An Analysis of "The End of Eternity" by Isaac Asimov

Introduction

Isaac Asimov was a prolific writer during his lifetime, at one point putting out a book per month over the period of four and a half years.[1] His works span a wide range of topics, covering science fiction, Greek and Roman history, mystery, fiction and nonfiction for teenagers, and a number of titles written on science and technology for the layman.[2] He has even written a guide to the Bible as well as a guide to Shakespeare. His mastery in science fiction can in part be attributed to his technical knowledge, having obtained a PhD in chemistry from the University of Columbia.[3] Furthermore, he spent ten years teaching biochemistry at the Boston Medical School. He has developed numerous works and is best known for his "Foundation" and "Robot" series. One that is often forgotten about is "The End of Eternity," which was published in 1955. In his autobiography "I. Asimov: A Memoir," he only barely mentions this novel, stating "As for *The End of Eternity*, that was an independent novel with no connections."[4] Despite its obscurity, the novel presents a remarkably unique and thought-out conception of what time travel could look like and highlights some of the technological advancements made in the years leading up to its publication.

Plot Synopsis

Technician Harlan is an Eternal, an entity which operates outside of reality, traveling throughout time and making slight adjustments (M.N.C. or "Minimum Necessary Change") so as to ensure that humanity lives harmoniously over the span of centuries on Earth. Harlan works for an organization called "Eternity" which oversees his work. Having been pulled from the timeline himself, Harlan underwent training, progressing from a Timer—someone freshly pulled from time and allowed to observe the workings of eternity—to a Cub—someone who is receiving training in the science behind eternity—to an Observer—A specialist allowed to enter time and observe the course of events—and finally to a Technician—someone tasked with physically making changes at various points in time to instigate a change in reality. Eternity operates on its own time, often referred to as "physiotime" as humans continue to age according to their biological clock. Eternity itself was created in the 27th century by technology developed by a Vikkor Mallansohn of the 24th century. Members of Eternity can use what are called "kettles" to move up and down the timeline to different centuries. The 27th through 70,000th

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[1] Isaac Asimov, An Interview with Isaac Asimov, Magnetic Media, 1975, National Archives, https://catalog.archives.gov/id/54491. T12:48

[2] Asimov.

[3] Isaac Asimov, *I. Asimov: A Memoir* (New York Toronto London Sydney Auckland: Bantam Books, 1995)., P136

[4] Asimov., P168

century are accessible to Eternity, but for unknown reasons the years 7 million to 15 million cannot be accessed.

It quickly becomes evident that Harlan does not like his line of work. Often technicians are shunned by the other members of Eternity because they blame Technicians for doing away with their "homewhen"—the time and reality they were pulled from. Every change a technician makes rewrites reality after that point, and thus those pulled from a later time have no home to return to. Despite not enjoying his treatment, Harlan does an excellent job as a technician, gaining the attention of Senior Computer Twissell who is the dean of the Allwhen council, the governing body of Eternity. Harlan's experience with the "primitive"—the period of time before 27th century—makes him an excellent candidate for teaching a new Cub, Brinsley Sheridan Cooper. The reason why he is teaching Cooper this topic is not revealed.

During his time teaching Cooper, Harland is assigned to live with a member of the 482nd century's aristocracy, Noÿs Lambent, during which time he falls in love with her. Realizing that she will be removed from reality in the next MNC, Harlan breaks the laws of Eternity and pulls her from the timeline, hiding her in the far upwhen beyond the 10 millionth century. Later, when he ventures back upwhen to find Noÿs, he finds that the kettle is blocked by some barrier. He travels back to Computer Twissell, believing that he is the one who has placed the block and knows of his crime. Confronting Twissell, Harlan makes the remarkable deduction that Eternity couldn't have been created by Vikkor Mallansohn alone as the mathematics and technology needed didn't exist at the time, and thus Cooper must be the agent that will be sent back to the 24th century to help develop this technology. Harlan uses this information to negotiate with Twissell, intent on interfering with the causal loop if Twissell doesn't release Noÿs. Twissell placates Harlan by agreeing to his demands, but then outsmarts Harlan by locking him in a completely automated control room, forcing him to continue to play along until Cooper is sent back in time. Harlan, in a moment of rash action, breaks the controls. This sends Cooper to 1932, thus interfering with Eternity's causal loop but not yet breaking it.

