London, 1846).

Everett, J. D., Letter to *Nature*, 20 April 1876, p. 486.

Fuller, A., *The Gospel, its own witnefs: or the Holy Nature and Divine Harmony of the Christian Religion Contrafted with the Immorality and Absurdity of Deism* (New York, 1801).

Gilfillan, G., *A Gallery of Literary Portraits* (Edinburgh, 1845).

Gilfillan, G., *A Second Gallery of Literary Portraits* (Edinburgh, 1852).

Hall, S. T., *Biographical Sketches of Remarkable People, chiefly from Personal Recollection, Miscellaneous Papers and Poems* (London, 1873).

Hanna, W., *Memoirs of the Life and Writings of Thomas Chalmers D.D., LL. D.*, vol I, (Edinburgh, 1849).

Hanna, W., *Memoirs of the Life and Writings of Thomas Chalmers D.D., LL. D.*, vol II, (Edinburgh, 1850).

Herschel, J. F. W, 'Address to the British Association for the Advancement of Science, June 19. 1845' in *Essays from the Edinburgh and Quarterly Reviews, with addresses and other pieces* (London, 1857), pp 634 – 682.

Herschel, J. F. W, 'Sir John Herschel's reply to Dr. Robinson', *The Athenaeum*; Nov 4, 1843; 836; pp. 983 – 984.

Herschel, J. F. W, *A Treatise on Astronomy* (London, 1833).

Herschel, J. F. W., *Outlines of Astronomy* (Philadelphia, 1849).

Herschel, W., 'Catalogue of 500 new nebulae', *Philosophical Transactions of the Royal Society*, 1802, 92.2, pp. 477 – 528.

Homer (tr. E. V. Rieu), *The Odyssey* (London, 1987).

Hume, D, *Dialogues Concerning Natural Religion* (London, 1777).

Hume, D., *An Enquiry Concerning Human Understanding* (1748 repr. London, 1777).

Hutton, J., *Theory of the earth, with proofs and illustrations. In four parts*. vol 1. (Edinburgh, 1795).

Huxley, T. H., 'Science' in T. H. Ward (ed.), *The reign of Queen Victoria: a survey of fifty years of progress*, vol 2 (London, 1887).

Huxley, T. H., 'The Struggle for Existence: A Programme', *Nineteenth Century*, Number CXXXII, February 1888, pp. 161 – 180.

James, W., 'Review of *The Unseen Universe'*, *Nation*, 20 (1875) pp. 366 – 367.

James, W., *The Will to Believe and other Essays in Popular Philosophy* (New York, 1912).

James, W., *The varieties of Religious Experience: a study in human nature, being the Gifford lectures on natural religion delivered at Edinburgh in 1901-1902* (London, 1902).

Jenkin, F., 'Lucretius and the atomic theory', in S. Colvin and J. A. Ewing (eds.), *Papers, Literary, Scientific etc. by the late Fleeming Jenkin, F.R.S, LL.D.*, vol 1 (London, 1887) pp. 177 – 214.

Johnson, W. (ed.), *Science and Revelation; A Series of lectures in reply to the theories of Tyndall, Huxley, Darwin, Spencer, etc*. (Belfast, 1875).

Journal of Science, Inventions, and improvements, *The Critic*, 1844-1847; Apr 11, 1846; 3, 67; p. 405.

King, A. G, *Kelvin the man* (London, 1925).

King, E. T., *Lord Kelvin's early home* (London, 1909).

Knight, W. A., *Memoir of John Nichol, Professor of English Literature in the University of Glasgow* (Glasgow, 1896).

Knott, C. G., Life and Scientific Work of Peter Guthrie Tait (Cambridge, 1911).

Laing Gordon, H., *Sir James Young Simpson and Chloroform (1811 – 1870)*, (London, 1897).

Laplace, P., (tr. Rev. H. H.Harte) *The System of the World* (London, 1830), vol II.

MacLehose, J, *Memoirs and Portraits of One Hundred Glasgow Men.* (Glasgow, 1886).

Martineau, J., 'Modern Materialism: Its Attitude towards Theology', *The Contemporary Review*; Dec 1, 1875; 27, pp. 323 – 346.

Maxwell, J. C., 'Molecules', *Nature*, 8, 25 September 1873, pp. 437 – 441.

Meadley, G. W., *Memoirs of William Paley, D.D.* (Sunderland, 1809).

Mitchel, F. A., *Ormsby MacKnight Mitchel: Astronomer and General. A Biographical Narrative.* (Boston, 1887)

Mitchell, O. M., *Popular Astronomy* (London, 1860).

Munro, J., *Heroes of the Telegraph* (London, 1891).

Nichol, J. P., 'ART. I.-On Political Economy, in connexion with the Moral State and Moral Prospects of Society.', *Westminster Review*, Jan. 1824 - Jan. 1836; Jul. 1832; 17, 33; pp. 1 – 33.

Nichol, J. P., 'Art. VI. State of Discovery and Speculation Concerning the Nebulae', *London and Westminster Review*, Apr. 1836 - Mar. 1840; Jul. 1836; 3, 2; pp. 390 – 409.

Nichol, J. P., 'Dr. Chalmers', *Tait's Edinburgh magazine*, Nov. 1832; 2, 8; pp. 189 – 195.

Nichol, J. P., 'On some recent discoveries in astronomy', *Tait's Edinburgh magazine,* 4.19, October 1833, pp. 57 – 64.

Nichol, J. P., **'**The Irish Tithe Bill', *Tait's Edinburgh magazine*; Jul. 1837; 4, 43: pp. 402 – 404.

Nichol, J. P., *Memorials from Ben Rhydding: concerning the place, its people, its cures.* (London, 1852).

Nichol, J. P., *The Architecture of the Heavens* (London, 1850).

Nichol, J. P., *The Stellar Universe: views of its arrangements, motions, and evolutions*. (Edinburgh, 1848).

Nichol, J. P., *Thoughts on some important points relating to the system of the world* (Edinburgh, 1846).

Nichol, J. P., *Views of Astronomy: seven lectures delivered before the Mercantile Library Association of New York in the months of January and February 1848* (New York, 1848).

Nichol, J. P., *Views of the Architecture of the Heavens. In a series of letters to a lady* (Edinburgh, 1837).

Nichol, J., *Thomas Carlyle* (London, 1892).

Paine, T., *The Age of Reason* (1794 repr. London, 1880).

Paley, W., *Natural Theology or Evidences of the Existence and Attributes of the Deity collected from the appearances of nature*. (Philadelphia PA, 1802).

Paley, W., *Paley's Natural Theology*, vol II (London, 1836).

Parker, J. H. (ed.), 'Professor Nichol', *The Gentleman's Magazine: and historical review*, July 1856-May 1868; Nov 1859; 207.

