



## Monthly Archives: July 2014



UNCATEGORIZED

# A SPACE ODYSSEY SERIES

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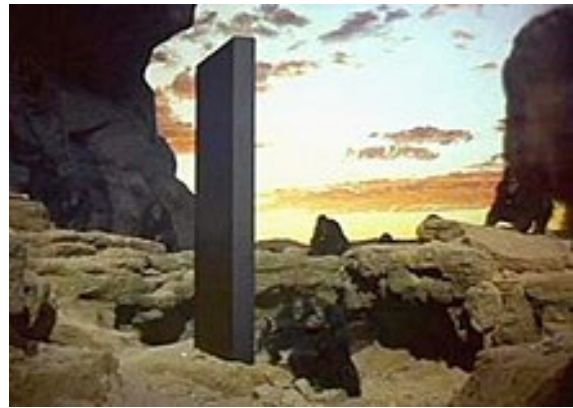
## A Space Odyssey Series

Science fiction is unique in its ability to tell stories. While most other forms of fantasy and fiction allow for the discussion of human nature, philosophy and politics, only science fiction allows for the discussion of the interplay between them and science. A lot of modern science fiction coming out today is horrible, focusing on giant bugs or attack from obscure aliens with no clear motive or discussion of the technology being employed. In these stories, the aliens are no better than having a story based on elves or ghosts. Arthur C. Clarke, being aware of this, went out to create the “good science fiction movie” (Clarke, 2001: A Space Odyssey). From this he set out to write [2001: A Space Odyssey](#). 2001 was not a lone book though. Inspired by birth of the space age, Arthur C. Clarke went on to write [2010: Odyssey Two](#), [2061: Odyssey Three](#) and finally [3001: The Final Odyssey](#). The focus of these books is on actually telling a story through the use of real science and what technologies might plausibly arise in the fifty years between when the book was written

and the time the book was set in. It is the goal of this essay to show that, while the technology of 2001: A Space Odyssey may seem outlandish by even today's standards, it is far from impossible.

## Biography

In order to understand the novels, you must first understand the life of the author. Arthur C. Clarke was born on December 16, 1917 in England. "Following service as a radar instructor and technician with the Royal Air Force in the Second World War, he honed his scientific acumen working as an editor for the academic journal Physics Abstracts, while earning a first-class degree in mathematics and physics at King's College London" (Benford). With this highly technical background he had no problem understanding the scientific papers coming out around that time period. His expertise was so refined that "in 1945, he proposed the use of satellites in geostationary orbits as communications relays. Clarke never patented the idea, but promoted it ceaselessly" (Benford). Geostationary orbits have revolutionized modern communications and allowed for faster growth through the interconnected financial institutions of the world. Clarke died on March 19 2008.



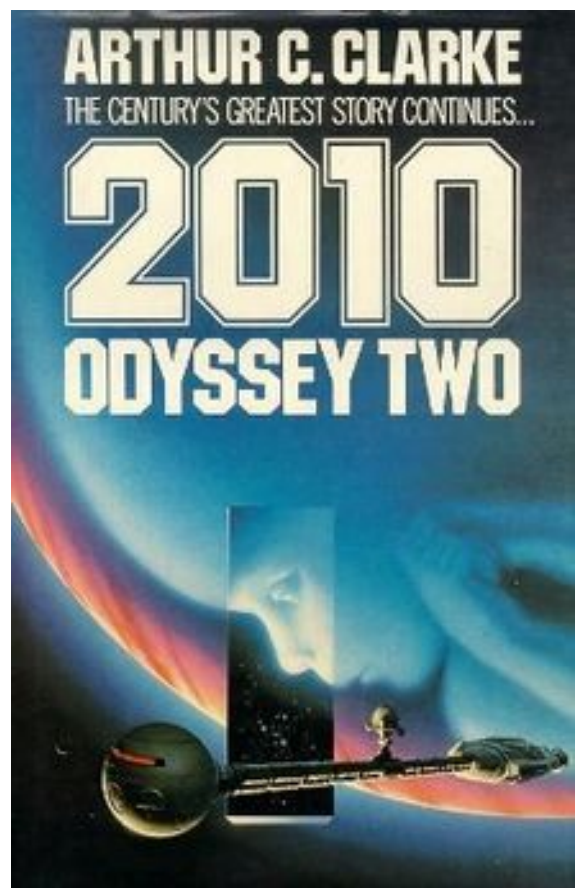
## Book Summary

In 1968, Clarke wrote the first book in the series 2001: A Space Odyssey. The book was a major success and with NASA further exploring the solar system during the next 14 years, other books had to follow. 2001: A Space Odyssey starts off with the evolution of man. A group of man-apes are existing in a cave but only just barely. Suddenly, a black monolith falls from the sky and over time teaches the man-apes hunting and tool use. It isn't much but it's enough to trigger an evolutionary response leading to Homo sapiens. The book then transitions to 2001 when a magnetic