Twissell, flabbergasted but reassured by the continued existence of Eternity, works with Harlan and goes back to retrieve Noÿs from upwhen. This time there is no barrier. Harlan now agrees with Twissell to rescue Cooper from the 1932nd and so he travels back in time with Noÿs. When they reach the 1932nd Harlan holds Noÿs at gunpoint, revealing that he suspects her of being from the years beyond the 7 millionth century. His rash actions to try and end Eternity had been entirely driven by her manipulation of him, and that her original existence in the timeline he had pulled her from was impossible. She admits this is the case, revealing that she was sent by the future to end Eternity. She conveys how the changes made by Eternity—the MNCs—forced humanity to stay on planet Earth instead of traveling out into space. During this time, aliens colonized the cosmos and ultimately humanity dies out. Had Eternity not intervened, mankind would have been the first among the stars and would have prospered. Harlan is conflicted as he had always thought that Eternity was doing the right thing by protecting humanity from its failures in attempting space travel but realizes that these failures were necessary in order to

eventually be successful. Ultimately Harlan chooses to not save Eternity, causing the sky to become grey and the to kettle disappear. As the story concludes, “With that disappearance, he knew, even as Noys moved slowly into his arms, came the end, the final end of Eternity. - And the beginning of Infinity.”

Time Paradigm

The novel posits an organization that exists in realm outside of the usual time and space of reality called “Eternity.” The time experienced by the members of Eternity progresses at a rate set by their biological clock. This is often referred to as “physiotime” where one “physioday” corresponds to the time over which the human body ages by one day on Earth in reality. The book notes this natural aging, stating, “In Eternity there was no Time as one ordinarily thought of Time in the universe outside, but men's bodies grew older and that was the unavoidable measure of Time even in the absence of meaningful physical phenomena.”[5] While time in Eternity is linear and unchanging, the timeline experienced in reality (or in “Time”) is mutable and can be altered by the members of Eternity. This means that members in Eternity can remember the way reality “used to be” and can enact their own series of changes in order to sculpt reality into what they want it to be. These changes are often handled by a specialized group called “Technicians,” which is the preoccupation of the main protagonist, Harlan.

Another group called “Observers” are also allowed to enter Time but must have as minimal an impact as possible. Harlan, having once been an observer, relates “He would have to say as little as possible, do as little as possible, be a part of the wall as much as possible. His true function was that of a pair of ears and a pair of eyes. Connecting those senses with the final report was his mind, which, ideally, had no other function.”[6] This indicates that Time has momentum in this conception of reality, where the inclusion of certain individuals or actions into the course of events can ultimately have a negligible impact on reality at a later point in time. Determining exactly what effect these adjustments to reality would have is the job of a group called “Computers.” The text makes a point of most of their computations being entirely statistical, where certain outcomes are statistically more probable than others, and that certain tolerances must be met before a technician is allowed to make a change. These changes have a specific designation called the “Minimal Necessary Change,” abbreviated MNC. The goal with these adjustments is to find what is the smallest possible change in reality necessary to make the adjustment while also minimizing extraneous or unintended side effects. The exact impact of the change is described as “ripples” in reality: “The ripples spread wider, reaching their maximum in the 2481st, which was twenty-five Centuries upwhen from the Touch. The intensity of the

[5] Isaac Asimov, *The End of Eternity* (Fawcett Crest, 1955). P40
[6] Asimov. P51

Reality Change declined thereafter."[7] Here the "Touch" is the change made by the Technician. The decline in intensity can again be attributed to Time's momentum.

The actual mechanism that enables time travel are referred to as "kettles," which are portrayed as being similar to elevators, but instead of moving up and down in space moves up and down in time. Harlan relates the experience of traveling in a kettle, stating, "And there was the little stir in his stomach, the faint (psychosomatic?) touch of dizziness, that told him that all the kettle contained, including himself, was rushing upwhen through Eternity."[8] At each century there is a station the kettle can stop at. These stations have all the necessities for living, such as food and dorms, and often members of eternity permanently reside at the station for the century they are assigned to work with.