Poe, E. A., 'The Murders in the Rue Morgue', *Tales* (London, 1846).

Proctor, R. A, *Other Worlds than Ours* (1870 repr. New York, 1886).

Proctor, R. A. and A. C. Ranyard, *Old and New Astronomy* (London, 1892).

Proctor, R. A., 'Astrology', *Myths and Marvels of Astronomy* (New York, 1877) pp. 1 – 52.

Proctor, R. A., 'Death of Worlds', *Knowledge*, vol 3, 4 May 1883, p. 263.

Proctor, R. A., 'Religion and the Unknown', *Knowledge*, vol 10, 1 July 1887, p. 197.

Proctor, R. A., 'Science and Religion. By the Editor', *Knowledge*, vol 1, 4 November 1881, pp. 3 - 4.

Proctor, R. A., 'The Unknowable; or, the Religion of Science', *Knowledge*, vol 9, 1 December 1885, p. 37.

Proctor, R. A., *Other suns than ours: a series of essays on suns – old, young and dead* (1887 repr. London, 1903).

Proctor, R. A., *Our Place among Infinities* (London, 1875).

Proctor, R. A., *Saturn and its System* (London, 1865).

Proctor, R. A., *Science Byways* (London, 1875).

Proctor, R. A., *The Great Pyramid: observatory, tomb, and temple* (London, 1883).

Ranyard, A. C., 'Richard Anthony Proctor', *Journal of the Royal Astronomical Society*, XLIX, 4 (Feb., 1889) pp. 164 - 167.

'Recent Astronomy', *British Quarterly Review*, 6 (Aug. 1847), pp. 1 – 40.

Robinson, T. R., 'Account of the Three-feet Telescope' in Parsons, C. (ed.), *The scientific papers of William Parsons, third Earl of Rosse 1800 – 1867* (Cambridge, 2011) pp 14 – 19.

Robinson, T. R., 'Dr. Robinson's reply to Sir John Herschel', *The Athenaeum*, Oct 21, 1843; 834; pp. 945 – 946.

Robinson, T. R., 'Dr. Robinson's reply to Sir John Herschel', *The Athenaeum*, Nov 18, 1843; 838; pp. 1027 – 1028.

Robinson, T. R., 'On Lord Rosse's Telescope (Continued)', *Proceedings of the Royal Irish Academy (1836-1869)*, vol 3 (1844 - 1847), pp. 114 - 133.

Robinson, T. R., 'On the Present Condition of the Earl of Rosse's Great Telescope', *Proceedings of the Royal Irish Academy (1836-1869)*, vol 4 (1847 - 1850), pp. 119 - 128.

Schuster, A., 'Memoir of the late Professor Balfour Stewart, LL.D., F.R.S. By Professor A. Schuster, Ph.D., F.R.S., F.R.A.S.,' in *Memoirs and Proceedings of the Manchester Literary & Philosophical Society*, Fourth Series, vol 1 (Manchester, 1888) pp. 253 – 272.

Schuster, A., *Biographical Fragments* (London, 1932).

Shakespeare, W., 'Hamlet, Prince of Denmark', *The Complete Works of William Shakespeare* (London, 1978) pp. 846 - 882.

Shelley, P. B., 'The Necessity of Atheism' in P. B. Shelley, (foreword by H. S. Salt), *Selected Prose Works of Shelley* (London, 1915) pp. 1 – 15.

Shelley, P. B., *Prometheus Unbound: a lyrical drama in four acts with other poems* (London, 1820).

Shelley, P. B., *Queen Mab; a philosophical poem* (London, 1813).

Smith, J., *The Book of Mormon* (Palmyra NY, 1830).

Spencer, H., 'The origin of animal-worship, etc.' in *The Fortnightly Review*, May 1870 (vol 13 old series, 7 new series) pp. 535 - 550.

Spencer, H., *First Principles of a new system of Philosophy* (New York, 1865).

Spencer, H., Recent astronomy, and the nebular hypothesis' in *Illustrations of Universal Progress; a Series of Discussions* (New York, 1865) pp. 239 – 299.

Spencer, H., Recent astronomy, and the nebular hypothesis', *Westminster Review*, Jan. 1852 - Jan. 1914; July 1858; 70, 137; pp. 185 – 225.

Stair Douglas, J. M., *The life and selections from the correspondence of William Whewell, D. D. late Master of Trinity College Cambridge* (London, 1881).

Stevenson, R. L., 'Memoir' in S. Colvin. and J. A. Ewing, (eds.), *Papers, Literary, Scientific etc. by the late Fleeming Jenkin, F.R.S., LL.D.* vol 1 (London, 1887) pp. xi – cliv.

Stewart, B and P. G. Tait, *The Unseen Universe: or Physical Speculations on a Future State*, (London, 1875).

Stewart, B. and P. G. Tait, *The Unseen Universe: or Physical Speculations on a Future State*, (London, 1886).

Stewart, B. and J. N. Lockyer, 'The Sun as a Type of the Material Universe: Part II The Place of Life in a Universe of Energy', *Macmillan's Magazine*, 1 May 1868; pp. 319 - .327.

Tait, P. G., 'Does Humanity demand a New Revelation', *International Review* (November 1878).

Tait, P. G., 'Dr. Balfour Stewart, F.R.S.', *Nature*, 29 December 1887, pp. 202 – 203.

Tait, P. G., 'Geological Time', *North British Review* 50 (1869) pp. 406 – 439.

Tait, P. G., *Lectures on some recent advances in physical science*, 2nd Edition (London, 1876).

Tayler, C. B., *Sermons for all seasons, chiefly on the subject of Tractarian error* (London, 1850).

Tennyson, A. L., 'In Memoriam A. H. H.' in K. Hodder (ed.) *The Works of Alfred Lord Tennyson* (London, 1994), pp. 305 – 389.

Tennyson, A. L., 'Ode on the Death of the Duke of Wellington' in K. Hodder (ed.) *The Works of Alfred Lord Tennyson* (London, 1994), pp. 400 – 407.

Tennyson, A. L., 'The Lotos-Eaters' in K. Hodder (ed.) *The Works of Alfred Lord Tennyson* (London, 1994) pp. 93 – 97.

Tennyson, A. L., 'The Princess' in K. Hodder (ed.) *The Works of Alfred Lord Tennyson* (London, 1994), pp. 227 – 303.

Thompson, S. P., *The Life of William Thomson: Baron Kelvin of Largs*, 2 vols (London, 1910).

Thomson, W., 'Appendix on the Age of the Sun', added August 15, 1854; *Edinburgh Royal Society Transactions*, vol XXI. (1857) pp. 63 - 80.