anomaly is found in the Tycho crater (TMA 1). Upon TMA 1 being unearthed a signal is sent to the planet Saturn. For clarification, in the novel 2001: A Space Odyssey the plan was to make a trip to Saturn, however in the [movie](#) that changed the location to Jupiter because they did not feel they had the budget to do Saturn justice. All the other books in the series revolve around the plot of the movie. The bulk of the book involves the crew of the Discovery One flying to Saturn to try and determine what the signal was about. The two crew members, David Bowman and Frank Poole, were sent as an exploration team but with no knowledge of the alien aspect of the mission. The time span for this trip would have been hard for humans during an extended stay in a zero gravity environment. Because of this the characters were kept in a spinning dome capable of simulating moon gravity. The onboard computer, Hal 9000, was told to keep this information from them, which contradicted its ethical programming. This dilemma would be acceptable for a person but not for a purely logical machine. As such, Hal was driven insane and killed off all of the crew but David. Once Hal was shot down, David continued the trip and, when met with another alien monolith (TMA 2), was uploaded as a "Star Child".

In 2010: Odyssey Two another mission was sent to Jupiter. The

Americans and Russians were both in a race to reach the ruins of Discovery One but its orbit was found to be decaying so Russia and the United States decided to team up in order to reach it in time. During the mission, China launched a bigger rocket in secret that was able to outpace Discover Two and make it to Jupiter a few weeks early. They landed on Europa, where they planned to use the water ice there as rocket fuel for the return trip. During that process, the Chinese ship was attacked by a large alien life form, confirming that life exists elsewhere in the solar system. During this time, the entity once known as David Bowman examines the planets in the solar system to see which ones harbor life. Once it is found that Europa is capable of harboring intelligent life but it is unable to do so due to being completely frozen over, the decision is made to implode Jupiter and turn it into a second sun. The crew of the Discovery Two just made it out with their lives. At the very end of the book a message is sent to the people of Earth from TMA 2 which only states "All these worlds are yours, except Europa. Attempt no landing there" (Clarke, 2010: Odyssey Two).



In 2061: Odyssey Three, Heywood Floyd was taking a vacation on a new ship with a built in ion drive. The drive was fast enough that it can take the trip from Earth to any planet in the solar system within