In addition to Eternity, there is an analogous organization housed within what are called the "Hidden Centuries" in the book. Early on it is introduced that the centuries between the 7 millionth year and the 15 millionth year were inaccessible to Eternity for reasons unknown. This goes unmentioned for a while until the end of the story where Harlan begins using the empty corridors of these centuries as a refuge for Noÿs. It is when Harlan tells Twissell about a barricade across the kettles at the 10 millionth year that Twissell confides in Harlan that he had always suspected a separate entity to be operating against Eternity in the far upwhen, blocking them out of these centuries so that Eternity couldn't make any more adjustments to the timeline past the 7 millionth year. Noÿs admits to being from the hidden centuries, relating that in a separate timeline they also learned how to travel through time: "We, too, had Time-travel, you see, but it was based on a completely different set of postulates than yours, and we preferred to view Time, rather than shifting mass. Furthermore, we dealt with our past only, our downwhen."[9] Though not many details are revealed about this alternative Eternity, it appears that its creation allowed this future race of time travelers to set up their own pocket in time and safeguard their reality. The ability to study Eternity and insert Noÿs into the downwhen governed by Eternity implies that their pocket in time progresses similarly with physiotime in parallel to Eternity, otherwise it would be hard to work it into the framework for time outlined in the story.

[Could add a section on paradoxes here]

Scientific Context

"The End of Eternity" was written during a time of great scientific and technological advancement, culminating in its publication in 1955. Beginning in 1936, Alan Turing first put forward his conception of the modern computer while working at Cambridge University. He describes an abstraction of what a computer should be, outlining limitless memory through

[7] Asimov. P60
[8] Asimov. P7
[9] Asimov, *I. Asimov*. P184

which a scanner can read and write data, a program that describes how to manipulate this information, and furthermore, the ability of this machine to modify its own programming.[10] This was later followed by the invention of the Atanasoff-Berry Computer in 1939, abbreviated ABC. This device was the first to use vacuum tubes to perform numerical calculations; up until then physical rotors or mechanical switches called 'relays' were used. Despite being a step forward in solid-state technology, it suffered from an unreliable binary card-reader and work on it was discontinued in 1942.[11] By 1954, electronic computers had advanced enough to be brought into wide use with the invention of the IBM 704 and 705 computers. Asimov, aware of these developments, wrote of his own ideas regarding computers, even going as far to create a whole sector of Eternity dedicated to operating them, aptly named "Computers." Asimov's electronic computers manifest as devices called "computaplexes," which are collections of small computing units that are imbued with the ability to perform statistical computations regarding the likelihood of outcomes resulting from some change in Time. Senior Computer Twissell maintains a configuration of computaplexes in the book, which Harlan describes when he first sees Twissell's office: "Twissell's office was a clean, long room of porcelain asepsis. One wall of the office was crowded from floor to ceiling and wall to distant wall with the computing micro-units which, together, made up the largest privately operated Computaplex in Eternity and, indeed, one of the largest altogether."[12] Though likely acquainted with the early room-sized computers, Asimov imagines smaller, compartmentalized units that hook up in networks, which provides a fascinating and retro-futuristic take on what computers could have become. Arguably this description could be mapped onto modern computing systems.

Another important technology that appears in the novel is the atomic bomb and nuclear technology. This relates directly to the Manhattan Project, which had its roots in the experiments conducted by James Chadwick at Cavendish in 1932 which revealed the existence of the neutron.[13] This led many scientists down the length path of probing subatomic particles and determining their properties. This research, in part, led to the development of new weapons. The military later got involved in the production of fissile material under the code name 'Manhattan Engineer District' which we now know as the Manhattan Project, and was put under the command of General Leslie Groves.[14] With the advent of World War I, Robert Oppenheimer was appointed director of a new laboratory code-named Project Y by General Groves, and soon after Los Alamos was acquired for the location of its nuclear weapon factory.[15] This all culminated in the Trinity test on July 16, 1945, marking the first successful nuclear explosion and the start of

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[10] Jack Copeland, "The Modern History of Computing," in *Stanford Encyclopedia of Philosophy*, ed. Zalta Edward (Metaphysics Research Lab, Stanford University, 2000), https://plato.stanford.edu/archives/win2020/entries/computing-history/.

[11] Copeland.

