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Christian E. Coffinet-Crean
University of Minnesota Morris

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To whomever is reading this paper or even this sentence; you have already done it, and you are going to read it again. How could one have already read something that they haven't even seen before? The answer to that would be Friedrich Nietzsche's theory about the universe known as eternal recurrence or eternal return, which has been studied for its metaphysical and ethical implications but has since been ignored for any possible cosmological value because of its lack of scientific backing. Nietzsche states in his *Werke* the explicit premises for his notion of eternal recurrence being that:

> time is eternal and infinite; space is limited and finite; the number of atoms, the constituent elements of the universe, is determined and finite. From these presuppositions [it] follows that only a finite number of configurations and combinations of atoms is possible and, therefore, that in a sufficiently long period of time, a recurrence of past configurations becomes necessary (Qtd. in Pfeffer, 278).

This bizarre theory has faced harsh criticism when examined by the sciences, mainly for its first two premises concerning time and space. However, by utilizing a rather controversial cosmological theory known as conformal cyclic cosmology and Jean-Pierre Luminet research of finite space, Nietzsche's eternal recurrence can finally enter the debate as a theory to challenge the current Big Bang based worldview.

ANALYSIS

Nietzsche's eternal return is a disturbing and complicated doctrine. A general explanation of eternal recurrence is that anything that has occurred or will occur is bound to repeat itself; from Nietzsche brushing his teeth back in his youth, to humans colonizing mars in the distant future. However, Nietzsche would disagree with this generalization because he believed the idea to have the greatest weight imaginable. In order to properly grasp Nietzsche's concept of eternal return, one must examine his works and find the first mention of it. In *The Gay Science*, it is first introduced in §341 with the thought experiment:

> What, if some day or night a demon were to steal after you into your loneliest loneliness and say to you "This life as you live it and have lived it, you will have to live it once more and innumerable times more; and there will be nothing new in it, but every pain and every joy and every thought and sigh and everything unutterably small or great in your life will have to return to you, all in the same succession and sequence--even this spider and this moonlight between the trees, and even this moment and I myself. The eternal hourglass of existence is turned upside down again and again, and you with it, speck of dust!"

It is truly a terrible thought, that the exact words being read and being recited in a reader's head will happen an infinite amount of times. There are some implications that this excerpt brings, such as the supposed "eternal hourglass of existence." Despite this hourglass being turned over and over, it is not as if time is supposed to "fall" and "fall back" as the sand does but has an existential element to it. This demon experiment is supposed to elicit a response out of the person

robbed for some sort of ascension which will not be delved into here, but the scientific proposition or implication that Nietzsche has proposed with this circular time will be.

The second book that discusses eternal recurrence is Nietzsche's *Thus Spoke Zarathustra,* with the most explicit excerpt found within the chapter "On the Vision and Riddle." It is worth noting that Nietzsche comes across as less traditional in this book compared to the rest of his work because his ideas are shared in a more story-like format. In the chapter, Zarathustra explains the terrible thought of eternal recurrence to a curious dwarf through a prompt or thought experiment. He asks the dwarf to imagine standing in a doorway--behind him is a path that stretches infinitely, and the same is ahead of him. Everything that can walk must have walked behind him on this infinite path along with everything that has walked ahead on the path, even them in the doorway. All the events that have happened along the path could have led him to that point, but this point is bound to be walked on again and again by the animals and people who have already walked this path. The initial reaction of the dwarf is that time is circular, which Zarathustra refutes, claiming that the issue is much deeper than time simply being cyclical, but that with this cyclical time free will cannot exist (136). If eternal recurrence is taken as a cosmology and proven true, then free will does not exist and everything is determined exactly.