Thomson, W., 'On the age of the sun's heat', *Macmillan's Magazine*, 5 (1862) pp. 288 – 293.

Thomson, W., 'On the Mechanical Energies of the Solar System.' *Edinburgh Royal Society Proceedings* [read April 17, 1854], vol III (1857) pp. 241 – 244.

Thomson, W., 'On the Secular Cooling of the Earth', *Transactions of the Royal Society of Edinburgh*, [Read April 28, 1862], vol XXIII, (1864) pp. 167- 169. Reprinted in W. Thomson, *Mathematical and Physical Papers*, vol III, (London, 1890) pp. 295 – 311.

Thomson, W., *Mathematical and Physical Papers*, vol 1 (Cambridge, 1882).

Todhunter, I., *William Whewell, D. D. Master of Trinity College, Cambridge. An account of his writings with selections from his literary and scientific correspondence*, 2 vols (London, 1876).

Tylor, E. B., *Primitive Culture*, 2 vols (London, 1871).

Tyndall, J, *Address delivered before the British Association assembled at Belfast* (London, 1874).

Tyndall, J., 'Apology for the Belfast Address' in J. Tyndall, *Fragments of Science: a series of detached essays, addresses and reviews*, vol II (New York, 1892), pp. 202 – 223.

Tyndall, J., 'The Reverend James Martineau and the Belfast Address' in J. Tyndall, *Fragments of Science: a series of detached essays, addresses and reviews*, vol II (New York, 1892) pp. 224 -250.

Wells, H. G., *The Time Machine: An Invention* (New York, 1895).

Whewell, W., 'Second Memoir on the Fundamental Antithesis of Philosophy', *Transactions of the Cambridge Philosophical Society*, vol VIII, part I (Cambridge, 1849) pp. 614 – 662.

Whewell, W., *A Dialogue on the Plurality of Worlds* (London, 1853).

Whewell, W., *Astronomy and General Physics considered with reference to natural theology* (London, 1833).

Whewell, W., *Indications of the Creator* (London, 1846).

Whewell, W., *Of the Plurality of Worlds: an Essay* (London, 1853).

Willm, J., *The Education of the People: a practical treatise on the realm of extending its sphere & improving its character. With a preliminary dissertation on some points connected with the present position of education in this country by J. P. Nichol, LL. D.* (Glasgow, 1847).

Bibliography of Secondary Sources

7th Earl of Rosse, 'William Parsons, third Earl of Rosse', *Hermathena*, No. 107 (Autumn 1968), pp. 5-13.

Alexander, D., *Rebuilding the Matrix: Science and Faith in the 21st Century* (Oxford, 2002).

Alison, Countess of Rosse, 'Part 2: Family Life at Birr' in C. Mollan, (ed.), *William Parsons 3rd Earl of Rosse: Astronomy and the castle in nineteenth-century Ireland* (Manchester, 2014), pp. 55 - 70.

Allen, N. B., 'A Note on Coleridge's "Kubla Khan"', *Modern Language Notes*, 57, 2 (Feb., 1942), pp. 108 – 113.

Alwin, D. F., R. L. Cohen and T. M. Newcomb, *Political Attitudes over the Lifespan: The Bennington Women after Fifty Years* (Madison WI, 1991).

Anderson, G., 'Retrieving the Lost Worlds of the Past: The Case for an Ontological Turn', *American Historical Review*, June 2015, 120, 3, pp. 786 – 810.

Armstrong, K., *A History of God: The 4,000-Year Quest of Judaism, Christianity, and Islam* (New York, 1993).

Astore, W. J., *Observing God: Thomas Dick, Evangelicalism, and Popular Science in Victorian Britain and America* (London, 2001).

Ayto, J., (ed.), *Oxford Dictionary of English Idioms*, 3rd Edition. (Oxford, 2009).

Baldwin, M., 'The shifting ground of *Nature*: establishing an organ of scientific communication in Britain, 1800 – 1900', *Hist. Sci.* 1 (2012) pp. 125 – 152.

Barton, R, 'John Tyndall, Pantheist: A Rereading of the Belfast Address', *Osiris*, 2nd Series, vol 3 (1987), pp. 111 - 134.

Barton, R., 'Scientific Authority and Scientific Controversy in *Nature*: North Britain against the X Club', in L. Henson et al. (eds.), *Culture and science in the nineteenth-century media* (Aldershot, 2004) pp. 223 – 235.

Bassuk, E. L., 'The Rest Cure: Repetition or Resolution of Victorian Women's Conflicts?' *Poetics Today*, vol 6, no 1/2, *The Female Body in Western Culture: Semiotic Perspectives* (1985) pp. 245 – 257.

Beer, G., '"The Death of the Sun": Victorian Solar Physics and Solar Myth.' In B. Bullen, (ed.) *The Sun is God: Painting, Literature and Mythology in the Nineteenth Century* (Oxford, 1989), pp. 159 – 180.

Benjamin Hutchinson, J. and L. Feldman Barrett, 'The Power of Predictions: An Emerging Paradigm for Psychological Research', *Current Directions in Psychological Science*, (June 2019) 28, 3, pp. 280 – 291.

Bennett, J. A., *Church, State and astronomy in Ireland* (Armagh, 1990).

Bernard Cohen, I. et al. (eds.), *Puritanism and the rise of Modern Science: The Merton Thesis*, (New Brunswick, 1990).

Bernhardt, B. C., and T. Singer, 'The neural basis of empathy', *Annual review of neuroscience*, 35 (2012) pp. 1 – 23.

Berridge, V., *Demons: our changing attitudes to alcohol, tobacco, & drugs* (Oxford, 2013).

Berridge**,** V**.**, *Opium and the People: Opiate Use and Drug Control Policy in Nineteenth and early Twentieth Century England* (London, 1999).

Bijker, W. E., T. P. Hughes and T. Pinch, *The social construction of technological systems: new directions in the sociology and history of technology*. Cambridge MA, 1987).

Blum, M. E., *Continuity, Quantum, Continuum and Dialectic: the foundational logics of western historical thinking* (New York, 2006).

Bobis, L. and J. Lequeux, 'Cassini, Rømer and the speed of light' in *Journal of Astronomical History and Heritage*, 11(2), 2008, pp. 97 - 105.

Boddice, R., *The History of Emotions* (Manchester, 2018).

Bowler, P. J. and I. R. Morus, *Making modern science: a historical survey* (Chicago, 2005).

Brooke, J. H. and G. N. Cantor, *Reconstructing Nature: The Engagement of Science and Religion* (Edinburgh, 1998).

Brooke, J. H., 'Darwin and Religion: Correcting the Caricatures', *Science & Education* (2010), 19, pp. 391 – 405. doi:10.1007/s11191-009-9211-9.