a matter of weeks. While on the vacation another ship crashed on

Europa and became the first

people to visit since we were

warned away. Floyd's ship was

the only one with the power to

get there and rescue them. In

3001: The Final Odyssey, the

body of Frank Poole was found

frozen in space and, with the

extreme cold and dry conditions,

was still preserved enough that

the more advanced people in

3001 were able to bring him back

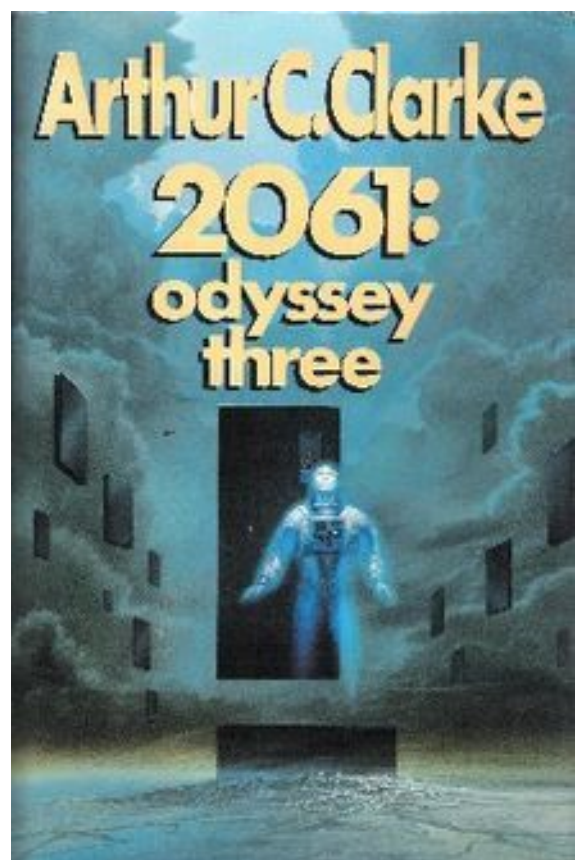
to life. The story of a future is

told from his perspective. At the end of the book, what use to be

David Bowman showed back up with a message. The aliens that built

the monolith saw what we were like in the 20th century and and

decided that we were a danger. Bowman thought we were worth





saving and planted a logic bomb into the monolith, keeping it from doing any harm.

## Artificial Gravity

It's a great story but what really drives it is how the development of technology is presented in the book. The first, and by far most recognizable, piece of technology is by far their artificial gravity. In most science fiction, artificial gravity is just something that works and is assumed to be done by technology that is just above and beyond anything we currently understand. Arthur C. Clark goes the

next step however in actually providing a mechanism by which gravity can be simulated. He was by no means the first to propose such an idea but he



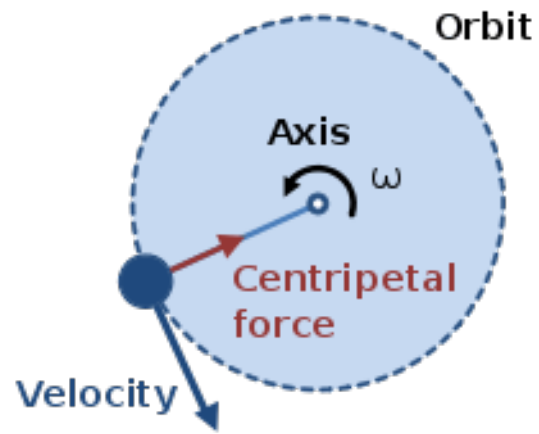
is the most famous as it was presented in the movie 2001: A Space Odyssey, which came out at roughly the same time.

The idea can be simplified into something as simple as a yoyo. If you take the yoyo in one hand and begin to spin it in a circle off to the side you will be able to see the same physics at play. The yoyo is being tossed off to the side tangent to the circle. What is keeping it from being tossed away is the string, which is providing an inward acceleration given by (Tipler and Mosca)

$$a=v^2/r$$

This just provides the magnitude of the acceleration but it is always pointing towards the center of the rotation. This acceleration can be anything though depending on how fast you spin the object or how big of a circle you decided to spin the object in. Fortunately, the book provides a lot of information of the ship itself. While the whole ship doesn't spin the dome in the front does. It was built with a

diameter of 16.7m (54.8 ft) which translates to a radius of 8.35m (27.4 ft). (Clarke, 2001: A Space Odyssey) At the same time, the gravity was kept at moon level because the moon seemed to be a good balance between the Earth's gravity and the lack of gravity that would be presented



in the rest of the ship (Clarke, 2001: A Space Odyssey). The moon has a constant gravitational acceleration of  $a=1.62 \text{ m/s}^2$ . From here we can rewrite the equation above to solve for the velocity at which discovery had to be spinning:

$$v = \sqrt{ar}$$

This means that the speed at which the dome had to of been spinning at is  $v=3.6 \text{ m/s}$  (8 mph). This speed is not very fast at all and should be within the realm that could be realistically done if we ever decide to build a ship of this nature.

