ЖАҢА ШЕТЕЛДІК ФИЛОСОФТАР
NEW FOREIGN PHILOSOPHERS
НОВЫЕ ЗАРУБЕЖНЫЕ ФИЛОСОФЫ

IRSTI 02.41.11 https://doi.org/10.26577/jpcp.2021.v78.i4.01

D.G. Safronov

University of Cambridge, England, Cambridge
e-mail: dgs43@cam.ac.uk

ON THE GENEALOGY OF THE ETERNAL RETURN: FROM MYTH TO PHYSICS AND BEYOND[1]

Guided to the notion of the eternal return by the philosophical intuitions of the Greek antiquity, Nietzsche turned to the physical sciences of his day in order to further his inquiry. This extensive intellectual engagement represented a genuine attempt to investigate the possible continuity of meaning between the mythical tradition, on the one hand, and the rational-empirical (i.e. scientific), on the other. In particular, Nietzsche was intrigued by the manner in which the relationship between myth and science played out in the wide-ranging debates on the eternal recurrence and entropy. Obscuring the view, however, lay the debris of metaphysical imports into the discourse of secular modern science. In the course of his ambitious undertaking to disentangle physics from metaphysics, Nietzsche discerned a possibility for synthesising the scientific explanation for his 'fundamental conception' (EH: Z, §1) with the mythical wisdom of the ages. His inferences proved nothing short of explosive. The doctrine of the eternal return of the same, instead of the docile cosmic torpor, urged the radical revaluation of all values. The measure of the eternal return's power was to dissolve its impersonation – the Übermensch – into a form of well-being. Nietzsche was convinced that his 'mightiest idea' (NF-1881:11[148]) illuminated the path we must follow lest we wish to incur the full force of the 'frightening wisdom of Silenus' (BT: §4).[2]

Key words: Entropy, physics, religion, eternal return, thermodynamics, myth, knowledge, science, genealogy, capitalism.

Д.Г. Сафронов

Кембридж университеті, Англия, Кембридж қ.
e-mail: dgs43@cam.ac.uk

Мәңгілік қайта оралу шежіресі туралы: мифтен физикаға және одан әрі

Ницшенің мәңгілік қайталану теориясына деген өзіндік көзқарастары грек антикалық дәуіріндегі философиялық интуициялардың сыбыры астында қалыптасты. Кейінірек зерттеуін жалғастыру үшін неміс философы кеңес алу үшін жаратылыстану ғылымдарына жүгінеді. Бұл ауқымды бастама мифтік және рационалды-эмпирикалық (яғни ғылыми) ой дәстүрлері арасындағы мағына сабақтастығын зерттеуге деген шынайы ниеттен туындады. Атап айтқанда, Ницшені миф пен ғылым арасындағы қатынас мәңгілік қайталану идеясы мен энтропия құбылысының концептуалды жазықтығында қалай ойналатыны қызықтырды. Зерттеу барысында ол метафизикалық сипаттағы идеологиялық төзімділік қазіргі ғылымның «тірек тірегі» қызметін атқара беретінін түсінді. Физика мен метафизика түбегейлі араласқан шиеленістерді шыдамдылықпен шеше отырып, Ницше өзінің «іргелі тұжырымдамасының» (EH: Z, §1) ғылыми түсіндірмесін ғасырлардың мифтік даналығымен синтездеу мүмкіндігін түсінді. Оның [алдын ала] тұжырымдары жарылғыш болды. Ұйқыдағы ғарыштық енжарлықтың орнына өзгермейтіндердің

[1] This essay is a small token of gratitude I owe to my physics teacher, Гизелла Михайловна Бровар – a truly inspirational educator, who taught us the love of physics and so much more. To my form tutor, Любовь Моисеевна Шин, who taught us to be unafraid of challenging conventional wisdom, and to my friends who, no matter how far I may have strayed, have always welcomed me back to our shared and cherished spiritual home – Almaty, by the grace of which we have remained connected and *au courant*.

[2] See Miriam Leonard's excellent discussion in *Tragic Modernities*, 2015:13-21.

мәңгілік қайта оралуы туралы ілім барлық құндылықтарды түбегейлі қайта бағалау қажеттілігін көрсетті. Ол дәлел ретінде қайта бағалау қажеттілігі пайда болған интеллектуалды ортаға айналды. Мәңгілік қайтару теориясының күші оның тұлғалануын – 'Übermensch' – әл-ауқат формасына айналдырды. Ницше өзінің «ең маңызды идеясы» (NF-1881: 11 [148]) Силеннің қараңғы пайғамбарлығында адамзатқа алдын ала айтылған тағдырдан аулақ болу үшін жүруіміз керек жолды көрсететініне сенімді болды (BT: §4).

Түйін сөздер: энтропия, физика, дін, мәңгілік қайтару, термодинамика, миф, білім, ғылым, генеалогия, капитализм.

Д.Г. Сафронов
Кембриджский университет, Англия, г. Кембридж
e-mail: dgs43@cam.ac.uk

Из родословной вечного возвращения: от мифологии к физике и далее

Изначальные взгляды Ницше на предмет теории вечного возвращения формировались под шепот философских интуиций греческой античности. Позже, с целью продолжить свои изыскания, немецкий философ обратился за консультацией к естественным наукам. Это масштабное начинание было движимо искренним стремлением исследовать преемственность смысла между традициями мифической и рационально-эмпирической (т.е. научной) мысли. В частности, Ницше был заинтригован тем, как взаимосвязь мифа и науки разыгрывается в концептуальной плоскости идеи вечного возвращения и феномена энтропии. В процессе исследований он осознал, что мировоззренческие допуски метафизического характера продолжали выполнять функцию «несущих опор» современной науки. Терпеливо распутывая клубок, в котором основательно перемешались физика и метафизика, Ницше уловил возможность синтеза научного объяснения своей «фундаментальной концепции» (EH: Z, §1) с мифической мудростью веков. Его [предварительные] выводы оказались взрывоопасными. Доктрина вечного возвращения неизменного, вместо сонного космического безразличия, указывала на необходимость радикальной переоценки всех ценностей. Она явилась интеллектуальной средой, в которой необходимость переоценки предстала, как очевидность. Сила теории вечного возвращения трансформировала свое олицетворение – Сверхчеловека ('Übermensch') – в форму благополучия. Ницше был убежден, что его «самая значимая идея» (NF-1881:11[148]) укажет путь, которому мы должны следовать, во избежание участи, предсказанной человечеству в мрачном пророчестве Силена (BT: §4).

Ключевые слова: энтропия, физика, религия, вечное возвращение, термодинамика, миф, знание, наука, генеалогия, капитализм.

Assuming we say yes to a single moment, we have not only said yes to ourselves, but to all existence. Because nothing stands for itself, neither in ourselves nor in things: and if only once has our soul trembled and sounded like a string with happiness, then all eternity were necessary to condition this one event – and all Eternity was approved, redeemed, justified, and affirmed in that single moment of our affirmation.

~ Nietzsche, NF-1886:7[38] ~

Introduction

This article explores some of the unheeded aspects of Nietzsche's eternal recurrence ('die ewige Wiederkunft')[3], which powered the conceptual nexus of his philosophical project culminating in the famous call for the revaluation of all values ('Umwerthung aller Werthe'). In broadest terms, the philosophy of the eternal return ('ER') concerns the manner in which we experience and relate to the world, as well as providing critical insight into what it would take to *live well* in this world. It is Nietzsche's answer to his own question of 'whether we still want to live and how':

> What do we do with the remainder of our life – we who have spent most of it in the most essential ignorance? (NF-1881:11[141])[4]

[3] For the purposes of this article, I use 'return' and 'recurrence' as interchangeable notions. See Ansell-Pearson's discussion of Nietzsche's use of '*die ewige Wiederkunft* (from the verb '*kommen*', to come) and *die ewige Wiederkehr* (from the verb '*kehren*', to turn)', 2005:19-20.

[4] Nietzsche's Critical Digital Archive, eKGWB, available at http://www.nietzschesource.org, is used to source unpublished material from Nietzsche's notebooks assembled in the Nachlass. Notes are organized according to the year, number of the notebook and the number of the notebook entry, e.g. NF-1881(year): 11(notebook number) [141] (note number). Nietzsche's private correspondence is referenced as 'BVN' ('Briefe von Nietzsche') and each entry is numbered and linked to the year, e.g. BVN-1883 [year of writing]:438 [entry number].

The eternal return is, at the same time, one of the most provocative thought experiments devised by Nietzsche.[5] By forcing 'becoming' (aka Heraclitus) and 'being' (aka Parmenides) into the boxing ring of philosophical heavyweights' (see PUW:21-22; NF-1886:7[54]), Nietzsche – not unlike Goethe's Faust (see UM: *SE*, 4)[6] – sought, 'in the mystery of their argument (PUW:21), a formula that would encode the relationship between the material well-being and spiritual transcendence. Nietzsche attached high hopes to his 'greatest doctrine': he intended to 'teach us something' important by means of it (NF-1884:25[227]).[7] Although a shadowy presence already haunting Nietzsche's earliest texts, the thought of the eternal return was first articulated in *The Gay Science* (1882) by none other than a 'demon' (GS: §341).[8] Nietzsche's earlier – private – formulation of the same, however, is more elegant, in my view:

> Human! Your whole life will be turned over and over again like an hourglass and it will run out again and again – a long minute in between, until all the conditions that you have become in the cycle of the world come together again. And then you will find every pain and every pleasure, every friend and enemy, every hope and every error, every blade of grass and every ray of sunlight, the whole context of all things. This ring, in which you are but a grain, shines again and again. And in every ring of human existence there always comes an hour when first the one, then the many, then the mightiest of all thoughts arises, that of the eternal return of all things – it is always the hour of noon for humanity. (NF-1881:11[148])

This puzzling statement invited a plethora of intertwined lines of academic inquiry pursued by those, who did not dismiss the eternal return as somewhat non-sensical beyond the limited utility as a rhetorical device.[9] The *cosmological* strand builds on Nietzsche's claim that the ER is 'the most scientific of all possible hypotheses' (NF-1886:5[71§6]).[10] The *ethical* interpretation focuses on the ER's ostensible 'existential imperative' (Magnus 1978:27): 'to live in such a way that you must wish to live again' (NF-1881:11[163]).[11] In addition, the ER is explored as a *health check* of sorts – a litmus test of one's attitude to life – 'a selective principle in the service of strength' (NF-1883:24[7]; NF-1887:9[8]) for the purpose of 'prevention of reduction', or 'rather destruction by mediocrity' (NF-1885:2[131]; NF-1884:25[227]).[12] Although each of the aforementioned clusters undoubtedly captures something important about the eternal return, none can earnestly claim to encapsulate the quintessence of Nietzsche's strange teaching – his 'most abysmal thought' (EH: *Z*, §6).[13] Nearly all strands of inquiry point to an insoluble contradiction at the heart of Nietzsche's theory and none find a way to progress past the identified aporia.[14] This confutation is an admission of inability to recognise that the eternal return is *no ordinary thought*: it cannot be grasped by the mind *a cappella*. Its provenance dictates that to be *understood*, the eternal return must be sensed beyond the reaches of the mind's computational activity. The understanding of the eternal return resides outside the boundaries of mere conscious perception but not in metaphysics. That is the puzzle, in respect of which, Nietzsche's eternal return is akin to the part of physics we are presently missing – it is an *awareness* of 'an unknown state of affairs' (NF-1873:29[52]) that could be capable of linking the quantum and the classical worlds.[15] Thinking the eternal return is an *experience* unlike any other cognitive activity we know. It is like the melody we may have a distant sense of but cannot yet hear, let alone express, since it requires an altogether new sensibility as a medium within which it could actualise itself.

[5] See Cooke 2005:16.

[6] Or even Dante who, having reached 'the middle of life', decided to descend into his own Inferno.

[7] See TI: *Ancients*, §5; see Löwith 1978:94; Lampert 1986:81.

[8] In this respect, it bears some similarity to another provocative thought experiment, which, courtesy of William Thomson (aka Lord Kelvin), became known as 'Maxwell's Demon' (Thomson 1874:86[12] in *Mathematical and Physical Papers*, Cambridge: CUP, 1911:11-21). Its objective was to challenge the irreversibility of entropic processes implied by the second law of thermodynamics. See Emden 2014:127-128 for an insightful commentary.

[9] E.g. as a literary artifice of mere irony, Nehamas in *Nietzsche: Life as Literature* (1985).

[10] Or, 'natural-scientific' (Löwith 1978:94) and 'descriptive-empirical one (Magnus 1978:7-10, 29).

[11] Or, that we must 'consider the future as decisive for all our evaluations – and not seek the laws of our actions behind us!' (NF-1884:26[256]).

[12] In this latter capacity, as a *test* of health and strength, the weak and unhealthy (agents of *ressentiment*) would 'perceive the belief in the eternal return as a curse' (NF-1886:5[71], §14). See also Eric Oger's discussion in 'The Eternal Return as Crucial Test', 2017.

[13] For an informed recent overview of the various schools of thought on the eternal return, see Paphitisa 2009, Cooke 2005 and Sinhababu 2019.

[14] See Heller 1988:173-187; Löwith 1997:83-94; Müller-Lauter 1999:89-91.

[15] This possibility is, however, hinted at. See Emden 2014:108 on lifting our 'understanding nature as becoming' from the constraints of causality.