The final work of Nietzsche's that will be dissected is his *Will to Power* due to the explicit chapter on recurrence. Despite the entire section, only aphorisms 1062,1063, and 1066 are the ones that will be focused on. In 1062, Nietzsche notes that "If the universe had a goal, that goal would have been reached by now. If any sort of unforeseen final state existed, that state also would have been reached" and continues with the theme that if the universe was to become or reach something, it would have happened by now (425). He furthers with citing "intellects" saying that the universe is in a constant "state of development," proving his prior claim of the universe lacking a goal or final state (426). An interesting portion he states is that

> The idea that the universe intentionally evades a goal, and even knows artificial means wherewith it prevents itself from falling into a circular movement, must occur to all that those who would fain attribute to the universe the capacity of eternally regenerating itself--that is to say, they would fain impose upon a finite, definite force which is invariable in quantity, like the universe, the miraculous gift of renewing its forms and its conditions for *all eternity* (426).

He brings up this "finite, definite force" and constantly refers to it throughout his argument on eternal recurrence. Rose Pfeffer discusses in her paper "Eternal Recurrence in Nietzsche's Philosophy" is that "Nietzsche's theory is not based upon the classical atomism which still prevailed in his time, but upon a dynamic energetic theory of explanation" (279). This theory of energetics was a competitor to atomism during Nietzsche's time but was ultimately unsuccessful in being adopted, leading his theory to be thrown out for any value. The next aphorism ties with this science as well, stating that "The principle of the conservation of energy inevitably involves eternal recurrence," essentially confirming Pfeffer's perspective (Will to Power 427). The use of energetics is one of the ultimate downfalls of eternal recurrence when observed by science in any time period. However, 1066 is the most cited when looking at eternal recurrence for any cosmological value due to it being somewhat of an informal proof. The entire passage will not be cited here due to it being almost a complete repetition of the first explanation of eternal recurrence, but a section of aphorism 1066 is worth mentioning:

> In infinity, at some moment or other, every possible combination must have once been realised; not only this, but it must have been realised an infinite number of times. And inasmuch as between every one of these combinations and its next recurrence every other possible combination would necessarily have been undergone, and since every one of these combinations would determine the whole series in the same order, a circular absolutely identical series is thus demonstrated: the universe is thus shown to be a circular movement which has already repeated itself an infinite number of times, and which plays its game for all eternity.--This conception is not simply materialistic; for if it were this, it would not involve an infinite recurrence of identical cases, but a finite state. Owing to the fact that the universe has not reached this finite state, materialism shows itself to be but an imperfect and provisional hypothesis.

This part of 1066 provides a better proof to Nietzsche's thoughts and to the concept of eternal recurrence overall. To vocalize what Nietzsche is saying in a more contemporary setting, the world that currently exists is just a combination of atoms and energies that have "mashed" together and the universe has been "mashed" into this specific order an infinite amount of times. Despite Nietzsche's clever way of using infinity in his arguments, this cosmological theory fell apart due to the lack of scientific support which was integral for eternal recurrence.

OPPOSITION

There are an enormous number of critics against Nietzsche and his eternal recurrence as a cosmological theory. Alexander Nehamus is one of the most well-known critics of Nietzsche and analyzes and criticizes Nietzsche in his book *Nietzsche, Life as Literature*. Nehamas's first criticism of Nietzsche's cosmology is that "this cosmological doctrine is not [to be] found in a number of passages where Nietzsche discusses the recurrence" (142). Nehamus furthers his claim with the lack of proof for eternal recurrence, and the lack of empirical evidence to support it. Whenever Nietzsche wrote about eternal recurrence, it was always about how the idea affected someone and not the science behind it. For example, the demon-kidnapping thought experiment it meant to expose the gravity of eternal recurrence and how one would respond to it. The science aspect that could have been portrayed is replaced with a demon. One would simply try to cite Nietzsche's *Will to Power* for direct evidence for eternal recurrence, but Nehamus refutes that attempt since "it is very difficult to determine the purpose of [those] sketches [are]" (143). The "purpose" that Nehamas is referring to may not be Nietzsche's, but of his sister Elizabeth Förster-Nietzsche. As stated by Walter Kaufmann in *Nietzsche: Philosopher, Psychologist, Anticrist*, Nietzsche's sister actually took over publishing her brother's works and utilized his famed status to edit anti-Semitic propaganda into his later works, one of them being *Will to Power* (16). So it is most likely that Elizabeth organized and edited *Will to Power*, but I would reason that the portions on eternal recurrence may have been included in the book for some continuity to connect *Will to Power* with previous works since the idea of eternal recurrence is such a complex one that Elizabeth probably did not understand. Another possible problem with eternal recurrence is that "if time is linear, where the recurrence happens on the time line is sufficient to differentiate it from its preceding occurrence. This means we can designate recurrences as happening at T_1 and then T_{12} and so on, and these designations are enough to keep the recurrences from being absolutely identical" (Palenick & Williams 395). That is why Nietzsche extends the idea that time is cyclical to prevent this issue. However, time being cyclical does not solve the problem entirely. Palenick & Williams further their claim by using an analogy involving this cyclical time and the number of configurations of the universe with the