## Artificial Intelligence

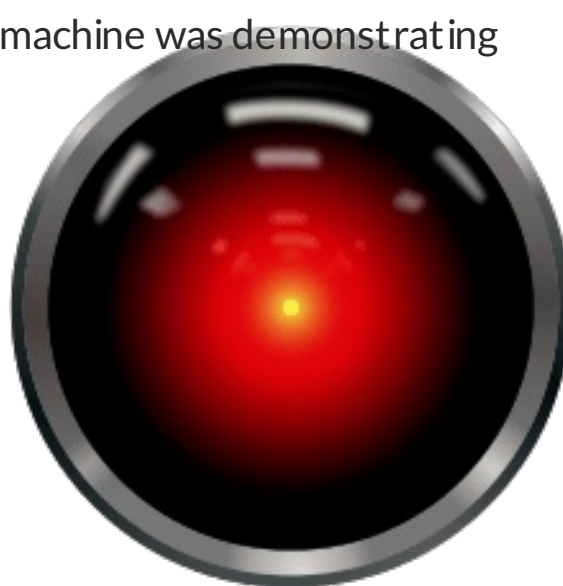
Artificial intelligence is one of the other most recognizable aspects of the story as well. The 2001: A Space Odyssey was famous for its depictions of the Hal 9000. During the trip to Saturn, only two people were left conscious. David worked one shift while Frank took the other. The shifts were 12 hours long so one would be coming on while the other was finishing his shift. Because most of their time was spent alone millions of miles away from civilization there was a concern over them being driven crazy by the isolation. As such Hal was put on not just as an on board computer but also as a second team member (Clarke, 2001: A Space Odyssey). This raises the question, however. Was Hal just a program that could simulate a human persona or was Hal a conscious being in his own right?

This question is not in itself new. In 1950, just 18 years before the book was written, Alan Turing was asking this very question. In his paper Computing Machinery and Intelligence he proposed a test

that could be used to determine if a machine was demonstrating true consciousness or if it was just acting out a program that was able to mimic a living being.

What Turing proposed was to present a computer and a person to a judge. The participants would be shielded behind a curtain to keep the judges from being able to know

which participant was which. The judge would then have a conversation with both the person and the computer. If the judge was unable to tell the difference between the two participants, then it would be said that the computer must hold some sort of consciousness. The computer would be said to pass the [Turing test](#) (Turing).



Surely creating a machine that is capable to passing the Turing test in impossible, right? Or at the very least, it is beyond what modern computer technology can do. This is a comforting thought as it keeps the robotic revolution in the realm of fiction. News came out, however, a few months ago that a computer was able to successfully pass the Turing test. This was a bit of a misnomer.

“I did get a chance to talk to [Goostman](#), before the droves of people wanting to do the same crashed the servers. Despite Oz’s harsh critique (he tends to go a bit overboard), I have to truthfully report that he’s good. Far from perfect, but not bad. Goostman makes all the mistakes the chatbots before him have made: he dodges questions, he changes the subject, he makes vague answers, he repeats things back to you in ways that no normal human does in a cute attempt to show that he’s listening, and of course he says really stupid stuff that doesn’t make any sense. Goostman’s creators explain his quirks away by giving him a fictional back story. See, Eugene is a 13-year-old Ukrainian kid. He has favorite foods and a pet guinea pig, and he feels okay derailing important interrogations to



tell you these things. I would have shot him as a replicant ages ago” (Naro).