Philosophical intuitions of the eternal return

Nietzsche traced the 'idea of the eternal recurrence, this highest formula of affirmation' to August 1881, when it was 'penned on a sheet of paper with the notation underneath, "6000 feet beyond man and time"' (EH: *Z*, §1).[16] His philosophical intuitions, however, that bore fruit at the sight of 'a powerful pyramidal rock not far from Surlei' (ibid.), on the shores of Lake Silvaplana have undergone a long period of intense intellectual gestation.

The inchoate language of 'the eternal cycle' (*'den ewigen Kreislauf'*) can be found in Nietzsche's correspondence dating back to 1868 (see BVN-1868:562).[17] In some of the early notes retained in the *Nachlass*, Nietzsche reflects on the origins of the 'work of art and the individual' in terms of 'a repetition of the original process from which the world originated' as 'a wave-ring within a wave' or as a 'ripple within the wave' (NF-1870:7[117]).[18] In an adjacent note, Nietzsche references 'the round dance of the stars' (NF-1870:7[121]) and in a poem, written in 1871, he expresses his early opposition to Schopenhauerian melancholy by invoking 'the proud and high-spirited eye, which rolls back and forth' (NF-1871:15[1]). Complementing these reflections, Nietzsche's unpublished *Prefaces*, including *On the Pathos of Truth* (1872), elucidate with uncanny clarity the existential angst aroused by the idea of the eternal return of the same (PUW:95).

Further conceptual underpinnings of the eternal recurrence can be found in *The Birth of Tragedy* (1872). Nietzsche discusses the 'perpetual becoming in time, space and causality' (BT: §4) alongside the ultimate 'sameness' and 'indestructibility of life' (BT: §7), which flows on 'beneath the whirl of phenomena' (BT: §18). Nietzsche's analysis of the Greek tragedy suggests that 'tragedy, with its metaphysical consolation, points to the eternal life of this core of existence, which abides through the perpetual destruction of appearances' (BT: §8). Taken together, these observations – expressing the creative-destructive union of the Dionysian and the Apollonian – bear conceptual resemblance to the perpetual cycle of energy's conservation achieved through the intractable entwining of framing, decay and rebirth. Later, in the *Untimely Meditations (1874)*, where Nietzsche explores the complex relationship between culture and history, he enunciates the notion of the conservation of energy and anticipates the eternal recurrence:

> I mean that power to grow out of itself in a peculiar way, to transform, and to incorporate into itself the past and the strange, to heal wounds, to replace lost things, to reproduce broken forms from the broken pieces. (UM: UDHL, §1)

Furthermore, Nietzsche references the 'Pythagorean belief' in that 'when the constellation of the heavenly bodies is repeated, the same things, down to the smallest event, must also be repeated on earth' (UM: *UDHL*: §2). Developing this line of thought, he makes a stipulation which later becomes critical for the doctrine of the eternal return. He posits that that, which returns 'at definite intervals', is 'the same complex of motives, the same *deus ex machina*', but – and this is important – 'the dice-game of chance and the future could never again produce anything *exactly similar* to what was produced in the past' (ibid.).[19] Some years later, in *Human, All Too Human* (1878), reflecting on [the urgent need for] the transition 'from the moral to a knowing humankind', Nietzsche develops the idea of 'a new habit of understanding … and surveying', which, having been developed over thousands of years, will resolve itself in the power of the humankind to periodically bring forth 'the wise and innocent man' (HAH: *HMS*, §107). His meditation beckons Zarathustra's arrival: having tasted the philosophical honey of *The Gay Science*, he would articulate the idea of the eternal return in a rare feat of singularity where an abstract conception finds precisely the right spokesperson through whom alone it is able to reveal itself. Whether he knew it or not, however, Zarathustra has been pregnant with the eternal return for at least as long as it took Nietzsche to give birth to his seminal idea.

Philosophical unease over the metaphysics of science

A certain sense of apprehension accompanies Nietzsche's early forays into the domain of the eter-

[16] See Nietzsche's clarification concerning the significance of '6000 feet' in NF-1881:11[239].

[17] For the embryonic ideas, it is possible to go further back still to Nietzsche's earliest [school] essays ('Fatum und Geschichte' and 'Willensfreiheit und Fatum') and correspondence dating between 1862-1868, although these are not particularly revealing, except as representing 'conception' points.

[18] 'Ripple within the wave' is Löb's translation in *Nietzsche: Writings from Early Notebooks*, 2010:36.

[19] Nietzsche would later clarify that 'the similar is not a degree of the same: but something completely different from the same' (NF-1881:11[166]; see also 11[237]). See Deleuze's discussion in *Nietzsche and Philosophy*, 1983:18-27. Additionally, Nietzsche's view chimes with the cosmology of the *Old Testament*, which distinguishes between the return of the self-same substance and the different superficiality (or, the 'vanity of vanities'), and merits further examination (see, for example, The Book of Ecclesiastes, Ch. 1, 'All is Vanity').

nal return. It starts with a haunting image of an 'abstract man' – a product of 'abstract education, abstract morality, abstract law and the abstract state' – who stands 'eternally hungry' and consumed by the unremitting and 'overabundant lust for knowledge' (BT: §23-24). Nietzsche alludes to the increasingly 'dissatisfied modern culture' that cannot find nourishment in 'anything it devours' (ibid.). He suggests there is something untoward in this state of affairs. How could science, knowledge and progress – all expressing 'the same unsatisfied delight in discovery' – not contribute to making us stronger, contented and fulfilled (ibid.)?

Nietzsche resuscitates the Heraclitan worry that *acquisition of knowledge* does not automatically add up to *understanding*.[20] He concurs that 'to know' something does not mean 'to understand' that very thing, as though psychological blockage of some sort develops to prevent 'conscious knowledge' from transforming into understanding in the very instant that 'infinity pours out of it' as though from 'a screw without end' (NF-1869:3[10]).[21] As though, petrified by infinity's inviting emptiness, conscious knowledge stands vulnerable and uncertain of which direction to take. Nietzsche wonders whether this 'appetite for and enjoyment of the chase and intrigues of knowledge – up to the highest and remotest stars' (D: §327) could have anything to do with the 'loss of our mythical home' as a vital protective cloak (BT: §23)? In other words, could it be that the Socratic scientific passion – 'without guidance from myth' – lacks an essential ingredient (ibid.: §17)? Nietzsche suggests that 'to make existence appear comprehensible and thus justified' is different from acquiring knowledge about this existence or, to be more precise, knowledge and its acquisition can only take us some of the way, but *not all the way*, to understanding the world and our existence sufficiently so that we could justify and value both unconditionally (ibid.). If that were the case – i.e. it was not *science proper* that held the hand of 'the forces of knowledge' as it guided their progress – then what, or who, did and to what ends (ibid.: §15-18)?

Nietzsche's misgivings, voiced in *The Birth of Tragedy*, problematise the connection between the 'spirit of modern science' and a 'sublime metaphysical illusion' that appears to accompany it (BT: §15). The dilemma which science faces, according to Nietzsche, is that although scientific inquiry emerges as an effective way of overcoming the superstition of religion (see NF-1888:15[63]), science seems unable to fulfil this objective on its own and, in consequence, it inevitably gets caught in the nets of the 'metaphysical bird catchers' (BGE: §230). In other words, Nietzsche highlights the issue of the scientific pursuits being affected by the very prejudices and metaphysical superstitions they intend to purge from the body of knowledge (Acampora 2004:173). As Christoph Cox points out, Nietzsche considers that there is still not enough science in science of his time and that the 'mechanistic physics and evolutionary biology are still not naturalistic enough' in their efforts to overcome 'the shadows of God' (Cox 1999:216).

The problem with the 'shadows of God', according to Nietzsche, is that they are *never value neutral*. Nietzsche cautions that 'God … makes himself small and pushes his way through the whole world … also as a demon of annihilation' (NF-1884:26[220]).[22] His earlier and related point is that the 'essence of religion is precisely to retain myth-making power' as science becomes secularised and, as though, freed from God (see NF-1873:27[1]). Something important changes, however, since the Christian myth-making is distinctly different from that of the Greek antiquity in terms of its teleology and epistemology. A different value-paradigm becomes projected onto and guides the process of knowledge acquisition henceforth.

With the advent of modernity and amid the ensuing 'seductions of secularisation' (PTAG: §1), the domicile of the 'truth claim' changes. Religion and morality, according to Nietzsche, having sublimely inaugurated 'the drive for knowledge' now seek to express themselves through science (NF-1872:19[218]). In the *Genealogy of Morals* (1887), Nietzsche adds that 'Christian conscience translates and sublimates into scientific conscience, into intellectual purity at any price' (GM: III, §27). Thus it acquires a new form and a new innocence, while – in substance – it continues to 'deprive man of his earlier belief in his own importance' (Brandes 1889: §4).[23] In this respect, one of the principal weaknesses of the modern science of his day, problematised by Nietzsche, is its susceptibility to the metaphysical charms of 'the will to truth':

[20] Heraclitus is alleged to have remarked that 'much learning does not teach the mind' (Turner 1903:54).

[21] This exhibits strong affinity to Heraclitus: 'the limits of the soul you could not discover, though traversing every path'. (See *Fragments*, Diels, Fr. 45:DK 22B45).

[22] See Nietzsche on the 'dangerous afterlife' of God 'in places where no one suspects it' in BGE: §12.

[23] Brandes, Georg (1889), 'An essay on the aristocratic radicalism of Friedrich Nietzsche', accessed from https://archive.org/details/essayonaristocra00bran/mode/2up.

> Science rests on a faith …it is still a metaphysical faith upon which our faith in science rests – that even we, seekers after knowledge today, we godless anti-metaphysicians still take our fire, too, from the flame lit by a faith that is thousand years old, that Christian faith, which was also the faith of Plato, that God is the truth, that truth is divine. (GS: §344)

These considerations guide Nietzsche's enduring search for the eternal return as an antidote to the mythless existence of modern society.[24] Nietzsche's intellectual journey, so conceived, simply cannot avoid delving into the fabric of science in order to develop an appreciation for the problems besieging it (ibid: §17). As Abel Rey, a prominent French philosopher and historian of physical science, points out:

> [W]ith an intuition of genius, one of the greatest philosophical geniuses of human history, would consecrate ten years of his life to a study of natural science in order to found his theory of return on atomic theory. (Babich 1994:65)

Nietzsche's interest in science

It is by no means my intention to seek vindication for Nietzsche as a scientist. My contention is that an examination of Nietzsche's critical engagement with the scientific debates of his time opens up a fruitful venue for exploring the conceptual roots of his theory.[25] Bernd Magnus' influential discussion on 'the philosophy of eternal recurrence' drew attention to the *gap in the Nietzsche scholarship*, which resulted from the systematic failure to examine more closely the implications of Nietzsche's intellectual involvement with natural sciences for all other components of his *oeuvre* (Magnus 1978:7-13). The passage of time notwithstanding, this gap persists. To explore this conjecture in relation to the eternal return, I will draw on the material contained in the yet to be published *Nachlass notebook*, known as *Notebook M III, 1 (Spring-Autumn 1881)*.[26] This collection of notes encompasses Nietzsche's broad-ranging discussion of the doctrine through the lens of physical science. It remained influential and Nietzsche 'had kept Notebook M III 1 (1881) with him for the entire final period of his creative activity' (Colli-Montinari 1967:60).[27]

Second half of the XIX century witnessed significant breakthroughs across the broad spectrum of natural sciences. Darwin's *On the Origin of Species* was published in 1859. Mendeleev's periodic table became the key synthesising development in chemistry from the late 1860s. In physics, one of the fastest developing fields was the reinvigorated science of thermodynamics. Scientific discoveries frequently highlight issues, significance of which extends beyond the narrowly defined disciplinary boundaries. Sometimes they inadvertently wake ancient riddles from the slumber of the ages (see Eliade 1959:146). It is in these two senses that scientific advances become of relevance to Nietzsche. His long-standing interest in science is easily ascertained.[28] The level of Nietzsche's grasp of the key scientific theories of his time from 'embryology to meteorology' (Brobjer, Moore 2004:1), as well as from 'physics to evolutionary biology' (Kragh 2008:139), remains a point of keen academic debate, which is best left for another occasion.[29] Suffice it to say, Nietzsche's was a genuine attempt to connect with 'the age of science' in a meaningful, 'complex and probing manner' from early on in his scholarly career (Brobjer, Moore 2004:1-7). At one point, Nietzsche seriously 'considered giving up philology for science' (Kaufmann 2013:25). In this respect, Müller-Lauter highlights Nietzsche's 'efforts to understand states of affairs for which his education had not prepared him' (Müller-Lauter 1999:161). Stephen Brush comments that subsequent to 1881, Nietzsche 'devoted several years to studying physics in an attempt to develop a scientific foundation' for his doctrine of the eternal recurrence (Brush 1966:15-16). More recent studies, like that by Juliano Neves (2019) and Joshua Rayman (2018), venture bolder claims:

> Physics is at the heart of Nietzsche's worldview. He identifies his aim as to set forth a philosophical physics (FW 335) and his general program can be described as a physics in the sense of replacing transcendent, causal, metaphysical explanations of nature with descriptions of underlying principles of force and energy. (Rayman 2018:167)

In *Ecce Homo* (1888), Nietzsche tells us that his serious interest in natural sciences starts around the time of writing *Human, All Too Human*, i.e. around

[24] See Heller's insightful discussion, 1988:10-17.

[25] For the *genealogical roots* of the eternal return, we shall have to dig deeper still.

[26] For informative and highly relevant discussion of some of the notes contained in M III 1, see Ansell-Pearson, 2005:1-21.

[27] See D'Iorio 2010:17-18 for further context.

[28] For an excellent and balanced overview of the Nietzsche scholarship on this issue, see Babette Babich, 1994:61-75 and Müller-Lauter, 1999:161-182.