Brooke, J. H., 'Natural theology and the plurality of worlds: Observations on the Brewster-Whewell debate, *Annals of Science*, 1977, 34:3, pp. 221 – 286.

Brooke, J. H., 'Science and the fortunes of Natural Theology: some historical perspectives', *Zygon*, vol 24, no. 1 (March 1989) pp. 3 – 22.

Brooke, J. H., *Science and Religion: Some Historical Perspectives* (Cambridge, 1991).

Brown, C., *The Death of Christian Britain: Understanding Secularisation, 1800-2000* (New York, 2001).

Brown, D., *The Poetry of Victorian Scientists: Style, Science and Nonsense* (Cambridge, 2013).

Brown, H., *William James on Radical Empiricism and Religion* (Toronto, 2000).

Brown, N., 'Devotional Cosmology: Poetry, Thermodynamics and Popular Astronomy, 1839-1889', PhD thesis submitted to the University of Glasgow (2016).

Brown, S. J, *Thomas Chalmers and the Godly Commonwealth in Scotland* (Oxford, 1982).

Brush, S. G., 'The nebular hypothesis and the evolutionary world view', *History of Science*, xxv (1987), pp. 245 – 278.

Brush, S. G., *The Nebulous Earth: The Origin of the Solar System and the Core of the Earth from Laplace to Jeffreys* (Cambridge, 1996).

Burgess, K., 'Sick Britons find religion in God's waiting room', *The Times*, 17 September 2018, p. 3.

Buttman, G., (tr. Pagel, B. E. J.) *The shadow of the telescope: A biography of John Herschel* (Guildford, 1974).

Byrne, K., *Tuberculosis and the Victorian literary imagination* (Cambridge, 2011).

Canales, J., *The Physicist and the Philosopher: Einstein, Bergson, and the Debate That Changed Our Understanding of Time* (Princeton NJ, 2015).

Carlton, E. J., *Patterns of Belief. Volume 2: Religions in Society (*London, 1973).

Carlton, H., 'Condensing from a Fluid Haze: John Pringle Nichol, the Nebular Hypothesis and Nineteenth-Century Cosmogony' in N. Campion and C. Impey (eds.) *Imagining Other Worlds: Explorations in Astronomy and Culture* (Ceredigion, 2018) pp. 87 – 94.

Chadwick, O., *The Victorian Church*, 2 vols (London, 1966 and 1971).

Chapman, A., 'William Parsons and the Irish nineteenth-century tradition of independent astronomical research' in C. Mollan, (ed.), *William Parsons 3rd Earl of Rosse: Astronomy and the castle in nineteenth-century Ireland* (Manchester, 2014) pp. 271 – 297.

Charbonneau, P., 'Stewart, Balfour' in T. Hockey, (ed.), *Biographical Encyclopedia of Astronomers* (New York, 2014) pp. 2057 – 2059.

Checkland, S. and O. Checkland, *Industry and Ethos: Scotland 1832 – 1914* (London, 1984).

Colp, R., 'More on Darwin's illness', *Hist. Sci.,* xxxviii (2000) pp. 219 – 236.

Colp, R., 'To Be an Invalid, Redux', *Journal of the History of Biology*, 31 (1998), pp. 211 – 240.

Crowe, M. J, *The extraterrestrial life debate 1750 – 1900: the idea of plurality of worlds from Kant to Lowell* (Mineola NY, 1999).

Crowe, M. J., 'Herschel, Sir John Frederick William, first baronet (1792–1871)', *Oxford Dictionary of National Biography*. www.oxforddnb.com/view/article/13101 (accessed 5 Nov 2015).

Daston, L. and P. Galison, *Objectivity* (New York, 2007).

Daston, L., 'The Moral Economy of Science', *Osiris*, (01/1995), 10, pp. 2 – 24.

Desmond, A. and J. R. Moore, *Darwin* (London, 1991).

Desmond, A., *Huxley: From Devil's Disciple to Evolution's High Priest* (London, 1998).

Devine, T. M., *The Scottish nation: 1700 – 2000* (London, 1999).

Dick, S. J, 'The Origins of the Extraterrestrial Life Debate and its Relation to the Scientific Revolution', *Journal of the History of Ideas*, vol 41, No. 1 (Jan. - Mar., 1980), pp. 3 - 27.

Dick, S. J., 'Cosmic Evolution: History, Culture, and Human Destiny' in S. J. Dick, and M. L. Lupisellsa, (eds.) *Cosmos & Culture; Cultural Evolution in a Cosmic Context* (Washington DC, 2009) pp 29 – 59.

Dixon, T., 'Introduction' in T. Dixon, G. Cantor, and S. Pumfrey, (eds.), *Science and Religion: New Historical Perspectives* (Cambridge, 2010) pp. 1 – 19.

Dixon, T., 'The Psychology of the Emotions in Britain and America in the Nineteenth Century: The Role of Religious and Antireligious Commitments', *Osiris*, 16, Science in Theistic Contexts: Cognitive Dimensions (2001), pp. 288 – 320.

Dixon, T., *From Passions to Emotions: The Creation of a Secular Psychological Category* (Cambridge, 2003).

Dixon, T., *Weeping Britannia: Portrait of a Nation in Tears* (Oxford, 2015).

Dobson, E., 'Literature and Culture in the Golden Age of Egyptology', PhD Thesis submitted to the University of Birmingham, November 2016.

Dormandy, T., *The White Death: a history of tuberculosis* (London, 1999).

Dreyer, J. L. E. and H. H. Turner, (eds.), *History of the Royal Astronomical Society: Volume 1 1820 – 1920* (1923 repr. Oxford, 1987).

Drinko, C. D., *Theatrical Improvisation, Consciousness, and Cognition* (New York, 2013).

Einstein, A., (tr. R. W. Lawson), *Relativity: The Special and General Theory.* (New York, 1920).

Einstein, A., 'Maxwell's influence on the development of the concept of physical reality' in *James Clerk Maxwell: A Commemoration Volume 1831 – 1931* (Cambridge, 1931) pp. 66 – 73.

Eisberg, J., 'Solar Science and Astrophysics' in Nye, M. J. (ed.), *Cambridge History of Science,* vol 5, chapter 26 (Cambridge, 2008) pp. 505 - 521.

Elliott, P., 'Erasmus Darwin, Herbert Spencer, and the Origins of the Evolutionary Worldview in British Provincial Scientific Culture, 1770–1850', *Isis,* vol 94, No. 1 (March 2003) pp. 1 – 29.

Evans, R. J., *The Pursuit of Power: Europe 1815 – 1914* (London, 2016).

Evans, S., 'Thatcher and the Victorians: A Suitable Case for Comparison?', *History*, October 1997, 82, 268, pp.601 – 620.