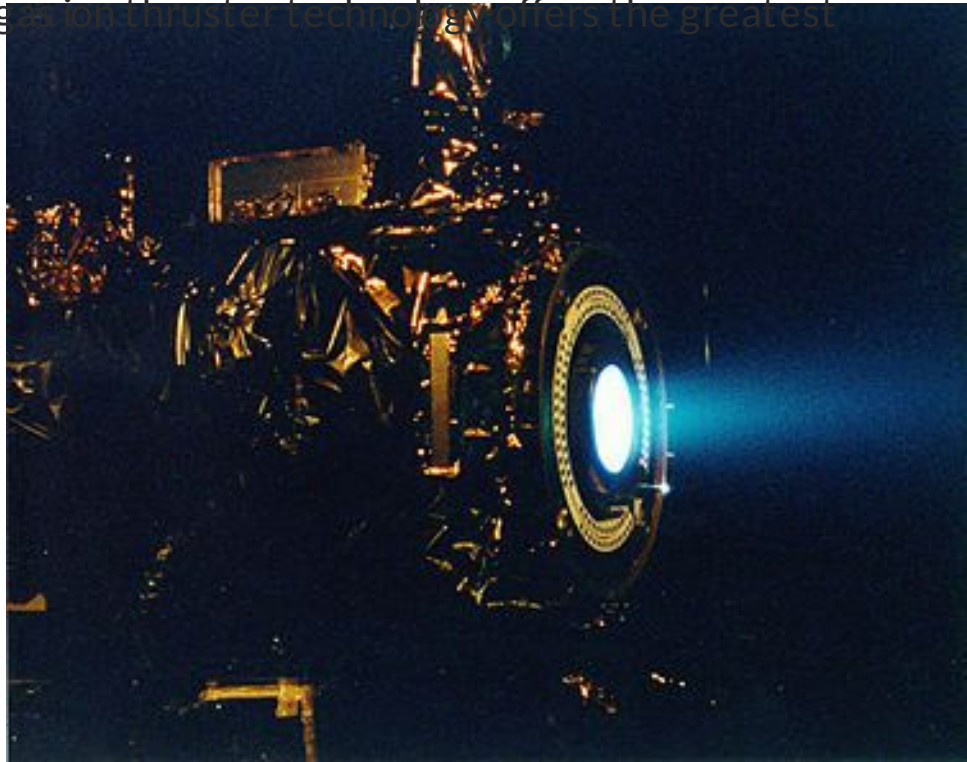
What happened was that, of thirty judges, only ten were convinced that what they were talking to was an actual person and not a simulation. This may not be all that impressive, however Turing predicted this bench mark would happen around the year 2000, so it really wasn't that far off. (Naro) While Hal was a fully functioning AI by the year 2001, this is something we still seem to have issues with. Even if we were able to come up with a computer able to pass the test, the question presented in 2001: A Space Odyssey and again in 2010: Odyssey Two still remains. When Hal was unplugged for the last time he asked a very pointed question, “will I dream Dave?” (Clarke, 2001: A Space Odyssey ) This is not a question a computer would normally ask nor would it really be something that a programmer would introduce during a shutdown process. The idea of dreaming is something unique to conscious beings and was the final hint that Hal was more than just a jumble of one's and zero's. Today's computers are nowhere near that advanced even though we are thirteen years beyond the era the book was trying to portray. This should not be taken as an argument against a true AI however. The idea of a computer passing the Turing test is still quite possible and in a few decades, may be considered commonplace.

## **Ion Drive**

AI's are considered to be among the pinnacles of technology, however, even they would have a hard time transversing interstellar space on anything other than a radio transmission. As such, in 2061 Odyssey Three, a new form of engine was introduced. When we think of most rockets, we picture either the space shuttle or one of the old rockets used in the Apollo program. Both of these systems used chemical fuel even once they made it into orbit around the Earth. A problem with this is that fuel is heavy, which requires more fuel to get it into orbit, which requires more fuel and so on.

[Ion drives](#) propose a solution for navigation once you get up into

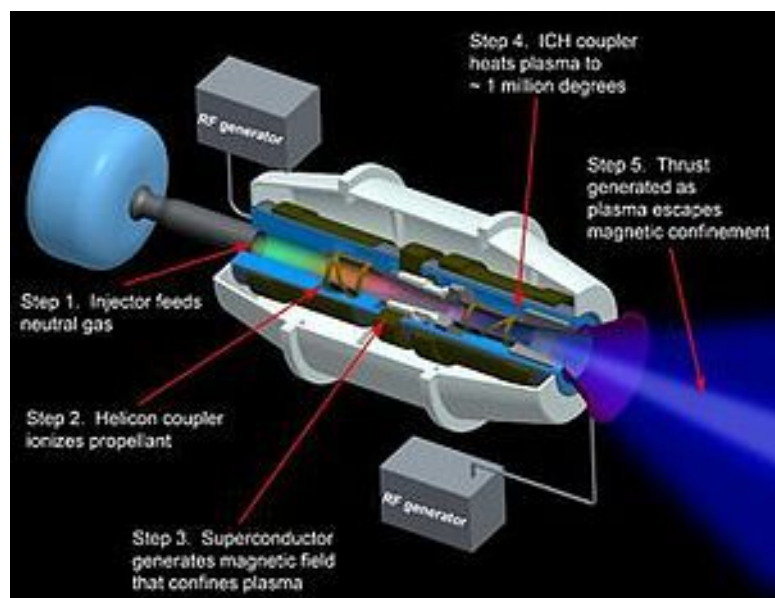
space. “Inert-gas ion thruster technology offers the greatest potential for providing high-specific-impulse, low-thrust, electric propulsion on large, earth-



orbital spacecraft” (Poeschel). They work by propelling a very low density gas out of a thruster electronically. They are able to get the gas to extremely high velocities. The result is that each atom is able to provide a tremendous amount of thrust; however, since it is kept at a low density, the overall thrust is kept low. They also solve the propellant problem of chemical based rockets. Since they use electricity to ionize their propellant they don’t need to drag along quite as much fuel. They don’t have the thrust to escape Earth but are ideal for orbit corrections or bringing a probe up to a high velocity over a long period of time.