[29] Cf. Brobjer describes Nietzsche's understanding of physics as 'sketchy' and his knowledge of mathematics 'rudimentary' (Brobjer and Moore 2004:20-21). Löwith's own view is that 'qua natural science … Nietzsche is a philosophising dilettante' (Löwith 1978:83).

1878 (EH: *HAH*, §3). He also considers this work (i.e. *HAH*) to be 'a good and accessible gateway to' his 'own mindset' (BVN-1886:733).

Conservation of Energy and the Eternal Return

The burgeoning field of thermodynamics, closely surveyed by Nietzsche, was one of the major intellectual battlefields of the second half of the nineteenth century. It is the branch of physics, which studies 'the relationship between heat, work, temperature, and energy'. In broad terms, thermodynamics deals with the transfer of energy from one place to another and from one form to another. The *two principal laws*, which underpin the discipline, happen to be of particular relevance to Nietzsche. In the first instance, it is the *law of conservation of energy*. During Nietzsche's lifetime this principle was expressed independently in the work of Mayer (1842), Joule (1843)[30] and Clausius (1850).[31] It states that the total energy in a closed system remains constant overtime. Following directly from 'Newton's equations', it came to be considered as 'one of the most incontrovertible laws' (Rovelli 2016:78). The main consequence of the first law ('TD1') is that energy can be neither created, nor destroyed and that only its transformations and transfers are possible.

Mayer's enunciation of the principle of conservation of energy,[32] can be regarded as an inflection point in the development of Nietzsche's thought on this subject.[33] His notes dating from spring 1881 to spring 1882 confirm that he reads Mayer's work on 'Die Kinetische Theorie' closely (BVN-1882:213), just as TD1 becomes a prominent input for his doctrine of the eternal recurrence.[34] The *Nachlass* notes make it clear that Nietzsche adopts the notion of *finite space (i.e. some version of a closed system) and infinite time* as his frame of reference:[35]

> The measure of the Total Energy is definite, not "infinite": let us beware of such conceptual debauchery! Consequently, the number of variations, changes, combinations and developments of this energy, while immensely large and practically "immeasurable", it is nonetheless also determined and not infinite. But the time in which the universe exercises its power is infinite; the energy therefore is eternally conserved and eternally active. Everything has happened countless times, inasmuch as the total configuration (Gesamtlage) of all forces recurs eternally. (NF-1881:11[202])[36]

By 1886, Nietzsche asserts conclusively that the concept of the eternal recurrence was a direct consequence of the first law of thermodynamics: 'the law of the conservation of energy *demands* eternal recurrence' (NF-1886:5[54]; *emphasis added*)[37]. The term 'demands' ('förder') is of key significance here. It allows to discern Nietzsche's intuition that in order to overcome the mechanistic indubitability – characteristic of the Newtonian natural law outlook ('Naturgesetz')[38] – embedded in the idea of conservation of energy, the eternal recurrence is, in some sense, necessary. The eternal return is 'demanded' not so much by the formulation as by the *spirit of the idea* of energy conservation, which lies dormant in Mayer's enunciation – still a captive of the metaphysical precepts – which dominate scientific thinking:

> Supposing, together with Mayer, one still believes in matter filled with atoms, one cannot then decree: "there is only one force" … Mayer himself envisages a second force in the background, the primum mobile, the dear God, beside the movement itself. He also needs him completely! (BVN-1882:213 – Letter to Heinrich Köselitz, 20/03/1882; emphasis added).

This passage highlights the unresolved tension, which Nietzsche finds in Mayer. Behind his materialistic atomism, Nietzsche detects 'the celebrated "metaphysical need" which still leads a dangerous afterlife in places where no one suspects it' (BGE: §12). Stretching the thread of his genealogical argument further back, Nietzsche suggests that residing

[30] James Joule disputed that Mayer pioneered this discovery and claimed to have been the first to do so in 1841 (Wisniak 2008:220).

[31] Wisniak 2008:218-220.

[32] Mayer, R.J. 'Bemerkungen über die Kräfte der unbelebten Natur'. Annalen der Chemie und Pharmacie 1862: 43, 233 ('*Comments on the Forces of Inorganic Nature*'). See Emden's informed account, 2014:173-174.

[33] See Robin Small in '*What Nietzsche Did During Science Wars*' in Brobjer-Moore 2004:159-160.

[34] See NF-1881:11[24-25], [201-202], [213] and [292]. Brobjer also presents evidence of Nietzsche's reading of one of Mayer's later manuscripts on the *Mechanics of Heat ('Mechanik der Wärme'*), published in 1867 (Brobjer-Moore 2004:38).

[35] See NF-1881:11[245], [269], [305]; NF-1885:36[25].

[36] Although, to the best of my knowledge, Deleuze never refers specifically to this critical note, Nietzsche's text fully supports Deleuze's intuition that the eternal return does not return the identical but 'is itself the one which ought to belong to diversity and to that which differs' (Deleuze 1983:46).

[37] This translation, which appears in *The Will to Power* (WP: §1063), is a quite a liberal interpretation of Nietzsche's actual phrasing by Hollingdale and Kaufmann.

[38] See *The Gay Science*, §37: 'Science has been promoted in recent centuries, partly because it was hoped to best understand God's goodness and wisdom with it, and the chief motive in the soul of *the great Englishmen (such as Newton)*'.

in the views of 'materialistic physicists and chemists' is the 'calamitous atomism which Christianity has taught best and longest, the *soul atomism*' (ibid.). It designates 'the belief which regards the soul as something indestructible, eternal, indivisible, as a monad, as an *atomon*: this belief ought to be expelled from science!' (ibid.):

> "Things" are not regular, not a rule: there are no things (- that's our fiction) … mechanics as a doctrine of movement is already a translation into the sense language of man. If we eliminate these additions, then there are no things left, but dynamic quanta, in a tense relation to all other dynamic quanta: whose essence consists in relation to all other quanta, in their "action" on them – the will to power not a being, not a becoming, but a pathos is the most elementary fact, from which only a becoming, an action result ... The mechanics formulate sequelae semiotic in sensual and psychological means of expression, it does not touch the causal force ... (NF-1888:14[79]; emphasis added)

As Nietzsche searches for the dynamic formulation of the principle of conservation of energy, the '*demand*' for the eternal recurrence' moves to the forefront of his thinking (NF-1886:5[54]). His phrasing suggests that the *eternal recurrence is a broader notion than the conservation of energy*. Indeed, the conservation of energy is itself a broader notion than the mechanistic conserving of energy would have it. Nietzsche's notes reveal a clear sense that the *regenerative properties of energy* must lie 'outside the mechanical laws' (NF-1881:11[313]). He senses that in order for the energy to be conserved without the divine intervention (i.e. on its own terms), it is important for it to be able to continue the cycle of transformations in such a way that it overcomes the limitations of the 'mechanistic conception of the First Law' (NF-1881:11[148]).[39] Failing that, in Nietzsche's mind, entails an inevitable return to the idea of God. As such the dilemma surrounding the conservation of energy appears, to Nietzsche, to be binary:

> Anyone who does not believe in a cycle of the universe must believe in the arbitrary God – that is the reason for my contemplation, in contrast to all previous theistic ones! (NF-1881:11[312])

Tales of the eternal return

Nietzsche regards modern science – a relatively recent development – as an attempt to interpret much older notions and to solve ancient riddles. Although the formulation of TD1 takes place during Nietzsche's lifetime, the notion underpinning it is a primeval and persistent one (Rovelli 2016:7; Sambursky 1956:200). It can be traced back to Thales of Miletus, Parmenides, Empedocles, *Heraclitus* and *Epicurus*, all of whom entertain some notion of the indestructible elements, or primal substance (Sambursky 1956:133, 197-205). Nietzsche's early reflections on the philosophy of Heraclitus – regarded as 'one of the greatest physicists in ancient times' (Turner 1903:57) – display the conceptual building blocks of the doctrine of the eternal recurrence:[40]

> A becoming and passing away, a building and destroying, without any moral attribution, in eternally equal innocence, has in this world alone the play of the artist and the child. And just as the child and the artist play, the everliving fire plays, builds and destroys, in innocence – and this game is played by the Aeon with itself. (PTAG: §7)

In a fascinating inquiry into *The Physical World of the Greeks* (1956), Samuel Sambursky finds that the pre-Socratic tradition, complemented by the insights of the thinkers of the Stoic period, can be rightly 'called a first tentative approach to the conception of thermodynamic processes in the inorganic world', including some early notions of the continuous 'formation and decay of the cosmos' (Sambursky 1956:133, 198). The *Nachlass* notes indicate that Nietzsche borrows from the Stoic cosmogony the terminology of conflagration ('*Feuersbrunst*'), which becomes a proxy for the process of decay which, in turn, becomes consumed by [regenerative] fire' (Sambursky 1956:200):[41]

> [T]he idea of cosmic cycles, when comprehended in terms of number, involves the identical repetition of the present, a fact which was seized on by philosophers like Nietzsche for the purpose of their own doctrine. It is most interesting to observe that the very same inner logic which in our times has linked together thermodynamics, statistical mechanics and the idea of the "return of the identical", was also the driving force in Greek thought. (Sambursky 1956:200-201; emphasis added)

The famous Roman poet, Lucretius – 'gloomy, yet bright disciple' of Epicurean wisdom (D: §72) – expanding on the concept that there is 'no place beyond the universe' (Wisniak 2008:159), presents perhaps the clearest articulation of the principle of the conservation of energy (or, in his case of 'sub-

[39] See also NF-1881:11[157], [228] and [247].

[40] See Acampora's comment that 'both Cox and Muller-Lauter have recognised that Nietzsche's alternative account of development is indebted to Heraclitus (Acampora 2004:175). See also Hatab 2005:120-122, 151-152.

[41] See NF-1876:23[14]; NF-1887:11[341].

stance') in a manner that closely anticipates Nietzsche's theory of the eternal recurrence:

> Nothing from nothing ever yet was born … naught from nothing can become … Nor nothing to nothing evermore return. And, too, the self-same power might end alike all things, were they not still together held by matter eternal, shackled through its parts, now more, now less. (Lucretius, De Rerum Natura, Book I, Substance is Eternal)

In 1878 Nietzsche concludes that '*we are still no further than Epicurus*'(341-270BC) in terms of understanding the machinations of the universe notwithstanding the proliferation of scientific knowledge (NF-1878:33[9]). His philological intuition concerning the concept embedded in the law of conservation of energy urges him to go 'beyond' Epicurus in terms of tracing its origins.[42] As Raymond Geuss aptly observes, 'Nietzsche's philology-based scepticism finds an adequate expression in his 'genealogies' (Geuss 2009:87). What is important to appreciate in this context is that Nietzsche, in search for answers, goes to back to the beginning of philosophy, to its mythical origins (see Heit 2014:218-221). As Geuss notes, 'first there were myths and poetic cosmologies, structured as narratives and genealogies, like that of Hesiod' (Geuss 2014:9).

Mythical thinking and the need for its revival, which Nietzsche implores throughout *The Birth of Tragedy*, is important in the sense of its ability to (a) *express, 'through intuition, the reciprocal necessity'* of a process, situation or of a social context and (b) establish *appropriate connection* between the knowable (i.e. domain of reason/science) and the unknowable (i.e. the intuitive domain of myth) without either setting these categories in an antagonistic opposition with one another, or breaking the continuity of meaning between them so that history could begin from the point of rapture with the domain of *mythos*.[43] Unlike the metaphysical formula that eludes critical scrutiny by domiciling the ultimate causes outside the physical world and by injecting animosity between it and 'a separate world beside it' (HAH: I, §11), an enduring myth, by virtue of its dual aspect – i.e. as a form of 'cosmic self-consciousness' (HAH: *AOM*, §185) compresently situated as though inside and outside of history (BT: §23) – helps to establish and to preserve these links and relationships throughout time in a manner that does not divorce the natural world from the mechanisms of its causation.[44] Nietzsche's suggestion, therefore, is that the *synthetic properties of mythical thinking*, when combined with the scientific methods, can contribute to a deeper *understanding* of a given phenomenon than either of the (a) scientific knowledge can afford on its own, or (b) when the latter is implicitly (or, unwittingly) combined with the metaphysical fiction. He acutely senses the need for the conceptual framework within which acquisition of knowledge could become commensurate (and synonymous) with gaining a deeper understanding of the phenomena in question, and he hopes that thinking the eternal return might just provide the required frame of reference. By removing the shackles of the *will to truth* from knowledge acquisition, the eternal return should be able to help it embrace the pursuit of understanding.

One of the earliest images that convey the concept of the conservation of energy is to be found in the ancient parable of the Phoenix rising from the ashes, which predates Epicurus. It comes into the Greek lore through Herodotus (484-425 B.C.), who recounts a somewhat sceptical account of the mystical Egyptian phoenix:

> [The Egyptians] have also another sacred bird called the phoenix which I myself have never seen, except in pictures. Indeed, it is a great rarity, even in Egypt, only coming there (according to the accounts of the people of Heliopolis) once in five hundred years, when the old phoenix dies … this bird comes all the way from Arabia, and brings the parent bird, all plastered over with myrrh, to the temple of the Sun, and there buries the body. (Herodotus, The Histories, Book II Trans. G. Rawlinson, 1858)

Nietzsche is intimately familiar with the work of Herodotus – 'a main source of knowledge' (NF-1870:5[123]) – including *The Histories* (c.425 B.C.), and considers him a critical component of any holistic education (see Barnes 2014:121).[45] Furthermore, the phoenix 'rising from the ashes' also features in Nietzsche's writings where the connotations of the principle of conservation of energy are clearly discernible.[46] One of Nietzsche's better-known aphorisms in this context comes from Zarathustra, who connects the phoenix wirh the beginnings of creativity: 'you must wish to consume yourself in your own flame: how could you wish to become new, unless you had first become ashes?' (ZS: I, *Creator*).