Feldman Barrett, L. 'The theory of constructed emotion: an active inference account of interoception and categorization', *Social Cognitive and Affective Neuroscience*, 2017, pp. 1 – 23.

Feldman Barrett, L., *How Emotions Are Made: The Secret Life of the Brain* (London, 2018).

Fergusson, D., 'Predestination: A Scottish Perspective', *Scottish Journal of Theology*, 1993, 46, 4, pp. 457 – 478.

Francis, M., *Herbert Spencer and the invention of modern life* (New York, 2007).

Fyfe, A., 'Publishing and the classics: Paley's *Natural theology* and the nineteenth-century scientific canon', *Stud. Hist. Phil. Sci.* 33 (2002) pp. 729 – 751.

Fyfe, A., 'The Reception of William Paley's "Natural Theology" in the University of Cambridge', *The British Journal for the History of Science*, 30, 3, Student Papers (Sep., 1997), pp. 321 - 335.

Galison, P., 'Einstein's Clocks: The Place of Time', *Critical Inquiry*, 26, 2 (Winter, 2000), pp. 355 – 389.

Gange, D., *Dialogues with the Dead: Egyptology in British Culture and Religion, 1822-1922* (Oxford, 2013).

Gange, D., *The Victorians: A Beginner's Guide* (London, 2016).

Gawande, A., *Being Mortal: Illness, Medicine, and what matters in the end* (London, 2014).

Gillespie, C. G., (ed.), *Dictionary of Scientific Biography*, vol XIV (New York, 1976).

Gillespie, M. A., *The theological origins of modernity* (Chicago, 2008).

Gillispie, C. G., *Genesis and Geology: the impact of scientific discoveries upon religious beliefs in the decades before Darwin* (New York, 1959).

Gillham, N. W., *A Life of Sir Francis Galton: from African Exploration to the Birth of Eugenics* (Oxford, 2001).

Gilmour, R., *The Victorian period: the intellectual and cultural context of English literature, 1830-1890* (London, 1993).

Goldman, M., *The Demon in the Aether, The Story of James Clerk Maxwell* (Edinburgh, 1983).

Gould S. J., *Darwin's island: The Galapagos in the garden of England.* (London, 2009).

Gregory, F., 'Intersections of Physical Science and Western Religion in the Nineteenth and Twentieth Centuries' in M. J. Nye (ed.) *Cambridge History of Science,* vol 5, chapter 2 (Cambridge, 2008) pp. 36-53.

Gribbin, J. R., *The Reason Why: The Miracle of Life on Earth* (London, 2011).

Griggs, E. L. and S. T. Porter, 'Samuel Taylor Coleridge and Opium', *Huntington Library Quarterly*, 17, 4 (Aug., 1954), pp. 357 – 378.

Gunn, S., *History and Cultural Theory* (Harlow, 2006).

Guthke, K. S., (tr. H. Atkins), *The last frontier: imagining other worlds, from the Copernican revolution to modern science fiction* (Ithaca NY, 1990).

Hahn, R., *Pierre Simon Laplace, 1749–1827: A Determined Scientist*. (Harvard, 2005).

Haldane, J. B. S., *Possible Worlds and Other Papers* (London, 1927).

Hall, C., *Civilising Subjects: metropole and colony in the English imagination 1830-1867* (Cambridge, 2002).

Hanham, A. and M. A. Hoskin, 'The Herschel Knighthoods: Facts and Fiction', *Journal for the History of Astronomy*, xliv (2013), pp. 149 – 164.

Harris, J., *Private Lives, Public Spirit: Britain 1870 – 1914* (London, 1994).

Harrison, M. O., H. G. Koenig, J. C. Hays, A. G. Eme-Akwari, and K. Pargament, 'The epidemiology of religious coping: a review of recent literature', *International Review of Psychiatry*, (2007) 13, 2, pp. 86 – 93.

Hayward, R., 'Busman's stomach and the embodiment of modernity', *Contemporary British History*, 31, 1 (2017), pp. 1 – 23. doi: 10.1080/13619462.2016.1226806.

Hayward, R., *Resisting History: Religious Transcendence and the Invention of the Unconscious* (Manchester, 2008).

Hefferman, W. C., 'The Singularity of our Inhabited World: William Whewell and A. R. Wallace in Dissent', *Journal of the History of Ideas,* 39, 1 (Jan. - Mar., 1978), pp. 81-100.

Henchman, A., '"The Globe we groan in": Astronomical Distance and Stellar Decay in In Memoriam' *Victorian Poetry*, 41, 1, Spring 2003, pp. 29 – 45.

Hilton, B., *The Age of Atonement: The Influence of Evangelicalism on Social and Economic Thought 1785-1865* (Oxford, 2001).

Hogan, M., 'William Parsons' influence on the town and community of Birr' in C. Mollan, (ed.), *William Parsons 3rd Earl of Rosse: Astronomy and the castle in nineteenth-century Ireland* (Manchester, 2014) pp. 90 – 121.

Holmes, J., 'Lucretius at the Fin de Siècle: Science, Religion and Poetry', *English Literature in Transition*, 1880-1920, 51, 3, 2008, pp. 266 - 280.

Hoskin, M. A., 'William Herschel and the Construction of the Heavens', *Proceedings of the American Philosophical Society*, 133, 3 (Sep., 1989) pp. 427 – 433.

Hoskin, M., 'Rosse, Robinson and the Resolution of the Nebulae', *Journal for the History of Astronomy*, 21, 4, (Nov., 1990), pp. 331 – 344.

Houlbrook, M., 'Commodifying the Self Within: Ghosts, Libels, and the Crook Life Story in Interwar Britain', *The Journal of Modern History*, 85 (June 2013) pp. 321 – 363.

Huang, H-F., 'Commercial and Sublime: Popular Astronomy Lectures in Nineteenth Century Britain', PhD Thesis submitted to University College London, 9 March 2015.

Huxley, A, *The Doors of Perception; and, Heaven and Hell* (Harmondsworth, 1959).

Inglis, L., *Milk of Paradise: a history of opium* (London, 2018).

Israel, K., *Names and Stories: Emilia Dilke and Victorian Culture* (Oxford, 2002).

Jackson, J. C., J. Jong, M. Bluemke, P. Poulter, L. Morgenroth, and J. Halberstadt, 'Testing the causal relationship between religious belief and death anxiety', *Religion, Brain & Behavior,* March 2017. doi:10.1080/2153599X.2016.1238842. (accessed 3 April 2017).

Jalland, P., *Death in the Victorian Family* (Oxford, 1996).

Jasanoff, A., *The biological mind: how brain, body, and the environment collaborate to make us who we are* (New York, 2018).