These are fine for probes and satellites however not so great for human travel to the outer planets. NASA states that the early ion drives “can be operated on xenon or argon propellant to produce 0.2 N of thrust at a specific impulse of 3000 sec with xenon propellant and at 6000 sec with argon propellant” (Poeschel). However in 1987 Arthur C. Clarke decided he needed to go faster. His ion drive was nothing special in and of itself. No technical specifications were ever given or any real mention of why it was better than all the others. What did make it special was its use of cold fusion. This may be comical by today’s standards since cold fusion is right up there with the philosopher’s stone however, at the time of publication, news of cold fusion was brand new.

Since cold fusion has been found to be impossible since the publication of the book, it is unlikely that any technology will ever be found that can emulate this rocket design in real life. Luck, as it would have it, is on the side of modern innovation. A company called Ad Astra Rocket Company has recently come out with a new rocket propulsion technology called the Variable Specific Impulse Magnetoplasma Rocket ([VASIMR](#)). “In a VASIMR® engine, gas such as argon, xenon, or hydrogen is injected into a tube surrounded by a magnet and a series of two radio wave (RF) couplers. The couplers turn cold gas into superheated plasma and the rocket’s magnetic nozzle converts the plasma thermal motion into a directed jet” (Astra). The engine works in two stages; it becomes ionized by the RF waves and becomes “cold plasma”. Cold plasma is a bit of a misnomer however. The plasma in this stage is still roughly the same temperature as the surface of the sun. This plasma is then sent to the “Ion Cyclotron Heating (ICH) section” (Astra). Here it is heated to roughly the same temperature as the core of the sun. Once the plasma is superheated, it is expelled the way any regular propellant would be.



“The rocket uses a magnetic nozzle to convert the ions orbital motion into useful linear momentum resulting in ion speeds on the order of 180,000 km/hr (112,000 mph)” (Astra).

The VASIMR engine has several advantages over traditional ion style engines. It can more easily vary its thrust, allowing it to be used more a wider range of missions without having to be drastically redesigned. Also, since the plasma is excited with RF waves, no engine parts have to come into direct contact with the hot plasma. As such the engine does not wear out as easily and can last longer.

Another advantage to this technology is that it can easily be scaled up for larger payloads. This may be able to move past putting satellites into orbit and allow for us to more easily capture nearby asteroids or even possibly sending men to Mars as suggested in the book. The limit to all of this is power. While the book relied on cold fusion for its power supply something more will be needed for large scale projects. Solar power will still be useful for near Earth missions however for anything bigger something more akin to a mini nuclear reactor would be desired. (Astra)

## **Conclusion**

Arthur C. Clarke was a revolutionary. Unlike a majority of modern science fiction writers he did not just use science as a convenient plot device or as a useful tool for social commentary. He inspired a future generation to innovate for a better tomorrow. He envisioned a world capable of travel to the outer planets, using sentient computers and artificial gravity inhabited by man as well as aliens. Later, he introduced the idea of life on Europa and how aliens may intervene in their evolution in the same manner they did in ours. Later on, he used advances in propulsion technology to shrink the size of the solar system in much the same way the steam boat and telegraph did to ours. Finally, in 3001, he brings up the idea that as technology increases and we are able to spread out into the cosmos we will finally be able to get beyond our let go our selfish desire for war and live in a utopia. Arthur C. Clark was very much an optimist, but his vision of the future is not entirely impossible.