alphabet. Even after some time, one could count how many times a configuration A or E occurred, making each time the configuration occurred not identical to the last. This point is easily refutable because the claim of infinite time makes it impossible to know which configuration this world is on. Furthermore, since each configuration is exactly the same, there is little worth in labeling each time this combination reoccurred. Another final counterpoint to eternal recurrence as a cosmological theory is the lack of focus Nietzsche provides for eternal recurrence as a cosmology when compared to the metaphysical, ethical, and psychological response to the doctrine, as emphasized in the demon thought experiment. Andrew Huddleston discusses this in his paper *Affirmation, Admirable Overvaluation, and the Eternal Recurrence*, with the assumption that "if the cosmological hypothesis were true, it might in fact undermine the existential import of it all, since everything forward and backward would presumably be fixed" (7). If eternal recurrence was true on a cosmological level, then the metaphysical and psychological response would be pointless. If Huddleston is posed with the demon experiment, he cannot choose any other response besides the one that has been said the infinite amount of times you were stolen in the first place. What Huddleston is forgetting is that his claim of pointlessness regarding the psychological and metaphysical implications of eternal recurrence is exactly what makes eternal recurrence Nietzsche's greatest weight. It is not just that everything has happened, even this paper being written, but that existence becomes almost if not completely pointless. The psychological response doesn't matter because no matter what anyone does when faced with the demon that Nietzsche uses, their response has already happened. Huddleston's point in refuting eternal recurrence does nothing if not further elaborates the idea of eternal recurrence.

CONTEMPORARY COSMOLOGY MEETS NIETZSCHE

Nietzsche's original concept of eternal recurrence was cast aside by science by using energetics and by philosophy with the issue of infinities and lack of scientific support in Nietzsche's work. However, I plan on using modern theories to support Nietzsche's idea so it can be reintroduced into the modern discussion on the universe. In order to bring back Nietzsche's eternal recurrence, the aforementioned premises must have an updated support system to even be considered. Nietzsche's first two premises "time is eternal and infinite" and "space is limited and finite" directly contrasts the commonly held Big Bang theory formulated by Georges Lemaître. In Milton K. Munitz's *Theories of The Universe*, Lemaître's theory is that a single atom, commonly known as a singularity in today's sciences, underwent radioactive disintegration and expanded into the universe that is seen today (339). The origins of this atom, which Lemaître calls the Primeval Atom, is unknown. However, Roger Penrose's conformal cyclic cosmology (CCC) hypothesizes an origin to the primeval atom. In *The Basic Ideas of Conformal Cyclic Cosmology*, Penrose explains that

> the universe undergoes repeated cycles of expansion, that [he] refers to as *aeons*, each starting from its own "big bang" and finally coming to a stage of accelerated expansion which continues indefinitely (which would be for an infinite time, according to how a clock made of physical material would measure time) in close accordance with current observations of our own aeon. There is no stage of contraction (to a "big crunch") in this model. Instead, each aeon of the universe, in a sense "forgets" how big it is, both as its big bang and in its very remote future where it becomes physically identical with the big bang of the next aeon, despite there being an infinite scale change involved, on passing from one aeon to the next (233).