Kahan, D. M. and J. C. Corbin, 'A note on the perverse effects of actively open-minded thinking on climate-change polarization', *Research and Politics,* October-December 2016: pp. 1 – 5. doi:10.1177/2053168016676705. (accessed 8 April 2019).

Kaplan, F., *Thomas Carlyle: a biography* (Cambridge, 1983).

Klein, S. B. and C. E. Gangi, 'The multiplicity of self: neuropsychological evidence and its implications for the self as a construct in psychological research', *Ann. N.Y. Acad. Sci.* 1191 (2010) pp. 1–15. doi:10.1111/j.1749-6632.2010.05441.x.

Knorr-Cetina, K, *The manufacture of knowledge: an essay on the constructivist and contextual nature of science*. (Oxford, 1981).

Koch, J. T. *Celtic Culture: A Historical Encyclopedia*, (Santa Barbara CA, 2006).

Koenig, H. G., D. B. Larson, and S. S. Larson, 'Religion and Coping with Serious Medical Illness', *The Annals of Pharmacotherapy,* 2001 March, 35, pp. 352 – 359.

Koh, E. Y., *The Victorian Religious Novel: Conversion, Confession, and the Marriage Plot*, PhD Thesis submitted to Rice University (Houston TX, 2011).

Kompanje, E. J. O. and J. W. F. Reumer, ‘‘Many bad attacks of sickness’ – Did Charles Darwin suffer from chronic borreliosis?’, *Deinsea*, 18 (December 2018) pp. 6 – 12.

Kuhn, T., *The structure of scientific revolutions* (Chicago, 1962).

Landsman, N., *From Colonials to Provincials, American Thought and Culture 1680 -1760.* (Ithaca NY, 1997).

Larsen, T., *Crisis of doubt: honest faith in nineteenth-century England* (Oxford, 2006).

Latour, B and S. Woolgar, *Laboratory Life: the Social Construction of Scientific Facts* (Princeton, 1979).

Latour, B., ‘On recalling ANT’ in J. Law and J. Hassard (eds.) *Actor Network Theory and After* (Oxford, 1999), pp. 15 – 25.

Lawrence, C., ‘The power and the glory: Humphry Davy and Romanticism’ in A. Cunningham, A. and N. Jardine, (eds.*), Romanticism and the sciences* (Cambridge, 1990) pp. 213 – 227, pp. 215 – 218.

Lawrence, P., ‘Heaven and Earth – the relation of the nebular hypothesis to geology’, in W. Yourgrau, and A. D. Breck, (eds.), *Cosmology, History and Theology* (New York, 1977), pp. 253 – 281.

Leedham-Green, E., *A concise history of the University of Cambridge* (Cambridge, 1996).

Leys, R., *The Ascent of Affect: Genealogy and Critique* (Chicago, 2017).

Lightman, B. V., ‘*Robert Elsmere* and the Agnostic Crises of Faith’, in. R. J. Helmstadter, and B. V. Lightman, (eds.) *Victorian Faith in Crisis: Essays on Continuity and Change in Nineteenth-Century Religious Belief* (London, 1990) pp. 283 – 311.

Lightman, B. V., ‘Victorian Sciences and Religions: Discordant Harmonies’, *Osiris*, 2nd Series, vol 16, Science in Theistic Contexts: Cognitive Dimensions (2001) pp. 343 – 366.

Lightman, B. V., *Victorian popularizers of science: designing nature for new audiences* (Chicago, 2007).

Linden, S. J., *Darke Hierogliphicks: Alchemy in English Literature from Chaucer to the Restoration* (Lexington KY, 1996).

Lindquist, K. A., T. D. Wager, H. Kober, E. Bliss-Moreau, and L. Feldman Barrett, ‘The brain basis of emotion: A meta-analytic review.’, *Behavioral and Brain Sciences*, 35, 3, June 2012, pp. 121 – 143.

Lord, C. G, L. Ross, L and M. R. Lepper, ‘Biased Assimilation and Attitude Polarization: The Effects of Prior Theories on Subsequently Considered Evidence’, *Journal of Personality and Social Psychology*, 1979, 37, 11, pp. 2098 – 2109.

Lovejoy, A. O., *The Great Chain of Being: A Study of the History of an Idea* (Cambridge MA, 2001).

Mangum, R. T. and M. S. Sweetnam, *The Scofield Bible: Its History and Impact on the Evangelical Church* (Colorado Springs, 2009).

Matus, J. L., ‘Trauma, Memory, and Railway Disaster: The Dickensian Connection’, *Victorian Studies*, 43, 3 (Spring, 2001) pp. 413 – 436.

McGrath, L. S., ‘History, Affect, and the Neurosciences’, *History of Psychology*, (2017), 20, 2, pp. 129 – 147.

McKeown, T. and R. G. Record, ‘Reasons for the decline of mortality in England and Wales during the nineteenth century’, *Population Studies*, (1962) 16:2, pp. 94 - 122.

Meadows, A. J., *Science and controversy: a biography of Sir Norman Lockyer* (London, 1977).

Medawar, P., *The art of the soluble: Creativity and originality in science* (London, 1967).

Melnyk, J., *Victorian Religion: Faith and Life in Britain*, (Westport CT, 2008).

Merton, R. K., ‘Science, Technology and Society in Seventeenth Century England’ in *Osiris*, 4, 2, (1938), pp. 360-632.

Meyer. B., ‘Till Death Do Us Part: The Consumptive Victorian Heroine in Popular Romantic Fiction’, *The Journal of Popular Culture*, 37, 2, 2003, pp. 287 – 308.

Mineka, F. E. (ed.), *The Earlier Letters of John Stuart Mill 1812 – 1848 (Volume XIII of the Collected Works of John Stuart Mill)*, (Toronto, 1963).

Moore, J. R., ‘Of Love and Death: why Darwin “gave up Christianity” in J. R. Moore, (ed.) *History, Humanity and Evolution: Essays for John C. Green* (Cambridge, 1998) pp. 195 – 229.

Moore, J. R., *The Post-Darwinian Controversies: a study of the Protestant struggle to come to terms with Darwin in Great Britain and North America, 1870-1900* (Cambridge, 1979).

Morus, I. R., *When Physics became King* (Chicago, 2005).

Murray, A., ‘Vestiges of the Phoenix: De Quincey, Kant and the Heavens’, *Victoriographies* 1.2 (2011) pp. 243 – 260. doi:10.3366/vic.2011.0031.

Nahim, P. J., ‘Maxwell’s grand unification’, *IEEE Spectrum*, March 1992, p. 45.

Nall, J., *News from Mars: Mass Media and the Forging of a New Astronomy, 1860-1910* (Pittsburgh, forthcoming September 2019).