[42] See Geuss' discussion on Nietzsche 'remaining intellectually true' to philology and mastering 'philosophical dimensions' in interpreting 'difficult texts' (Geuss 2009:81).

[43] See Nietzsche's discussion in BT: §3-4.

[44] See Murphy's and Roberts' enlightening discussion, 2004:68-72 and Luchte 2009:17.

[45] See BVN-1861:288; BVN-1875:456a; NF-1876:15[27] and HAH: *WS*, §223.

[46] See HAH: I, §133; BVN-1880: 65 – Letter to F. Overbeck; D: §568 and NF-1884:28[42].

The phoenix, however, does not become an abiding metaphor in Nietzsche's work, although it clearly embodies the elements of rebirth from the ashes as important and consistent with the notion of the periodic rebirth of the universe. Nietzsche's views on the subject are informed by an earlier source still, namely, by the tradition of 'Hesiodic theogony', composed around 700BC.[47] Hesiod, the 'teacher of most men' (Hershbell 1970:145), famously pronounced that 'fire is the basis of all craft. Without it, Man cannot persist' (Ayres 2016:233). This assertion informs the myth of Prometheus, which becomes an important conceptual import into Nietzsche's philosophy. Equally influential is the 'Orphic phase … of the Greek genius (HC, p.176), manifested in the retelling of the 'Orphic mysteries' in the poetry of Ibycus and in the 'Homeric hymns', where the 'the orgiastic flutes of Olympus' could still be heard (BT: §6).[48]

Within the Orphic and the Hesiodic traditions Nietzsche finds the 'Dionysian myths proper with their everlasting content' (NF-1870:7[123]). The myth of Dionysus, generally considered the central, defining myth of Orphism (Meisner 2018:238-9; Porter 2014:41), becomes one of the most pervasive and enduring conceptual topologies within Nietzsche's philosophy and an anchor to the eternal recurrence. In Dionysus Nietzsche finds one of the earliest dynamic expressions of the law of conservation of energy, which also has important implications in relation to of entropy:[49]

> [T]he future ruler of the world as a child (Dionysos [Zagreus]) is dismembered by the Titans and how he is now to be worshiped in this state as Zagreus. At the same time … this rupture, the actual Dionysian suffering, is, akin to a transformation into air, water, earth, and rock, plants and animals. (NF-1870:7[123])

Nietzsche sees the rebirth of Dionysus, known as the 'dismembered and the rising' as well as the 'suffering and redeeming God' (Redding 2009:164; Williamson 2004:133), as distinct from the mythology of the vegetation deity, with which many other creation and resurrection myths are thought to be connected (Mettinger 2001; Stookey 2004). Setting them apart is a clear element of volition (i.e. the will to rise from the ashes) required in order to overcome and to rise above the predicament of dismemberment regardless of its causes.[50] This will becomes an important anti-entropic signifier in Nietzsche's thinking (BGE: §225).[51]

Dionysus rises from the ashes to which Zeus reduces the Titans who feasted on the yet unborn Dionysus, who himself becomes these ashes, save for his heart, rescued and re-assembled by his father Zeus. The legend tells us that from the ashes of the titans 'came the first humans, who thus possessed both the evil nature of the Titans and the divine nature of the gods'.[52] *Dionysus thus projects a medium and a modality within which conservation of energy and entropy are reconciled and recognised not only as the necessary and irreducible 'sides of existence' but also as desirable* (NF-1888:16[32]). Nietzsche tells us that, in contrast to the 'god on the cross', 'Dionysus cut to pieces is a *promise* of life: it (i.e. life – DS) will be eternally reborn and will return home again from destruction' (NF-1888:14[89]). For Nietzsche, the name for this cycle – alone capable of bridging 'the two most extreme modes of thought' – is the eternal recurrence. Nietzsche associates it with the 'Dionysian affirmation of the world as it is, without subtraction, exception or selection – it wants the eternal circulation: the same things, the same logic and illogic of entanglements' (NF-1888:16[32]; WP: §1041).[53] Deleuze later notes that the myth of Dionysus – 'master of the eternal return'– is 'how Nietzsche understood physical science, the energetics and thermodynamics of his time' (Deleuze 1983:30).

It is also important to take into account the Norse myth of the 'Twilight of the Gods' ('Götterdämmerung' or, 'Ragnarökkr'; see Eliade 1959:115) as a source to which Nietzsche turns in thinking about the eternal recurrence.[54] The myth, which likely dates back to pre-Christian period (Bernharðsson 2007:25-38), tells of the declining gods, who perish in the 'devouring fire', which 'raged … fiercely until everything was consumed, when the earth, blackened and scarred, slowly sank down beneath the boiling waves of the sea' (Guerber 1995:270). Only due to the imperishable forces of Nature the

[47] See NF-1870:5[123]; NF-1871:16[19]; HAH: I, §170.

[48] See PTAG: §1, BVN-1864:426 and Meisner 2018:280.

[49] In the *Nachlass* note NF-1887:11[282], Nietzsche hypothesises the 'resurrection in causal connection with … sacrifice (after the type of Dionysus, Mithras, Osiris)'.

[50] We should not discount is a distinct possibility that we do not know enough about plants to be conclusive on volition in view of nature's truly insatiable lust for life.

[51] See the excellent discussion in Murphy and Roberts, 2004:58-65.

[52] Encyclopaedia Britannica, accessed from: https://www.britannica.com/topic/Dionysus; Bonnefoy 1992:91.

[53] See also KGW, VII 4/2 34 [260], GOA XVI, p.396.

[54] For Nietzsche's references to the Scandinavian mythology, see BGE: §260, NCW: *A Music Without a Future* and NF-1884:25[217].

earth, 'purged by fire and purified by its immersion in the sea, would rise again in all its pristine beauty and be illumined by the sun' (ibid.). In fact, 'Götterdämmerung' becomes an intellectual filter through which Nietzsche interprets the Greek antiquity well in advance of Wagner's *Götterdämmerung*, which completes the famous operatic cycle, '*Der Ring des Nibelungen*', in 1876 (NF-1869:1[59]; DW-1870: §2; BT: §9).

Only Zarathustra – the founder of religions – likely reaches still further back in time,[55] and with him Nietzsche's search for the doctrine of eternal recurrence becomes fulfilled. Completing the circle in *Ecce Homo* (1888), Nietzsche notes that 'this doctrine of Zarathustra *might* in the end have been taught already by Heraclitus' (EH: *BT*, §3). In Zarathustra, not unlike in Dionysus, Nietzsche finds the irreducible duality of existence and the corresponding idea of time, which is twofold and embodies both the circular and the progressive linear time, history and meta-history – entangled in an unconditioned cycle, which houses a 'circle within circles' (NF-1870:7[117]; see NF-1881:11[184]). It is only appropriate, therefore, that Zarathustra should articulate Nietzsche's 'fundamental conception' (EH: *Z*, §1), which calls for a different sensibility.

What is critical, is that in all of the mythical tales of the eternal return that inform Nietzsche's thinking, *conservation of energy* is intimately connected with – cannot be conceived without – the *reversal of entropy* (i.e. the recurrence of previous states). The myths may not tell us how or why negentropy occurs, but they do tell us that entropy is the necessary component of the conservation of energy the *transformations of which must carry on beyond any point of equilibrium* in order to make conservation itself possible.[56] Although no clear explanation can be gleaned from the legends of the past concerning how negentropy occurs, the two concepts – of conservation and entropy – are not opposed to one another and both form part of the same necessity: necessity of the eternal return. The discipline of thermodynamics, as we know, has developed a different take on tackling these questions. This helps to explain why Nietzsche – alongside many other great minds – wrestled quite as much as he did with the conundrums posed by the second law of thermodynamics ('TD2').

[55] See, Litchfield West, 2010:3-10.

[56] See Schrodinger's fascinating discussion on 'metabolism' in *What is Life?* (1967:71).

Entropy and the Eternal Return

(i). A few words on the genealogy of entropy

TD2, better known as the 'Law of Entropy', states that transformations of energy become increasingly less tractable and progressively less useful in terms of their capacity to underwrite further transformations. Rudolph Clausius formulated this law in '*On the Motive Power of Heat* (1850). Less than a year later, working independently of Clausius (Sharlin 1979:114), William Thomson (aka Lord Kelvin) arrived at his own formulation[57], which he succinctly summarised a decade thence:

> The second great law of thermodynamics involves a certain principle of irreversible action in Nature. It is shown that, although mechanical energy is indestructible, there is a universal tendency to its dissipation, which produces gradual augmentation and diffusion of heat, cessation of motion, and exhaustion of potential energy through the material universe. (Thomson 1862: On the Age of the Sun's Heat)

This discovery came with a number of *disquieting caveats*. The law of entropy, at least implicitly, assumes infinite time and infinite space, which unfold in progressive fashion. However, in a closed system (i.e. the framework for TD1), this process naturally trends towards the final state.[58] As increasing entropy entails gradual energy deterioration and decay – 'TD2' is sometimes described as a law inefficiency, circumscribed by the definitive 'arrow of time', irreversibility and irrevocability of deleterious transformations. Thomson articulates the idea of the 'heat death' of the universe in the distant future:

> The result (of TD2 – DS) would inevitably be a state of universal rest and death, if the universe were finite and left to obey existing laws. But it is impossible to conceive a limit to the extent of matter in the universe; and therefore, science points rather to an endless progress, through an endless space, of action involving the transformation of potential energy into palpable motion and thence into heat, than to a single finite mechanism, running down like a clock, and stopping for ever. It is also impossible to conceive either the beginning or the continuance of life, without an overruling creative power; and, therefore, no conclusions of dynamical science regarding the future condition of the earth can be held to give dispiriting views as to the destiny of the race of intelligent beings by which it is at present inhabited. (Thomson 1862: On the Age of the Sun's Heat)

[57] William Thomson (1851), *On the Dynamical Theory of Heat, a*ccessed from https://zapatopi.net/kelvin/papers/on_the_dynamical_theory_of_heat.html#fn5b.

[58] See Thomson 1874:86[15-16] in *Mathematical and Physical Papers*, Cambridge: CUP, 1911:11-21.

In other words, science was progressive and could neither see the end to progress, nor be held responsible for 'heat death', if the latter were to occur. These scientific premonitions, other than issuing an indirect challenge to God (i.e. was he really infinite, all-powerful and omniscient?), crystallised in the notion of *entropy*, coined by Clausius in 1865.[59]

It is hardly surprising that 'entropy' did not simply become the *sine qua non* of thermodynamics but that the lid of this particular Pandora's Box, thus opened, was soon blown away by the maelstrom of ensuing connotations that impregnated the imagination of the entire intellectual milieu. 'Entropy' became an important and multifaceted intellectual watershed, implications of which stretched far beyond the disciplinary boundaries of physics. Theories contested within thermodynamics formed a part of the much larger cosmological, theological, philosophical, political-economic and sociological debate.[60] Henri Bergson (1859-1941), in his influential work, *L'Évolution créatrice* (1907), characterised the Entropy Law as 'the most metaphysical of the laws of physics since it points out … the direction in which the world is going' (Bergson 1907:243).[61] Spengler, who dedicated a number of sections in the *Decline of the West* to discussing the social and historical implications of entropy, likened it to 'the most conspicuous' symbol of decline of the Western civilisation.[62] In *The Entropy Law and the Economic Process* (1971), Georgescu-Roegen pointed out that 'from the epistemological viewpoint, the Entropy Law may be regarded as the greatest transformation ever suffered by physics' owing to the 'recognition … that there is qualitative change in the universe' (Georgescu-Roegen 1971:9-10).[63]

(ii). Nietzsche and Lord Kelvin

Nietzsche's critical engagement with the law of entropy can be reconstructed as a Socratic dialogue with William Thomson, who becomes Nietzsche's discarnate interlocutor, representing the mechanistic worldview embodied in the law of 'the final state' (NF-1888:14[188/4]):[64]

> The bursting bubble of foam at the foot of a waterfall would reunite and descend into the water; the thermal motions would re-concentrate their energy, and throw the mass up the fall in drops re-forming into a close column of ascending water. … And if also the materialistic hypothesis of life were true, living creatures would grow backwards, with conscious knowledge of the future, but no memory of the past, and would become again unborn. But the real phenomena of life infinitely transcend human science; and speculation regarding consequences of their imagined reversal is utterly unprofitable. Far otherwise, however, is it in respect to the reversal of the motions of matter uninfluenced by life, a very elementary consideration of which leads to the full explanation of the theory of dissipation of energy.[65]

Thomson and Nietzsche would likely agree that 'the real phenomena of life infinitely transcend human science'. From that point onward, however, Thomson delegates authority for subsequent proceedings to the divine architect, as the material world could not, in his view, come back to any previous state without a violation of the 'laws, which have been manifested to man; that is *without a creative act or an act possessing similar power*' (ibid.). In fact, 'Thomson believed that through the law of entropy he had discovered mathematical proof that there must have been a creation' (Brush 1966:10).[66]

[59] Entropy's etymological roots are Greek. '*Entropia*' literally means 'a turning forward', an 'intrinsic direction', and a 'transformational content'. Entropy becomes defined as 'a measure of the unavailable energy in a closed thermodynamic system, which is also considered to be a measure of the system's disorder, otherwise known as 'molecular chaos'. In his 1865 paper, Clausius also concludes that 'the entropy of the universe tends towards a maximum' (Klein 1969:140-141).