[12] Asimov, *The End of Eternity*. P122

[13] Jeff A. Hughes, *The Manhattan Project: Big Science and the Atom Bomb* (Columbia University Press, 2003). P45

[14] Jeff A. Hughes, *The Manhattan Project: Big Science and the Atom Bomb* (Columbia University Press, 2003). P54

[15] Jeff A. Hughes, *The Manhattan Project: Big Science and the Atom Bomb* (Columbia University Press, 2003). P61-63

the nuclear age. Not long after, this technology was deployed on Nagasaki and Hiroshima in August 1945. In the years following the war, much contention was held over further development of nuclear weapons. Oppenheimer spent a considerable amount of time working towards the peaceful use of nucleonics, later stating, "Perhaps, as much as anything, my theme has to do with enlisting time and nature in the conduct of our international affairs: in the quest for peace and a freer world."[16] Nuclear technology takes center stage in the concluding scenes of "The End of Eternity" when Bradley Sheridan Cooper, after having been lost in the 20th century—specifically in 1932—due to the intervention of Harlan, posts an advertisement in a magazine of the time featuring an anachronism of the mushroom cloud of an atomic bomb. This is later found by Harlan, enabling him to save Cooper. In the reality imagined by Asimov, if it weren't for Eternity's influence mankind would inevitably develop nuclear technology, eventually allowing them to successfully navigate space. Throughout the book it is evident that Eternity tries to prevent progression in nucleonics for fear that mankind would destroy itself with the technology. Harlan reflects on the almost inevitable inclination of mankind towards this technology, as he narrates, "Man had to be protected from his own too flourishing technical mind. That more than anything else. Not a physioyear passed but that somewhere in Time nuclear technology veered too close to the dangerous and had to be steered away."[17] Noÿs divulges that if it weren't for Eternity, mankind would have developed the technology sooner, allowing them to travel out to other stars. This prohibition on this technology makes mankind late to the intergalactic space race, as aliens end up colonizing other planets before man. This ultimately forces mankind into isolation on Earth. Noÿs accuses Eternity for the extinction of man, stating, "They didn't just die out. It took thousands of Centuries. There were ups and downs but, on the whole, there was a loss of purpose, a sense of futility, a feeling of hopelessness that could not be overcome. Eventually there was one last decline of the birth rate and finally, extinction. Your Eternity did that."[18]

With all that hinges on man going into space as soon as possible in the book, it is evident that the early years of the space race have made their mark on the plot. The development of rocketry goes as far back as 1898 when Konstantin Tsiolkovsky, a Russian-Soviet rocket scientist, proposed the idea of space exploration via rockets.[19] Progress in this field was accelerated following the end of WWII and the fall of Germany when many German rocket scientists emigrated to the United States. Furthermore, the heightened pressures of the beginning of the Cold War fomented efforts in the United States and in the USSR to be the first to explore the "final frontier" of space. Intercontinental ballistic missiles served as precursors to space-oriented rocketry, highlighting how intertwined scientific advancement and military technology

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[16] Robert Oppenheimer, "The Open Mind," *February 1949*, accessed March 11, 2023, https://www.theatlantic.com/magazine/archive/1949/02/the-open-mind/305431/.
[17] EOE P95
[18] EOE P185
[19] Tom Benson, "Brief History of Rockets," NASA, May 13, 2021, https://www.grc.nasa.gov/www/k-12/TRC/Rockets/history_of_rockets.html.

are. This all culminated in the launch of *Sputnik* by the Soviets on October 4, 1957, marking the first successful entry in the space race. Asimov, in living through this, developed a world view where it is man's natural inclination to explore. In an interview from 1975 with Sy Bourgin, Asimov says "The entire history of mankind has been that of crossing the hilltop to see what's in the next valley. Mankind has been exploring the earth for thousands of years … Just because we have now explored the entire earth ... it seems a shame to stultify this impulse of ours and the next thing to explore is the moon and the planets."[20] The novel ends with Harlan choosing to end Eternity, thus allowing mankind to develop nuclear technology and be the first to claim other planetary systems.

[Could add in Dyson spheres and Nova Sol]

Legacy

Although "The End of Eternity" hasn't received much attention since its publication, other works by Isaac Asimov have been incredibly influential in the science fiction genre. Living in a time of extensive technological advancement and witnessing man's first steps into space, Asimov took hold of the fantastical possibilities that science could provide and molded them into otherworldly stories that somehow seem plausible, even if not set in our lifetimes. Asimov, in writing his novels, wished to present an alternative reality—perhaps our reality somewhere upwhen—where technology has changed the way we live and see the world. When asked what science fiction is, Asimov states, "I think science fiction refers to different societies, which are connected to ours, through scientific and technological change. There is always that feeling that we are heading, right now rapidly, into changing societies."[21] Though he may no longer be writing stories, his novels continue to influence how we think of our own future and what we wish to do with it.

[20] Asimov, An Interview with Isaac Asimov. T8:20
[21] Asimov, An Interview with Isaac Asimov. T20:40