Nasim, O. W, ‘The ‘Landmark’ and ‘Groundwork’ of stars: John Herschel, photography and the drawing of nebulae’, *Studies in History and Philosophy of Science*, 42 (2011) pp. 67 – 84.

Nasim, O. W., ‘Observation, working images and procedure: the ‘Great Spiral’ in Lord Rosse's astronomical record books and beyond*’, The British Journal for the History of Science*, 43, (2010), pp 353 – 389. doi10.1017/S0007087410000051.

North, J. D., ‘Proctor, Richard Anthony’ in C. G. Gillespie (ed.), *Dictionary of Scientific Biography*, vol XI (New York, 1975) pp. 162 – 163.

Numbers, R. L., *The Creationists: The Evolution of Scientific Creationism* (Berkeley CA, 1992).

O’Connor, R., *The Earth on Show* (Chicago, 2007).

Ogilvie, M. B., ‘Robert Chambers and the Nebular Hypothesis’, *The British Journal for the History of Science*, 8, 3 (Nov., 1975), pp. 214 – 232.

Oswald. M. E. and S. Grosjean, 'Confirmation Bias' in Pohl, R. F. (ed.), *Cognitive Illusions: A Handbook on Fallacies and Biases in Thinking, Judgement and Memory* (Hove, 2004)

Owen, A., *Place of Enchantment: British Occultism and the Culture of the Modern* (Chicago, 2004).

Pang, A. S., *Empire and the Sun: Victorian Solar Eclipse Expeditions*, (Stanford, 2002).

Pargament, K. I., B. W. Smith, H. G. Koenig, and L. Perez, 'Patterns of Positive and Negative Religious Coping with Major Life Stressors', *Journal for the Scientific Study of Religion*, 37, 4 (Dec., 1998), pp. 710 - 724.

Parsons, G., (ed.) *Religion in Victorian Britain*, 4 vols (Manchester, 1988).

Pennock, R. T., *Tower of Babel: The Evidence against the New Creationism* (Cambridge MA, 2000).

Plamper, J., 'The History of Emotions: An Interview with William Reddy, Barbara Rosenwein, and Peter Stearns', *History and Theory* 49 (May 2010), pp. 237 - 265.

Plant, S., *Writing on Drugs* (New York, 2001).

Porter, R., *Enlightenment: Britain and the Creation of the Modern World* (London, 2000).

Reddy, W., *The navigation of feeling: a framework for the history of emotions* (Cambridge, 2001).

Reisenauer, E. M., '"The battle of the standards": Great Pyramid metrology and British identity', 1850 -1890, *The Historian*, 65 (2003) pp. 931 – 978.

Richards, E., "'Metaphorical mystifications': the Romantic gestation of nature in British biology" in Cunningham, A. and Jardine, N. (eds.*), Romanticism and the sciences* (Cambridge, 1990) pp. 130 – 143.

Roper, M., 'Splitting in unsent letters: writing as a social practice and a psychological activity', *Social History*, 26, 3, October 2001, pp.318 – 339.

Rosenwein B. H. and R. Cristiani, *What is the History of Emotions?* (Cambridge, 2018).

Roxborogh, J., 'The Legacy of Thomas Chalmers', *International Bulletin of Missionary Research*, (October 1999), pp. 173 – 176.

Rudwick, M. J. S., *The Great Controversy: the shaping of scientific knowledge among Gentlemanly specialists* (Chicago, 1985).

Russell, A., *Lord Kelvin: his life and work* (London, 1912).

Russell, B., *History of Western Philosophy and its Connection with Political and Social Circumstances from the Earliest Times to the Present Day* (London, 1946).

Schaffer, S., 'Celestial Eccentric', *Nature*, 333, 2 June 1988, pp. 405 - 406.

Schaffer, S., 'Herschel in Bedlam: Natural History and Stellar Astronomy', *British Journal for the History of Science*, 13, 3 (1980), pp. 211- 239.

Schaffer, S., 'On astronomical drawing' in C. A. Jones, and P. Galison, (eds.) *Picturing science, producing art* (New York, 1998), pp. 441 – 474.

Schaffer, S., 'The Leviathan of Parsonstown: literary technology and scientific representation', in Lenoir, T. (ed.) *Inscribing science: scientific texts and the materiality of communication* (Stanford, 1998), pp. 182 – 222.

Schaffer, S., 'The nebular hypothesis and the science of progress' in J. R. Moore (ed.) *History, Humanity and Evolution: Essays for John C. Greene* (Cambridge, 1989), pp. 131 – 164.

Schaffer. S., 'Astronomers Mark Time: Discipline and the Personal Equation', *Science in Context*, 2, 1 (1988), pp. 115 - 145.

Schechner, S. J., *Time & Time Again: how science and culture shape the past, the present and future* (Cambridge MA, 2014).

Schumpeter, J. A., *History of economic analysis* (New York, 1954).

Schweber, S. S., 'John Herschel and Charles Darwin: A Study in Parallel Lives', *Journal of the History of Biology*, 22, 1 (Spring, 1989), pp. 1 – 71.

Secord, J. A., 'Behind the veil: Robert Chambers and *Vestiges*' in J. R. Moore, (ed.) *History, Humanity and Evolution: Essays for John C. Greene* (Cambridge, 1989), pp. 165 – 194.

Secord, J. A., *Visions of Science: Books and readers at the dawn of the Victorian age* (Oxford, 2014).

Secord, J. A., *Victorian Sensation: The Extraordinary Publication, Reception, and Secret Authorship of Vestiges of the Natural History of Creation* (Chicago, 2000).

Seth, A. K. and M. Tsakiris, 'Being a Beast Machine: The Somatic Basis of Selfhood', *Trends in Cognitive Sciences*, November 2018, 22, 11, pp. 969 – 981.

Seth, A. K., 'Interoceptive inference, emotion, and the embodied self.', *Trends in Cognitive Sciences*, 17, 11, 2013, pp. 565 – 573.

Shapin, S. and S. Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life* (Princeton NJ, 1985).

Shapin, S., 'Understanding the Merton Thesis', *Isis*, 79, 4 (1988), pp. 594 - 605.

Shields, A., 'The public life and political opinions of the 3rd Earl of Rosse' in C. Mollan, (ed.), *William Parsons 3rd Earl of Rosse: Astronomy and the castle in nineteenth-century Ireland* (Manchester, 2014) pp. 122 – 158.

Singer, K., *'Stoned Shelley: Revolutionary Tactics and Women Under the Influence',* Studies in Romanticism, Winter 2009, 48, 4, pp. 687 – 701.

Smail, D. L., *On Deep History and the Brain* (Berkeley CA, 2008).

Smith, C. and M. Norton Wise, *Energy and Empire: A biographical study of Lord Kelvin* (Cambridge, 1989).