[60] See Sharlin 1979:113; Brush 1966:12, Zencey 1991:48. Müller notes that 'the teleological character of entropy aroused quite some interest, not only among physicists, but also among historians, philosophers, sociologists and economists' (Müller 2007:73).

[61] Accessed from https://www.gutenberg.org/files/26163/26163-h/26163-h.htm. Kaufmann notes that TD2 can be interpreted as being 'still founded on the Biblical assumption of an absolute beginning (i.e. Creation, *Genesis* 1:1-2 – DS) and end (Armageddon, *Revelation* 16:14, 16 – DS) events' (Kaufmann 1950:332). Viewed in this light, the law of entropy becomes a variation on the Biblical prophecy.

[62] See Spengler, *The Decline of the West*, vol.1, Ch. XI, § XIV, *Faustian and Apollinian Culture* (pp.375-428). Accessed from https://archive.org/details/declineofwest01spenuoft/page/n5/mode/2up.

[63] The law of entropy continues to confound scientific minds to this day. See the excellent discussion in Čápek and Sheehan (2005).

[64] Thomson features in Nietzsche's private writings twice, most famously in his note on '*The New World Conception*' (NF-1888:14[188]) where incidentally Nietzsche misspells Thomson as Thom«p»son. As a result of this typo, this Nietzsche's explicit refutation of Thomson's entropy hypothesis is overlooked by many Nietzsche readers, whilst Kaufmann and Hollingdale, for the avoidance of doubt feel compelled to add «William Thomson» into their translation of Nietzsche's note, which features as the penultimate aphorism §1066 of *The Will to Power*.

[65] Thomson 1874:86[11-12] in *Mathematical and Physical Papers*, Cambridge: CUP, 1911:11-12.

[66] Pope Pius XII, in the address titled 'Theology and Modern Science', delivered in 1951, stated that 'the law of entropy … postulates eloquently the existence of a Necessary Being'.

> [O]verwhelmingly strong proofs of intelligent and benevolent design lie all around us, and if ever perplexities, whether metaphysical or scientific, turn us away from them for a time, they come back upon us with irresistible force, showing to us through nature the influence of a free will, and teaching us that all living beings depend on one ever-acting Creator and Ruler. (Thomson 1871:197)

In Nietzsche's reckoning, harbouring 'the claims of the creator' (NF-1885:34[204]) is problematic, not least due to the nihilistic permutations that ensue from such claims.[67] He takes issue with, at least, three consequences of the mode of thinking, exemplified by Thomson. In the *first instance*, he objects to the claim that 'everything is progressive' and that the 'mechanical effect escapes irrecoverably' albeit, mysteriously, 'without loss of *vis viva*' (Sharlin 1979:213). Nietzsche argues that in order to allay concerns about the negative aspects of entropy (physical and social alike), it becomes tempting to ascribe felicitous connotations to the entropic process in the same manner man's 'fall from grace' once acquired felicity when, in the feat of 're-baptising', decay – cultural and ethical – was cast as 'progress' (NF-1887:9[173]).[68] This is achieved by positing God as both – presiding over the proceedings and choosing the final destination:

> The only way to preserve the meaning for the concept "God" would be: God not as the driving force, but God as a maximal state – a point in the evolution of the will to power by means of which further evolution just as much as all the evolution hitherto could be explained (NF-1887:10[38]; emphasis added).

This way should humankind ever reach the dead-end, the latter would appear as a foregone conclusion as everyone would have been told that 'God' intended it so. Nietzsche would argue that 'God' (ER, after all, may be regarded as a kind of 'god'; see Müller-Lauter 1999:89), was never much of a problem and the real issue is 'whose' God it was, i.e., what values he represented. Without God, Nietzsche tells us, infinity becomes 'the most paralyzing idea' (NF-1886:5[71]; see NF-1885:36[23]) and where science cannot reach, it is tempted to 'fly away from earthly things' and beat its wings 'against eternal walls' to help its theories reach closure (see Z: I, *Gift-Giving*, §2). What would happen, Nietzsche conjectures, if God turned out to be a 'demon of annihilation' (NF-1884:26[220], who would use science and knowledge 'to destroy the world' (NF-1869:3[11])?

Secondly, the irreversible increase in entropy rules out the possibility of repetitions of 'any previous state' (ibid.). Nietzsche's point is that *the concept of infinity appears to be set in some contradiction to the principle of the conservation of energy*, and is therefore 'unthinkable without falling back into the old creator concept' (NF:1881:11[292]):

> The eternally becoming new presupposes: that the force arbitrarily increases itself, that it has not only the intention, but also the means to guard itself against repetition (NF-1881:11[292])

Following the logic of Thomson's argument, Nietzsche detects something peculiar. Namely that *any system conceived as closed exhibits an inherent incentive to become increasingly open* in order to avoid (or to outpace) the full consequences of the law of entropy. As such, *equilibrium* – thermal or otherwise – represents a genuine puzzle in the sense that preventability of 'heat death' depends on our belief in God's infinity and benevolence (i.e. that *heat death is not part of the Divine Plan*) being justified.[69] In other words, infinity ends up circumscribed by God's infinitely omniscient benevolence and this magnificent conceptual edifice *has to keep expanding,* or to be thought of as expanding, in order to outpace the inevitable logic of its own consequences drawing their full force. Could it be, therefore, Nietzsche asks, that the law of entropy requires the assumption of infinite space and infinite time precisely in order to lift the threat of the final state ever materialising, rather than the opposite being the case, i.e. that reaching out from the vastness of its emptiness, infinity seeks the solace of entropy?

Last, but not least, Nietzsche finds that the conceptual architecture of TD2 leaves the door wide open to the misconstruals and misappropriations of the *concept of equilibrium*, which he regards as 'provisional' at best:

[67] Thomson, who is known to have held 'definite opinions about the separation of scientific thought from theology', nonetheless 'believed that God's role was implicit' (Sharlin 1979:113; Smith 1976:298). Cf. *Entropic Creations* (2008), where Helga Kragh presents an alternative position, claiming that Thomson denied 'the heat death as a reality of the future of the universe' (Kragh 2008:141-142). This in turn, leads Kragh to misinterpret Nietzsche's reaction in relation to the 'Thomson Hypothesis', as well as misconstruing Nietzsche's own idea of eternal recurrence.

[68] Incidentally, Nietzsche warns that 'it is always wrong to expect «progress» from an ideal: the victory of the ideal has always been a retrograde movement' (NF-1887:11[135]).

[69] See Thomson 1898:88[27] in *Mathematical and Physical Papers*, Cambridge: CUP, 1911:24-29. See also Russell's discussion in *The Scientific Method* (2009:85) and Tatterstall (2014:20).

> The complete equilibrium must either be an impossibility in itself, or the changes of the force must enter the cycle before that possibly possible equilibrium has occurred. (NF-1881:11[265]; see also 11[245])

Nietzsche warns against the dangers of [falsely] equating the 'seeming state of equilibrium' ('Gleichgewicht') with achieving the 'goal' in the evolution of the species (NF-1887:9[144]). His insistence that the 'state of equilibrium' should not be mistaken for having reached 'the summit' (NF-1887:10[138]) appears well grounded in light of the continuous misinterpretation of the physical phenomena within the vernacular of social sciences. The felicitous notion of 'equilibrium' – as guiding humankind in the direction of the 'civilized and thriving nations' (Smith, WN1:36), rather than towards some shipwreck scenario, in which humankind could perish[70] – has been an integral part of economic theory, since the time of Adam Smith.[71] Another example of the 'fraudulent and twisted' (EH: *Destiny*, §4) misappropriation of entropy to suit the 'present ideals' (NF-1881:11[98]), Nietzsche finds in the work of the 'décadent biologist' – i.e. 'social Darwinist' – Herbert Spencer (NF-1888:14[40]). Writing on the *First Principles* (1867), Spencer engaged in a detailed polemic concerning the felicitous provenance of entropy, as progress, that was guiding the evolution of the entire universe 'from a more diffused or incoherent form' to the 'ultimate establishment of a balance' and 'harmony between man's mental nature and the conditions of his existence'.[72] Ironically, in addition to Nietzsche, catching out Spencer's fallacy, was none other than Bertrand Russell:

> I don't know whether he was ever made to realise the implications of the second law of thermodynamics; if so, he might well be upset. The law says that everything tends to uniformity and a dead level, diminishing (not increasing) heterogeneity. (Letter to Beatrice Webb, 4 June 1923)[73]

Suffice it to say that barely a decade later, in one of his most influential works on *The Scientific Outlook* (1931), Russell asserted that the 'second law of thermodynamics … states, speaking generally, that the *universe tends towards democracy*, and that when it has achieved that state, it will be incapable of doing anything more' (Russell 2009:64).[74] Nietzsche likens such 'Don Juans of knowledge' to the 'drunkards who end up drinking absinthe and aqua fortis' having pursued knowledge 'until at last there remains nothing of knowledge left to hunt down except the absolutely detrimental' (D: §327).

(iii). Entropy and Nietzsche's eternal return

As far as Nietzsche is concerned, it is *perfectly possible to develop a plausible appreciation* of the likely repercussions of entropy from the Greek mythical tradition.[75] Hesiod's famous didactic poem *The Works and Days*, composed around 700 B.C. (BVN-1870:76), contains two critical aetiologies that convey the notion of entropy: the myth of *Prometheus and Pandora* and the *Myth of the Five Ages*.[76] Still, Nietzsche becomes absorbed in the scientific explanations of this diverse phenomenon and not merely, as Michel Serres claims, because 'everyone was just constructing motors' (Large 1999:152). Reflecting on the issue within the context of the *eternal recurrence*, Nietzsche is unable to discount the possibility that the transformations of energy may continue to follow the transformative cycle *past the point of equilibrium*, where energy (as work) may become 'lost to man irrecoverably, but not lost in the material world' (Sharlin 1979:112):

> We cannot conceive of becoming other than being the transition from one persisting "dead" state to another enduring "dead" state. Oh, we call the "dead" – the motionless! As if there were something motionless! The living is not a contrast of the dead, but a special case. (NF-1881:11[150]; emphasis added)

This comment insinuates that recycling of energy carries on past the point where the 'dead state' has been reached (i.e. *entropy is not the end*), thus representing 'the incessant transformation' and 'the constant struggle' (NF-1881:11[197]; see NF-1888:24[1]). Elsewhere in the *Nachlass*, Nietzsche suggests the mere appearance of equilibrium may be mistaken for equilibrium itself where 'the speed of … growth and transformation' slows down con-

[70] See Z: III, *Gravity*, §2; Conway 2002:16-18; 107-111; 236.

[71] See Myers 1976:560; Arrow, Hahn 1971:2; Hahn 1973:1-2; Heilbroner 1979; Clark 1989:49; Hetherington 1983; Mosini 2009:2-15. See also (cf.) Montes 2003:723-724. Although Montes argues that 'the popular view of Smith as a forerunner or founder of general economic equilibrium theory must be laid to rest' (ibid.:723), he fails decisively in his attempts to dismantle this association.

[72] See Spencer 1867: Ch III, §56, p.212 and Ch. XVI, *Equilibration*, §130-137, pp. 442-486.

[73] See Webb 1946:78.

[74] Russell did caveat his view by suggesting that being only 'probabilistic', the second law 'may not hold in all times and places' (Russell 2009:84).

[75] See Nietzsche's discussion in *UM*, which reference the Hesiodic 'iron age' as the 'fifth act' of humankind's passage on earth, with clear resonances to the entropic tendencies of modernity, the limitations of the mechanistic interpretations, including of history, and their infelicitous consequences (UM: *UDHL*, §2, §8). See Kragh 2016 for further context.

[76] See *Daybreak*, §189.

siderably and for an extended period, so that 'actual small continuations and increases do not come into consideration … – a phase of transformations in which the change is not visible so that an equilibrium appears to be reached' (NF-1887:9[144]).

Nietzsche suggests, therefore, that some process – yet unknown to the science of his day but an appreciation of which could be discerned from the mythical intuitions of the ancients – has to occur to *connect conservation of energy with the law of entropy* in a manner that ensures the endless cycle of energy transformations.[77] This imagined and intractable process – that may (a) run contrary to the logic of the law of entropy (or operate outside its perimeter), but nevertheless (b) falls short of invoking metaphysical fancies – somehow has to form part of the constitution of the world and of life, although not necessarily of human life.[78] Nietzsche senses that 'something unstable of power, something undulatory is completely unthinkable to us' may constitute the re-generative propensity of life while remaining invisible indeed to the ordinary human eye' (PTAG: §7; NF-1881:11[306]). The trap to avoid is not 'to fantasize into the unthinkable and not fall back into the old concept of creator' (NF-1881:11[292]; NF-1885:36[15]):

> The world of forces ('Die Welt der Kräfte') suffers no diminution; otherwise it would have weakened and perished in the end of time. The world of forces does not stand still: otherwise it would have been reached, and the clock of existence would stand still. The world of forces never comes to equilibrium, it never has a moment of rest, its power and movement are the same for any time. Whatever state this world can reach, it must have reached it, not once, but countless times. (NF-1881:11[148])

Nietzsche *does not consider the two laws of thermodynamics in isolation from , or as contradicting, one another*[79]. Instead, he works with the ontological tension and epistemological unease he senses at the heart of the discipline. This tension, acutely sensed by Thomson himself (Sharlin 1979:213), found no clear resolution either in Thomson, or in Nietzsche's thinking. In the final reckoning, Nietzsche characterises the 'Thomson Hypothesis' as 'merely provisional' – i.e. no different to how he regards the eternal return (NF-1881:11[203]) from the position of being unable to supply *definitive proof*:

> [S]peaking metaphysically: if becoming could resolve itself into being or into nothingness), then this state must have been reached. But it has not been reached … This is the sole certainty we have in our hands to serve as a corrective to a great host of world hypotheses (…) possible in themselves. If the mechanistic theory cannot avoid the consequence, drawn for it by William Thomson, of leading to a final state, then the mechanistic theory stands refuted. The world as a circular movement … plays its game in infinitum. (NF-1888:14[188]) [80]

This brings up one of the key points Nietzsche tries to get across: when it is impossible to prove a hypothesis, the nature of valuations that speak on its behalf – the voice(s) from behind the veil – become important in terms of conjuring up its legitimacy in order to further themselves, thereby instrumentalising the hypothesis – turning it into a means of achieving the desired ends (see EH: Z, §6).[81] This is where the choice may become stark: either the 'entropic' God of modernity – who, in Nietzsche's view, underwrites the 'mechanistic theory' (ibid.), or – the eternal return.