Penrose's theory comes from his research involving cosmic background radiation (CMB), though this aspect of his research is not explored further in this essay. In addition to his CMB research, Penrose also utilizes the second law of thermodynamics and the arguments surrounding the Big Bang model to further support his theory. Although it may not represent the law completely, a simple explanation of the second law of thermodynamics states that as time progresses, entropy increases where entropy is the disorder or non-uniformity of the universe. From the singularity that is emphasized in the Big Bang model, time goes on and entropy increases like the law says. As entropy grows, Penrose says that black holes will eventually be formed due to the "gravitational clumping" that the stars and other high mass objects in space promote (237). And after these black holes form and essentially consume all matter possible, the black holes will eventually disintegrate as according to Hawking's black hole radiation (239). If CCC is true, then time must be treated as infinite and can be used as scientific evidence for eternal return.

To make room for finite space in contemporary cosmology that eternal recurrence needs, the premise must be extended to a theory that Jean-Paul Luminet founded. Before Luminet's theory is explored, a crucial factor to his findings and this argument must be mentioned. A rather general concept to find the curvature of space pertains to the density of the matter in space (Ω_0). As Luminet notes in his research, "$\Omega_0 < 1$ corresponds to a space of negative curvature (hyperbolic geometry), $\Omega_0 = 1$ to a space of zero curvature, also called flat space (Euclidean geometry), and $\Omega_0 > 1$ to a space of positive curvature (spherical geometry)" (Luminet 294). Only if the critical density of the universe is greater than one, then space will be finite and be shaped similarly to a circle with variations depending on the actual number of the density. Luminet found that Ω_0 was somewhere between 1 and 1.04, but that does little to confirm the shape of space except for disproving the possibility of hyperbolic space. However, Luminet furthers a claim of finite space with his studies of harmonics in the universe derived from fossil radiation (295). When studying data collected by the WMAP satellite, Luminet noted that "there is a notable loss of power" between space and harmonics when observed by large angles which conflicts with the flat model of space. Another thing to add to this conflict is the mismatch between theoretical data and Luminet's observable data; the strength of observable harmonics found were significantly less than the theoretical computations, furthering Luminet's claim. In short,

> If [the universe] is infinite, or at least much larger than the cosmological horizon, all wavelengths are allowed and fluctuations should be presented on all scales. On the contrary, if its size is finite and smaller than that of the horizon, then very long wavelengths are forbidden. In this type of small wraparound universe, there must therefore be a natural length scale above which the Universe ceases to vibrate, and this translates into a loss of power in the spectrum of the fossil radiation on angular scales greater than this maximum. Exactly this is observed in the WMAP data. (297)

Supposing Luminet's studies of the cosmos are true, then space would be considered finite and fulfill the last premise needed to support Nietzsche's eternal recurrence.

CONCLUSION

Despite Nietzsche claiming that eternal recurrence may be insufficient due to his lack of scientific knowledge, contemporary theories pertaining to the universe can finally be used in support of such a grim doctrine. The critics towards eternal recurrence fall into the trap of Nietzsche's use of infinite time, for which many of the arguments fall short of the extent that infinite time possesses to Nietzsche. Penrose's conformal cyclic cosmology utilizes CMB and inconsistencies involving current discussion around the second law of thermodynamics to conclude his cyclical universe, permitting time to be infinite. Luminet's studies of CMB involving harmonics has led him to believe that the universe is a closed or finite system due to the loss of power or energy that his observations found. Depending on the cohesion of Luminet's and Penrose's work, Nietzsche's eternal recurrence can be treated as a sufficient yet controversial theory about the cosmos.

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