Smith, C., 'Force, Energy, and Thermodynamics' in M. J. Nye (ed.) *Cambridge History of Science*, vol 5, chapter 15 (Cambridge, 2008) pp. 289 – 310.

Smith, C., *The Science of Energy: A Cultural History of Energy Physics in Victorian Britain* (London, 1998).

Smith, J., 'De Quincey's Revisions to "The System of the Heavens"', *Victorian Periodicals Review*, 26, 4 (Winter, 1993), pp. 203 – 212.

Snyder, L. J., 'It's *All* Necessarily So: William Whewell on Scientific Truth'**,** *Studies in History and Philosophy of Science,* 25, 5, (1994) pp. 785 - 807.

Snyder, L. J., 'Lord only of the ruffians and fiends'? William Whewell and the plurality of worlds debate', *Studies in History and Philosophy of Science*, 38 (2007) pp. 584 – 592.

Snyder, L. J., *Reforming Philosophy: a Victorian Debate on Science and Society* (Chicago, 2006).

Southgate, B., *'A new type of history': fictional proposals for dealing with the past* (London, 2015).

Stafford, W., *John Stuart Mill* (Basingstoke, 1998).

Stanley, M., 'The Pointsman: Maxwell's Demon, Victorian Free Will, and The Boundaries of Science', *Journal of the History of Ideas,* 69, 3, July 2008, pp. 467 - 491.

Steedman, C., *An Everyday Life of the English Working Class: Work, Self, and Sociability in the Early Nineteenth Century* (Cambridge, 2013).

Steinicke, W., 'Birr Castle observations of non-stellar objects and the development of nebular theories' in C. Mollan, (ed.), *William Parsons 3rd Earl of Rosse: Astronomy and the castle in nineteenth-century Ireland* (Manchester, 2014), pp. 210 – 270.

Steinicke, W., 'The M51 mystery: Lord Rosse, Robinson, South and the discovery of spiral structure in 1845', *Journal of Astronomical History and Heritage*, 15, 1 (2012) pp. 19 – 29.

Steinicke, W., *Observing and Cataloguing Nebulae and Star Clusters: From Herschel to Dreyer's New General Catalogue* (Cambridge, 2010)**.**

Stevenson, C. B., 'The Shade of Homer Exorcises the Ghost of De Quincey: Tennyson's "The Lotos-Eaters"', *Browning Institute Studies*, 10 (1982), pp. 117 - 141.

Stott, R., 'Thomas Carlyle and the Crowd: revolution, geology and the convulsive 'nature' of time', *Journal of Victorian Culture*, 01 March 1999, 4, 1, pp. 1 – 24.

Sturrock, J., *The Language of Autobiography: studies in the first person singular*, (Cambridge, 1993) pp. 215 – 216.

Sweet, M., *Inventing the Victorians* (London, 2001).

Tapp, E., 'The Unwrapping of a Mummy' in David, A. R. (ed.), *Manchester Museum Mummy Project: Multidisciplinary Research on Ancient Egyptian Mummified Remains* (Manchester, 1979) pp. 83 – 94.

R. G. Tedeschi, C. L. Park, and L. G. Calhoun, *Posttraumatic Growth: Positive Changes in the Aftermath of Crisis* (Mahwah NJ, 1998).

Theerman, P., 'James Clerk Maxwell and religion', *American Journal of Physics*, 54, 312 (1986), pp. 312 – 317.

Theodore Hoppen, K., *Ireland since 1800: Conflict and Conformity* (Harlow, 1999).

Topham, J. R., 'Natural theology and the sciences' in P. Harrison (ed.), The Cambridge Companion to Science and Religion (Cambridge, 2010) pp. 59 – 79.

Toulmin, S. and J. Goodfield, *The Discovery of Time* (Chicago, 1977).

Trevor-Roper, H., 'The Invention of Tradition: The Highland Tradition of Scotland', in E. Hobsbawm and T. Ranger, *The Invention of Tradition* (Cambridge, 2012) pp. 15 – 42.

Turner, F. M., 'Lucretius among the Victorians', *Victorian Studies*, 16, 3 (Mar., 1973) pp. 329 - 348.

Turner, F. M., 'The late Victorian conflict of science and religion as an event in nineteenth-century intellectual and cultural history', in T. Dixon, G. Cantor, and S. Pumfrey, (eds.), *Science and Religion: New Historical Perspectives* (Cambridge, 2010) pp. 87 – 110.

Turner, F. M., 'The Victorian Conflict between Science and Religion: A Professional Dimension', *Isis*, 69, 3 (Sep., 1978), pp. 356-376.

Vance, N., *Bible and Novel: Narrative Authority and the Death of God* (Oxford, 2013).

Walsh, K., M. King, L. Jones, A. Tookman, and R. Blizard, 'Spiritual beliefs may affect outcome of bereavement: prospective study', *British Medical Journal*, 324, 29 June 2002.

Weekes, T. C., 'Origin of the 3rd Earl's interest in astronomy' in C. Mollan (ed.), *William Parsons 3rd Earl of Rosse: Astronomy and the castle in nineteenth-century Ireland* (Manchester, 2014) pp. 30 – 43.

Weekes, T. C., 'The Nineteenth-Century Spiral Nebula Whodunit', *Physics in Perspective*, 12 (2010) pp. 146 – 162.

Wheeler, M., *Heaven, Hell, & the Victorians* (Cambridge, 1994).

Wheeler-Barclay, M, *Science of Religion in Britain, 1860-1915*. (Charlottesville VA, 2010).

White, H, *Metahistory: The Historical Imagination in Nineteenth-Century Europe* (Baltimore, 1973).

Whitrow, G. J., 'The role of time in cosmology', in W. Yourgrau, and A. D. Breck, (eds.) *Cosmology, History and Theology* (New York, 1977), pp. 159 – 177.

Wilde, N., 'Scepticism and Faith in the Philosophy of Pascal', *The Harvard Theological Review*, 9, 1 (Jan., 1916), pp. 56 - 83.

Wood, A., '"The Fashionable Diseases": Women's Complaints and Their Treatment in Nineteenth-Century America', *The Journal of Interdisciplinary History*, 4, 1, The Historian and the Arts (Summer, 1973), pp. 25 – 52.

Yeo, R., 'William Whewell, natural theology and the philosophy of science in mid nineteenth century Britain', *Annals of Science*, 1979, 36, 5, pp. 493 - 516.

Young, G. M., *Victorian England: Portrait of an Age* (London, 1936).

Young, R. J. C., *Colonial desire: hybridity in theory, culture and race* (London, 1995).

Yule, J. D., 'The impact of science on British religious thought in the second quarter of the nineteenth century', PhD thesis submitted to Cambridge University (1976).