Concluding remarks: audacity of the circle

The eternal return, not unlike the conundrums thrown up by the laws of thermodynamics, remains agonisingly inconclusive and impervious to capture by reason alone. Nietzsche's 'law of the circle' (NF-1881:11[157]), it seems, can only disclose itself, let alone supply its proof, outside of the mind's immediate grasp – beyond the computational: 'the ultimate truth of the flow of things does not tolerate incorporation, our organs (for Life) are set up for error' (NF-1881:11[162]; see NF-1881:11[153],[201],[202]).[82] Annoyingly for some,

[77] Nietzsche's note NF-1881:11[201] can be read as suggesting that chemical (i.e., 'micro') changes (e.g., decomposition) continue to occur after the physical (i.e., 'macro', 'mechanical') transformations have ceased or ceased being observable. In other words, chemistry takes over from physics at the molecular-atomic level of energy transformations, making the 'rising from the ashes' possible: 'All chemical qualities can become and perish and come again. Countless "properties" may have developed for which we cannot observe from our time and space angle. The change in a chemical quality is perhaps also taking place now, only to such a subtle degree that it slips out of our finest recalculation'. See also NF-1881:11[149],[237],[247] and NF-1884:26[432].

[78] PT, *Preface,* p.248; see also NF-1881:11[149].

[79] Cf. McNeil 2021:114.

[80] Ironically, Bertrand Russell – Nietzsche's devout intellectual adversary – arrives at the same conclusion, see Russell 2009:84.

[81] As Heller aptly surmised, Nietzsche urges us to accept full responsibility for the 'kind of questions' we ask and to realise 'what values are implied in the answers' we seek (Heller 1988:10). See Nietzsche's critical comments on 'the modesty of hypotheses' in GS: §344.

[82] Not unlike the estimated number of the atoms of hydrogen (H) in the observable universe (10^82) or the Earth's time horizon in terms of available sunlight, estimated by Thomson (absent the unforeseen meteoric events), to be in the range of 10-100 million years and since then 'upgraded to the current

the eternal return is 'not religious' and cannot be simply believed in a sense of a 'religious dogma' (NF-1881:11[248]). Rather than becoming the 'religion of religions', Nietzsche's teaching is 'the thought of thoughts' and he insisted that the eternal return was something that had to be *thought* and (in order to be) *practiced* (NF-1887:9[8]).[83] Unable to complete the work on his 'mächtigste Gedanke' (NF-1881:11[148]), Nietzsche remained open to being 'convinced of the improbability' of his truths (BVN-1885:609). One thing he did not doubt, however, was the transformative potential of the hypothesis itself (NF-1881:11[248]).[84] His warning was explicit enough: if the thought of the eternal return 'gained possession of you, it would change you as you are or perhaps even crush you' (GS: §341), irrespective of whether you happen to be an *Übermensch* (Kain 2007:59). This formulation draws on the earlier comment, which also conveys a strong sense of the transformative properties of the thought of the eternal return:

> If the idea of the eternal recurrence is only a probability or a possibility, the thought of a possibility can also affect, shake up and reshape us, not just sensations or certain expectations! (NF-1881:11[203])[85]

The eternal return, in Nietzsche's view, is *no ordinary thought* that could be drawn from the shallow pool of conscious knowledge (see BGE: §32). There is a reason why its power extends further than the 'very low and paltry' intellectuality would permit (see D: §548). The centaur-like provenance of the eternal return marks the 'complementariness of human and equine natures, merging the physical, mental and spiritual aspects of being' (Lawrence 1994:66) in a manner that transforms the latter into becoming. The experience of thinking – *becoming aware of* – the eternal return is distinct from simply thinking it. It requires reinvigorating a dormant sensibility that would allow to experience the eternal return in the holistic manner that remains inaccessible to either the mind or the spirit working in isolation from one another (see NF-1884:26[432]). In Zarathustra, Nietzsche likens this transformative torment to *biting off the head of the snake that had lodged itself inside one's throat*.[86] Having removed this obstacle, the disorientating awakening follows from which one emerges renewed, different and compelled:

> No longer shepherd, no longer human – one changed, radiant, laughing! Never yet on earth has a human being laughed as he laughed! O, my brothers, I heard a laughter that was no human laughter; and now a thirst gnaws at me, a longing that never grows still. My longing for this laughter gnaws at me. (Z: III, *Vision and Riddle*)

In an effort to synthesise theory and value and to fuse the sanctity of knowledge with the animality of life steps beyond the strictly defined scientific boundaries, past and present. It invites science into the metaphorical domain of myth. Today's cosmology along with modern quantum physics – both leaning towards the infinity of space and the finite nature of time – may well assert that Nietzsche was wrong, although, in reality, this would only confirm Nietzsche's view that scientific opinions change over time (NF-1881:11[269]). Let us sum up in simple terms, for the uninitiated in the fineries of scientific jargon, where we stand today. 'Infinite space' is not much further than Kelvin's conception and 'finite time' – remains an expression of the primordial anthropocentrism and the most abiding human fear (of death). What about Heraclitus and Epicurus – are we much further than them? In terms of knowledge, undoubtedly. In terms of understanding – not quite so clear. As scientific conceptions ebb and flow, Nietzsche tells us, the question of how we should live remains, just as man remains a conduit for the existential predicament that he continually interprets while the latter incessantly speaks through him and shapes him in the process.[87] Hence, Nietzsche warns, we need to take care how and with what we fill the gaps and imperfections in knowledge, how we seek to complete equations, scientific and more generally. It would be a mistake, in Nietzsche's view, to consider *thinking the eternal return* (i.e. the discrepancy between knowledge and understanding) and *living the eternal return* (i.e. revaluation of values) as though they were either separate, or unrelated questions.

estimates of between 5-10 billion years (before the Earth gets engulfed by the expanding Sun). Duration of human life on earth, however, is a different matter altogether. See Nietzsche's thoughts on this in NF-1881:11[228].

[83] See NF-1881:11[158-160] and Müller-Lauter's excellent commentary (1999:89-91). See also see Franck 2011:68 and Klossowski 1997:53.

[84] See Gillespie 2017:21; Small 2016:56; Heller 1988:184 and Kain 2007:54-56.

[85] Even for Zarathustra, the eternal return is at once his destiny but 'also the greatest danger and sickness too' (see Z: III, *The Convalescent*, §2). See also NF-1881:11[220].

[86] Clear contrast can be drawn between Nietzsche's narrative and Christ's torment of having to pass through the Cross to attain the 'luminous mystery of transfiguration' (see Luke 22:39-46).

[87] See NF-1872:19[210]: 'Time, space and causality are only metaphors of knowledge by which we interpret things for ourselves.

In light of this, the following holds true in respect of the eternal return: in growing the allegorical wings, fins and developing gills, Nietzsche's formula of affirmation – akin to Sisyphus – does not seek a metaphysical exit from the confines of the physical world. It does not require an external frame of reference – the proverbial *Punctum Archimedis* – to validate its premises. Nietzsche means for the eternal return to replace 'metaphysics and religion' (NF-1887:9[8]) and he does not 'believe in sound research without the guidance of the body' (NF-1884:26[432]). Furthermore, the curative property of the eternal return – through the healing power of myth – is to moderate the pace of the 'blindly raging industriousness' (GS: §21) with which we go about acquiring and applying knowledge, never allowing it to mature into understanding (see NF-1872:19[27], [155]). As a modality of perspectival knowing that should, in Nietzsche's view, govern our interaction with the world and in the world, the eternal return demands development of knowledge as understanding[88] quite as much as 'the conservation of energy demands the eternal return' (NF-1886:5[54]).

Nietzsche suggests that we, moderns, no longer have the *patience* for myths. Consumed by the haste of secularization, today 'one lives for the day, one lives very fast, one lives very irresponsibly' (TI: *Skirmishes*, §39). We can no longer spare the time and the effort to follow where the ancient tales may lead us. We do not know *how* what the myths tell us about the conservation and regeneration of energy happens but the myths may, nonetheless, be telling us something important by telling us that it does happen. Furthermore, the myths draw our attention to the *heterogeneity of entropy*. They highlight unmistakable parallels between the processes observable in the natural and human worlds. Hesiod's *The Works and Days* is but one example of this.

In this respect, as Lawrence Hatab suggests, Nietzsche's eternal return can and, perhaps, should be read 'literally' (Hatab 2005:180). In particular, Nietzsche's intellectual confrontation with entropy comes across as a stark way of highlighting the contradictory nature of mechanistic thinking. Nietzsche's point is that entropy cannot be God's problem to solve. Dealing with entropy, as a facet of humankind's continued existence on earth, becomes the question of *human agency*. For all our knowledge of entropy, our understanding of it remains limited and, as a result, human activity ends up a net contributor to its pervasive spread. Nietzsche urges us to examine 'the erroneous procedures by means of which' this type of knowledge 'is arrived at' (NF-1887:9[62]). It is quite possible, he argues, that the patient and unhurried (i.e. *truly scientific*) deciphering of the mythical wisdom may contain some missing ingredient for converting knowledge into understanding that would be helpful for our worldly endeavours (see BT: §3). In other words, the eternal return could act as a conduit – a mobilizing force – connecting human agency to the world in a manner that would (a) empower it (i.e. human agency) to resist the onset of entropic tendencies and (b) refute modes of valuation which seek to legitimize and to exonerate entropy.[89] This may well contain the meaning of Nietzsche's 'strange and insane task' of 'translating man back into nature', achieved first through 'the dehumanization of nature and then the naturalization of man after he has reinstated the purity of the term "nature"' (NF-1881:11[211]):

> [T]o become master over the many vain and overly enthusiastic interpretations and connotations that have so far been scrawled and painted over that eternal basic text of homo natura; to see to it that man henceforth stands … hardened in the discipline of science, he stands before the rest of nature, with intrepid Oedipus eyes and sealed Odysseus ears, deaf to the siren songs of old metaphysical bird catchers who have been piping at him all too long, "you are more, you are higher, you are of a different origin!" — that may be a strange and insane task, but it is a task—who would deny that? Why did we choose this insane task? Or, putting it differently: "why have knowledge at all?" (BGE: §230; emphasis added)[90]

The present-day examples, illustrating Nietzsche's point, are not hard to find. Thinking the eternal return, one may feel justified recognising in today's exodus of the planet's billionaires – racing each other to colonise Mars (a distant vision of the same old *New Jerusalem*) under the guise of furthering scientific knowledge and space exploration – the hallmarks of a cynical attempt to outrun the entropic consequences of the very activities that helped to forge their timorous fortunes (see Kümmel 2011). It is not a revelation that continuous, let alone infinite, economic growth is not plausible in the world of finite resources.[91] In this sense, at least, our world is a closed system. The second law of thermodynamics

[88] I.e., as 'Erkenntnis' supplementing 'Wissen', rather than sitting passively beside it – a kind of scientific philosophy, rather than the philosophy of science, which merely muses over the misadventures of science.

[89] See NF-1888:14[81].

[90] See the excellent discussion in Vanessa Lemm's *Homo Natura*, 2020.

[91] See Soddy 1926, Bataille 1967, Georgescu-Roegen 1971 and 1976.

tells us so.[92] Its conclusions, however, are likely to remain subject to conjecture and fertile soil for political expediency, for as long as (1) these resources last (= can be exploited for gain), or (2) the system, based on ultimately metaphysical precepts, finds new ways to keep expanding, and/or (3) an unexpected discovery helps to alter the entropic algorithm:

> Today's system is predicated on the progressive conversion of nature into products, people into consumers, cultures into markets and time into money. We could perhaps extend that growth for a few more years by fracking, deep-sea oil drilling, deforestation, land grabs from indigenous people and so on, but only at a higher and higher cost to future generations.[93]

Nietzsche – who obviously knew nothing of fracking – understood well the patterns of thinking and the 'methods of acquiring knowledge' (D: §547) that would not only condone fracking but would welcome it with open arms.[94] His eternal return would require that until and unless we *painstakingly* develop sufficient understanding of the overall impact of such an activity as fracking, in order to be able to gauge its value and long-ranging repercussions, we should not proceed with it. The understanding Nietzsche seeks is not to be confused with 'perfect knowledge' that would suffocate action (NF-1869:3[10]). Rather, it resonates with Zarathustra's plea to 'remain faithful to the earth' (Z: I, *Gift-Giving*, §2), on account of which we should particularly resist the urge to give into a 'new need' promoted by the 'false logic' of money-making and greed (see UM: *SE*, §4-6).[95] Knowledge, acquired under the banner of greed and called upon to legitimise contemptible profit-seeking, however scientific it may claim to be, is incapable of providing a reliable basis for understanding of life's essential properties. It is proficient at spawning fictitious needs and inflaming fraudulent desires – both undeniable sources of entropy. In other words, knowledge that 'does not serve the meaning of the earth' (Z: I, *Gift-Giving*, §2) – cannot be considered 'sound knowledge', which is why Nietzsche urges us to learn to 'acquire knowledge concerning our needs' in a very different manner (NF-1879:40[3]).

Nietzsche insists that only the 'great' can command the eternal return (PT: *Preface*, §1). The superficial, the passing, the disingenuous, the materialistic dross – dare not demand eternity. Instead, they insist on being 'presently' consumed and replaced as quickly as possible as – the only way they can be spared the shame of infelicitous provenance. These chimeras – from the commanding office towers, private mansions, jets, yachts, supercars, to vanities, electronic gadgets, fast fashion, virtual currencies, private space tourism and soon to be snapped up metaverse villas – today command the vastly disproportionate share of the entire civilisational effort and resources. All of them also scream of incurable anguish as they listlessly weave modernity's tapestry of the highly entropic and unequivocally dystopian future, devoid of Penelope's strength and resolve to unwind it (HAH: I, §251). This is the tricky thing to understand, let alone to accept, about Nietzsche's ambivalence towards science: when scientific endeavours end up confined to growing knowledge rather than to greater understanding, however inadvertently, science contributes not to furthering humankind but to its decay and eventual downfall.[96] This is particularly so, when it is acting in the interests of furthering the 'contemptible money-economy' (UM: *SE*, §4-6).

For this reason, the eternal return is helpful in establishing appropriate connections, including to our present-day reality. It is well capable of crossing boundaries from the domain of personal ethics to the modality of humankind's interactions with the natural world, as well as mercilessly interrogating social orders. The force of Nietzsche's critique of the modern Western civilisation derives its potency from his teaching of the eternal recurrence (see Hatab 2005:286). Capitalism, if we think about it, *cannot withstand the thought of the eternal return*. The latter contains the requirement of *sustainability*, of sustaining that [habitat] to which one could not only return but also call it home for countless generations to come (see PUW:96; NF-1888:24[1]). As a system of arranging human affairs in the world, based on the unquestioned primacy of the economy, capitalism is the purveyor of entropy *par excellence*.[97] Capitalism's wilful and deleterious neglect of the past drowned in the 'frivolous deification of the present' (BT: §24), its goal-less drift and

[92] See Binswanger 1994:101-102; Rifkin 1979:61-62; Seaford 2009:157.

[93] Charles Eistenstein (2012), 'We Cannot Grow Ourselves Out of Debt', accessed from: https://www.theguardian.com/commentisfree/2012/sep/03/debt-federal-reserve-fixation-on-growth.

[94] *Bitcoin mining* might be a more compelling example of pursuing 'the absolutely detrimental' forms of knowledge (D: §327), especially where coal is burned in vast quantities to lock in the arbitrage fortunes for the coin miners (see https://www.reuters.com/business/energy/crypto-boom-strains-kazakhstans-coal-powered-energy-grid-2021-11-10/).

[95] See Lampert's insightful discussion, 1986:81-83.

[96] See Nietzsche's discussion on 'natural science, with its goal of knowledge, drives towards downfall'– a critical input into the theory of the eternal return – in NF-1869:3[11]; NF-1872:19[181], [182], [198], [206] and [218].

[97] See Robert Biel's engaging discussion in *The Entropy of Capitalism*, 2013.

demonstrative obliviousness to the future – exemplified by the frenzied consumer culture and ruthless annihilation of the natural world in the incessant chase after profit regardless of the climbing total cost of such pursuits, accompanied by the growing vulnerability of humankind's mental health and spiritual destitution – would fail the test by the eternal return on every single score.[98] Nietzsche's argument suggests that in as much as capitalism is synonymous with entropy, the doctrine of the eternal return is as potent a weapon as humankind could hope to muster in order to fight it. Today, when it seems little further evidence is required that 'our world is burning' (Robinson 2014:1), paradoxically, we remain hostage to the same entropic valuations that have guided us to this point.[99] In this respect, the eternal return beckons no less than 'the greatest of struggles' that justifiably requires 'a new weapon' (NF-1885:2[131]). Hence, Nietzsche's insistence that we better – by thinking and living the eternal return – embark on the wholesale *revaluation of all values*, lest we wish to act out the fate of the 'clever animals', who once 'invented knowledge':

> When nature had drawn a few breaths, the star solidified and the clever animals died. It was time, too: for although they prided themselves on knowing a lot, they had finally discovered, to their great annoyance, that they knew everything wrongly. They died and as they died they cursed truth. That was the way of those desperate animals that had invented knowledge. (PT, Preface, p.248)

It is inevitable, in Nietzsche's view, that the eternal return would play out with or without our consciously acting on it. It would, however, be a catastrophic mistake to pretend that Nietzsche addresses anyone other than ourselves, or that the burden of its proof rests on someone else's shoulders. The one illusion to which – having delved into Nietzsche's eternal return – we are no longer entitled, is a thought that giving political effectiveness to Nietzsche's philosophical insight has nothing to do with us. *Over the eternal return of that which recurs as the self-same* – i.e., – 'the chorus of the satyrs who live ineradicably, as it were, behind all civilization and remain eternally the same, despite the changes of generations and of the history of nations' (BT: §7) – *we do not and cannot have a sublunary handle.* However, over our transient stint on the circumference of the eternal return (the mysterious Epicurean *atomic swerve* that so beguiled young Marx) that stretches back to pre-history and reaches to the future across generations – in that liminal space where difference is alone possible – no one has a claim but us.[100] Hence, as Blumenberg succinctly surmised, the 'responsibility for the condition of the world' is squarely a challenge 'relating to the future, not as an original offence in the past' (Blumenberg 1983:137).

Whether the eternal return is a prophecy and a call to arms (or, indeed, the weighty hammer of Nietzsche's 'experimental philosophy')[101] is for us to decide. One thing is for certain, Nietzsche intended the eternal return to help us *become what we are* (GS: §270, §335). Just as this doctrine waited patiently for Zarathustra's announcement, it remains in no particular hurry. But perhaps we should be, lest we – paralysed by the irremediable nihilism (NF-1886:5[71]) and 'no longer able to give birth to a dancing star' (Z: Prologue, §5) – wish to be consigned to posterity as the 'pitiful, short-living human beings, surrendered to their narrow needs, ever again awakening to the same necessities and with trouble saving themselves in the face of the same' (PUW:95). This has to be so if – in any way – 'the future that we want affects our now' (NF-1883:7[6]) and what we 'abstain from also weaves at the web of all human future' (Z: III, *Virtue*, §3). This is the audacity with which Nietzsche's circle completes itself – by incorporating rather than by negating the linearity of human time: *conservation of energy* demands the *eternal return*, which, in turn, demands the *revaluation of values*, which, in turn, requires a generous helping of *amor fati*[102] not just to cope with the comprehension of it but to correspond to it in a manner that would render the *Übermensch* as the 'type of highest well-being' in this world (EH: *Good Books*, §1).[103] Whatever we may think of it, Nietzsche's eternal return is not for the faintheartedly.

The article is published with the support of the Public Fund "Art Eurasia" (Almaty, Kazakhstan).

[98] Not least, on account of Nietzsche's *fundamental* insistence that 'we must consider the future as decisive for all our evaluations – and not seek the laws of our actions behind us!' (NF-1884:26[256]).

[99] See Kümmel 2011:272; Sedlacek 2013:326-7; Robinson 2014:1; Avery 2016:63, Ayres 2016:485 and Johnston 2021:27-28.

[100] Incidentally, this would help to explain Nietzsche's statements that (a) 'never yet has there been an overman' (Z: II, *Priests*) and (b) 'there was no psychology at all before me' (EH: *Destiny*, §6) not as glaring contradictions in his doctrine but as supporting the dichotomy of the eternal return, which births difference (see NF-1881:11[231],[237]). This was correctly, in my view, intuited by Deleuze (1983:48) and Klossowski (1997:57-73). Cf. Heller 1988:183-184.

[101] See NF-1883:24[4]; NF-1884:26[298], 27[80].

[102] EH, *Clever*, §10.

[103] See Lampert's excellent discussion, 1986:258 and Kain on the eternal return giving the Übermensch meaning and threatening to crush him by bringing him 'too close to the truth' (2007:59).

References

Acampora, Christa Davis (2004), 'Between Mechanism and Teleology' in Nietzsche and Science, eds. Brobjer and Moore, Aldershot: Ashgate, pp.171-189.

Ansell-Pearson, Keith (2005), 'The Eternal Return of the Overhuman: The Weightiest Knowledge and the Abyss of Light', Journal of Nietzsche Studies, 2005, No. 30:1-21.

Arrow, Kenneth J. and Frank H. Hahn (1971), General Competitive Analysis, Amsterdam: North-Holland.

Avery, John Scales (2016), Collected Essays, vol.1, London: Irene Publishing.

Ayres, Robert (2016), Energy, Complexity and Wealth Maximization, NY: Springer.

Babich, E. Babette (1994), Nietzsche's Philosophy of Science: Reflecting Science on The Ground of Art and Life, Albany, NY: SUNY Press.

- (1999) ed., Nietzsche, Epistemology and Philosophy of Science II, Dortrecht: Springer Science+Business Media B.V.

Barnes, John (2014), 'Nietzsche and Diogenes Laertius' in Nietzsche as a Scholar of Antiquity, eds. Jensen and Heit, London and NY: Bloomsbury Academic, pp.115-139.

Bataille, Georges (1967), The Accursed Share: An Essay on General Economy, vol.1 (Consumption), London: Zone Books.

Biel, Robert M (2013), The Entropy of Capitalism, London: Haymarket Books.

Binswanger, Hans Christoph (1994), Money and Magic, London: Quantum Publishers.

Blumenberg, Hans (1983), The Legitimacy of the Modern Age, Cambridge, MA: The MIT Press.

Bonnefoy, Yves (1992), Greek and Egyptian Mythologies, Chicago: University of Chicago Press.

Brobjer, Thomas and Gregory Moore (2004), ed., Nietzsche and Science, Aldershot: Ashgate.

Brush, Stephen G. (1966), Kinetic Theory: Introduction and Original Texts, vol. 2, Irreversible Processes, Oxford: Pergamon Press.

Burley, Peter and John Foster, eds. (1994), Economics and Thermodynamics: New Perspectives on Economic Analysis, Dortrecht: Springer Science + Business Media LLC.

Čápek, Vladislav and Daniel P. Sheehan (2005), Challenges to the Second Law of Thermodynamics
Theory and Experiment, Dordrecht: Springer.

Clark, Charles M.A. (1989), 'Equilibrium for What? Reflections on Social Order in Economics', Journal of Economic Issues, Vol. 23(2):597-606.

Collier, John D. (1990), 'Two faces of Maxwell's demon reveal the nature of irreversibility', Studies in History and Philosophy of Science Part A, Volume 21(2): 257-268.

Colli, Giorgio and Mazzino Montinari, eds. (1967), Nietzsche Werke, Kritische Gesamtausgabe ('KGW' or 'Werke'), Berlin: Walter de Gruyter.

Conway, Daniel W. (2002), Nietzsche's Dangerous Game, Cambridge: CUP.

Cooke, Alexander (2005), 'Eternal Return and the Problem of the Constitution of Identity', Journal of Nietzsche Studies, No. 29:16-34.

Cox, Christoph (1999), Nietzsche: Naturalism and Interpretation, Berkeley: University of California Press.

Deleuze, Gilles (1983), Nietzsche and Philosophy, London: The Athlone Press.

D'Iorio, Paolo (2010), 'The Eternal Return: Genesis and Interpretation', transl. Frank Chouraqui, The Agonist, Vol.3(1):1-43

Edmonds, Radcliffe (1999), 'Tearing Apart the Zagreus Myth: A Few Disparaging Remarks on Orphism and Original Sin', Classical Antiquity, Vol.18(1):35-73.

Eliade, Mircea (1959), Cosmos and History: The Myth of the Eternal Return, transl. Willard R. Trask, Princeton, N.J.: Princeton University Press.

Franck, Didier (2011), Nietzsche and the Shadow of God, Evanston, IL: Northwestern University Press.

Georgescu-Roegen, Nicolas (1971), The Entropy Law and the Economic Process, Cambridge, MA: Harvard University Press.

- (1976) Energy and Economic Myths, NY: Pergamon Press.

Geuss, Raymond (2009), Politics and the Imagination, Princeton, NJ: Princeton University Press.

- (2014) A World Without Why, Princeton, NJ: Princeton University Press.

Gillespie, Michael Allen (2017), Nietzsche's Final Teaching, Chicago & London: The University of Chicago Press.

Grottanelli, Cristiano (1997), 'Nietzsche and Myth', History of Religions, Vol. 37(1):3-20.

Guerber, H.A. (1995), Myths of Northern Lands, NY: Biblio and Tannen Publishers.

Hahn, Frank H. (1972), On the Notion of Equilibrium in Economics, Cambridge: CUP.

Hatab, Lawrence (2005), Nietzsche's Life Sentence: Coming to Terms with Eternal Recurrence, NY: Routledge.

Heilbroner, Robert L. (1979), 'Modern Economics as a Chapter in the History of Economic Thought', History of Political Economy, Duke University Press, vol. 11(2):101-117.

Heit, Helmut (2014), 'Nietzsche's Genealogy of Early Greek Philosophy' in Nietzsche as a Scholar of Antiquity, eds. Jensen and Heit, London and NY: Bloomsbury Academic, pp.217-231.

Heller, Erich (1988), The Importance of Nietzsche, Chicago and London: University of Chicago Press.

Henrichs, Albert (1984), 'Loss of Self, Suffering, Violence: The Modern View of Dionysus from Nietzsche to Girard', Harvard Studies in Classical Philology, Vol. 88:205-240.

Hetherington, Norris S. (1983), 'Isaac Newton's Influence on Adam Smith's Natural Laws in Economics', Journal of the History of Ideas, Vol. 44(3):497-505.

Holte, Stine (2020), 'Nietzsche's eternal return and the Question of hope', Studia Theologica – Nordic Journal of Theology, Vol.74(2):139-158.

Jensen, Anthony K. and Helmut Heit, eds. (2014), Nietzsche as a Scholar of Antiquity, London and NY: Bloomsbury Academic.

Johnston, Adrian (2021, forthcoming), 'Capitalism's Implants: A Hegelian Theory of Failed Revolutions', Crisis and Critique, special issue: 'The Two-Hundredth Anniversary of Hegel's Philosophy of Right, ed. Agon Hamza and Frank Ruda.

Philip J. Kain, Philip J. (2007), 'Nietzsche, Eternal Recurrence, and the Horror of Existence', The Journal of Nietzsche Studies, Issue 33, pp. 49-63.

Kaufmann, Walter (2013), Nietzsche As Philosopher, Psychologist, Antichrist, Princeton, NJ: Princeton University Press.

Keenan, Dennis King (2003), 'Nietzsche and the Eternal Return of Sacrifice', Research in Phenomenology, Vol. 33:167-185.

Klein, Martin J. (1969), 'Gibbs on Clausius', Historical Studies in the Physical Sciences, Vol. 1:127–149.

Klossowski, Pierre (1997), Nietzsche and the Vicious Circle, transl. Daniel W. Smith, Chicago: University of Chicago Press.

Kragh, Helge S. (2008), Entropic Creation: Religious Contexts of Thermodynamics and Cosmology, London: Routledge.

Jeremy Killian (2019), 'Not Another Image of Torment: Nietzsche, Eternal Recurrence, and Theatricality' in Understanding Nietzsche, Understanding Modernism, eds. Brian Pines and Douglas Burnham, London: Bloomsbury Collections, Ch.8, pp.133-145.

Kümmel, Reiner (2011), The Second Law of Economics: Energy, Entropy and the Origin of Wealth, Dortrecht: Springer Science+Business Media.

Lampert, Laurence (1986), Nietzsche's Teaching, New Haven & London: Yale University Press.

Large, Duncan (1999), 'Hermes contra Dionysus: Michel Serres's Critique of Nietzsche', in Nietzsche, Epistemology and Philosophy of Science II, ed. Babich Babette E, Dortrecht: Springer Science+Business Media B.V., pp.151-161.

Lawrence, Elizabeth Atwood (1994), 'The Centaur: Its History and Meaning in Human Culture', Journal of popular culture', Vol.27(4):57-68.

Lemm, Vanessa (2015), 'Nietzsche's Agon For Politics?', Contemporary Political Theory, Vol. 14(1): e12–e17.

- (2020) Homo Natura, Edinburgh: Edinburgh University Press, 2020.

Leonard, Miriam, (2015), Tragic Modernities, Cambridge, MA: Harvard University Press

Loeb, Paul S. (2013), 'Eternal Recurrence' in The Oxford Handbook of Nietzsche, eds. Ken Gemes and John Richardson, Oxford: OUP, pp. 645-671.

Löwith, Karl (1997), Nietzsche's Philosophy of the Eternal Recurrence of the Same, Berkeley: University of California Press.

Luchte, James (2009), 'Zarathustra and the Children of Abraham', The Agonist, Vol.2(2):7-30.

Magnus, Bernd (1978): Nietzsche's Existential Imperative, Bloomington and London: Indiana University Press.

Magnus, Bernd, Stanley Stewart, Jean-Pierre Mileur (1993), Nietzsche's Case: Philosophy as/and Literature, New York: Routledge.

McNeil, Bevis E. (2021), Nietzsche and Eternal Recurrence, Cham, Switzerland: Palgrave Macmillan.

Meisner, Dwayne A (2018), Orphic Tradition and the Birth of Gods, Oxford: OUP.

Meyer, Matthew (2014), Reading Nietzsche Through the Ancients, Berlin: De Gruyter.

Montes, Leonidas (2003), 'Smith and Newton: some methodological issues concerning general economic equilibrium theory', Cambridge Journal of Economics, Vol. 27(5):723-747.

Mosini, Valeria ed. (2009), Equilibrium in Economics: Scope and Limits, London: Routledge.

Murphy, Peter and David Roberts (2004), Dialectic of Romanticism, London: Bloomsbury.

Müller-Lauter, Wolfgang (1999), Nietzsche: His Philosophy of Contradictions and the Contradictions of His Philosophy, Champaign, IL: University of Illinois Press.

Nehamas, Alexander (1985), Nietzsche – Life as Literature, Cambridge, MA: Harvard University Press.

Neves, Juliano C. S. (2019), 'Nietzsche for Physicists', Philosophia Scientiæ, 23(1):185–201.

Nietzsche, Friedrich (1844-1900)[104]:

- Grenke, Michael W., Matthew K. Davis, Lise van Boxel (2005), Friedrich Nietzsche: Prefaces to Unwritten Works ('PUW'), South Bend, IN: St. Augustine's Press.
- Writings from Early Notebooks ('EN', 1867-1879), ed. Raymond Geuss and Alexander Nehamas, transl. Ladislaus Löb, Cambridge: CUP, 3rd edition, 2015.
- The Greek State ('GSt', 1871) in On the Genealogy of Morality (GM), ed. Keith Ansell-Pearson, transl. Carol Diethe, Cambridge: CUP, 1994, pp. 164-174.
- Homer on Competition ('HC', 1872) in On the Genealogy of Morality, ed. Keith Ansell-Pearson, transl. Carol Diethe, Cambridge: CUP, 1994, pp. 174-181.
- On the Pathos of Truth ('PT', 1872) in Writings from Early Notebooks, ed. Raymond Geuss and Alexander Nehamas, Cambridge: CUP, 3rd edition, 2015, pp. 248-253
- The Birth of Tragedy ('BT', 1872), transl. by Walter Kauffmann, New York: Vintage Books, 1967.
- Philosophy in the Tragic Age of the Greeks ('PTAG', 1873), Marianne Cowan, London: Regency Publishing, 1998.
- On Truth and Lies in the Extra-Moral Sense ('TLEMS', 1873) in Writings from Early Notebooks, ed. Raymond Geuss and Alexander Nehamas, CUP, 3rd edition, 2015.
- Untimely Meditations ('UM', 1873-76), ed. Daniel Breazeale, transl. R.J. Hollingdale, Cambridge: CUP, 1997.
- Human, All-Too Human ('HAH', 1878-80), ed. Richard Schacht, transl. R. J. Hollingdale, Cambridge: CUP, 1996.
- Daybreak ('D', 1881), eds. Maudemarie Clark and Brian Leiter, transl. R. J. Hollingdale, Cambridge: CUP, 1997.
- The Gay Science ('GS', 1882), transl. Walter Kaufmann, New York: Vintage Books, 1974.
- Thus Spoke Zarathustra, ('Z', 1883-85), transl. Walter Kaufmann, New York: Random House, 1954.
- Beyond Good and Evil ('BGE', 1886) in Basic Writings Of Nietzsche, ed. and transl. Walter Kaufmann, New York: Modern Library, 2000.
- On the Genealogy of Morality ('GM', 1887), ed. Keith Ansell-Pearson, transl. Carol Diethe, Cambridge: CUP, 1994.
- Twilight of The Idols ('TI', 1888) in The Portable Nietzsche, ed. and transl. Walter Kaufmann, London: Penguin Classics, 2008.
- The Antichrist ('AC', 1888) in The Portable Nietzsche, ed. and transl. Walter Kaufmann, London: Penguin Classics, 2008.

– Nietzsche Contra Wagner ('NCW', 1888) in The Portable Nietzsche, ed. and transl. Walter Kaufmann, London and NY: Penguin Classics, 2008.

[104] Nietzsche's texts ordered chronologically. Dates of publication used for citations provided at the end of each entry.

- Writings from the Late Notebooks ('LN', 1885-1888), ed. Rüdiger Bittner, transl. Kate Sturge, Cambridge: CUP, 2003.

- Ecce Homo ('EH', 1888), in Basic Writings of Nietzsche, ed. and transl. Walter Kaufmann, New York: Modern Library, 2000.

- The Will to Power ('WP', 1901), ed. Walter Kaufmann, transl. Walter Kaufmann and R. J. Hollingdale. New York: Random House, 1968.

Oger, Eric (1997), 'The Eternal Return as Crucial Test', Journal of Nietzsche Studies, No. 14:1-18.

Paphitisa, Sharli Anne (2009), 'The Doctrine of Eternal Recurrence and Its Significance to On the Genealogy of Morals', South African Journal of Philosophy, Vol.28(2):189-198.

Pfeffer, Rose (1965), 'Eternal Recurrence in Nietzsche's Philosophy', The Review of Metaphysics, Vol. 19(2):276-300.

Porter, James I. (2014), 'Nietzsche's Radical Philology' in in Nietzsche as a Scholar of Antiquity, eds. Jensen and Heit, London and NY: Bloomsbury Academic, pp.27-53.

Rayman, Joshua (2018), 'Representationalism in Nietzsche's Early Physics: Cosmology and Sensation in the Zeitatomenlehre', Nietzsche-Studien, Vol.47(1):167-194.

Redding, Paul (2009), Continental Idealism: Leibniz to Nietzsche, London and NY: Routledge.

Rifkin, Jeremy and Ted Howard (1979), The Emerging Order: God in an Age of Scarcity, NY: G. P. Putnam's Sons.

Robinson, William L. (2014), Global Capitalism and the Crisis of Humanity, Cambridge: CUP.

Rovelli, Carlo (2016), Reality Is Not What It Seems, London: Penguin.

Russell, Bertrand (2009), The Scientific Outlook, London & NY: Routledge.

Sambursky, Samuel and Merton Dagut (1956), The Physical World of the Greeks, New Haven, CT: Princeton University Press.

Schrödinger, Erwin (1967), What is Life?, Cambridge: CUP.

Seaford, Richard (2009), Money and the Early Greek Mind, Cambridge: CUP.

Sedlacek, Tomas (2013), Economics of Good and Evil, Oxford: OUP.

Sharlin, Harold Issadore (1979), Lord Kelvin: The Dynamic Victorian, University Park: Pennsylvania State University Press.

Sinhababu, Neil (2019), 'Loving the Eternal Recurrence', The Journal of Nietzsche Studies, Vol. 50(1):106-124.

Small, Robin (2016), Friedrich Nietzsche: Reconciling Life and Knowledge, Cham, SUI: Springer.

Smith, Adam (1904), An Inquiry into the Nature and Causes of the Wealth of Nations (WN: 1&2), ed. Edwin Cannan, London: Methuen, 1904, Vol. 1&2

Soddy, Frederick (1926), Wealth, Virtual Wealth and Debt: The Solution of the Economic Paradox, London: George Allen & Unwin.

Soll, Ivan (1973), 'Reflections on Recurrence: A Re-examination of Nietzsche's Doctrine, die Ewige Wiederkehr des Gleichen' in Nietzsche: A Collection of Critical Essays, ed. R. Solomon, Garden City, N.Y.: Anchor, pp. 343-357.

Spencer, Herbert (1867), First Principles, London: Williams and Norgate.

Sterling, M.C. (1977), 'Recent Discussions of Eternal Recurrence: Some Critical Comments', Nietzsche-Studien, Vol. 6(1):261-291.

Talay, Zeynep (2011), 'A Dialogue with Nietzsche: Blumenberg and Löwith on History and Progress', History of European Ideas, Vol.37:376-381.

Tampio, Nicholas (2010), 'The Politics of the Eternal Return', Theory & Event, Vol. 13(3):1-7.

Tattersall, Mason (2014), 'Thermal Degeneration: Thermodynamics and the Heat-Death of the Universe in Victorian Science, Philosophy, and Culture' in Decadence, Degeneration, and the End, eds. Marja Härmänmaa and Christopher Nissen, London: Palgrave Macmillan, pp.17-34.

Thomson, William (1911), Mathematical and Physical Papers, Cambridge: CUP.

Turner, William (1903), History of Philosophy, Boston & London: The Athenaeum Press.

Webb, Beatrice (1946), My Apprenticeship, London & NY: Longmans, Green & Co.

West, Martin Litchfield (2010), Zoroaster – The Hymns of Zoroaster, London & NY: I.B. Tauris.

Williamson, George S. (2004), The Longing for Myth in Germany: Religion and Aesthetic Culture from Romanticism to Nietzsche, Chicago: University of Chicago Press.

Wilkerson, Dale (2006), Nietzsche and the Greeks, London: Continuum Books.

Wisniak, Jamie (2008), 'Conservation of Energy: Readings on the Origins of the First Law of Thermodynamics', Educación Química, Vol. 19(2):216-225.

Zencey, Eric (1991), 'Some Brief Speculations on the Popularity of Entropy as Metaphor', Metaphor and Symbolic Activity, Vol 6(1):47-56.