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## STUDENT CONTRIBUTIONS

# MY SISTER'S KEEPER

JULY 2, 2014 | 3 COMMENTS

Jasmine Denton  
My Sister's Keeper

By: Jodi Picoult

When you think of the expression, “My sister’s keeper” a general thought of an older sibling providing nurturing care to a younger sibling automatically comes into mind. A teenager that soothes their upset pre-teen sibling because the heart throb crush of the opposite sex does not share the same feelings, or the idea of an older sibling teaching the younger one the ways of life and proving encouraging words to influence good behavior in school, basically the general concept behind being a normal sibling. In the case of Anna and Kate Fitzgerald however this concept is out of the ordinary

because Anna was born with the sole purpose of keeping her older sister Kate alive, “her sister’s keeper”. The book *My Sister’s Keeper* is a captivating novel that discusses moral conflict, family values, genetic makeup, designer babies, cancer and cancer treatment. This book by author Jodi Picoult is among the top best sellers because it discusses controversial topics such as stem cell research and designer babies in relation to a medical situation that will grab the reader and leave them searching through scholarly journals for more information on the science behind this book. Jodi Picoult did a great job with interesting the everyday reader while also involving science, medicine, and ethics. *My Sister’s Keeper* was used to raise the question of whether or not it is morally acceptable to create a life and use it to save another life, and also when if ever is it ok to subject someone to medical procedures against their will.

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### **About the author**

Jodi Lynn Picoult was born May 19, 1966 in Long island. She is an American author who has written numerous books featured on the New York Time’s, Best Sellers list. Jodi Picoult was interested in writing at a young age. When she was old enough to read and write she authored her first work known as “The lobster which Misunderstood”.



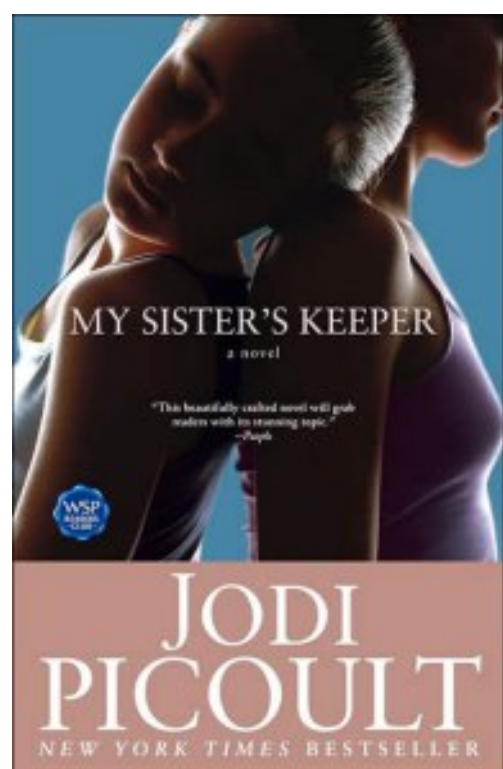
(Journal) Jodi took her love for writing to college. Jodi attended Princeton where she majored in creative writing (picoult). While attending college she published work in *Seventeen Magazine*, and throughout college worked for a few companies as a writer to pay the bills (picoult). After College, Jodi began a career as a writer for Wall Street, a copywriter for an ad agency, and also as a middle school teacher. She then took her education to the next level and attended grad school to get a master’s degree in education at Harvard University (picoult). Jodi

continued to write, and was later married to Tim Van Leer and started a family. A short time after she was married, Jodi published her first novel titled *The Songs of a Humpback Whale* in 1992, followed by several other novels that charted the top of the best sellers list. In later years Jodi Picoult was given several awards such as, The New England Bookseller Award for Fiction, the Book Browse Diamond Award for novel of the year, and even a lifetime achievement award (picoult). She has also been recognized for countless achievements for several other novels she has published. The work Jodi Picoult has done is inspiring to her fan base because it deals with so many interesting topics, and because of her skillful writing style. Jodi Picoult is an author, wife, mother, and a member of numerous charities (picoult). Jodi Picoult's Novel *My Sister's Keeper* had so much success after it was published that it was made into a major motion film. *My Sister's Keeper* the movie was released in 2009 (wikipedia). The film starred Cameron Diaz, Abigail Breslin, and Joan Cusack. When the movie was released there were some major changes in the plot, but it was still a hit in the box office (wikipedia).

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### **The story of My Sister' Keeper**

The Book is structured around the Fitzgerald Family. The members are parents, Sara and Brian. The kids are Jesse, Kate, and Anna. The book starts out with background information about the family and the issues they are all dealing with. Brian and Sara have a son named Jesse who is healthy as a young child. When he is a few years old he gets a new little sister named Kate. Unlike Jesse, Kate is not so lucky when it comes to health. When she is around the age



of two she begins to get sick often, and Kate develops mysterious bruises. The parents take her to the doctor to get some test done. Sara and Brian find out that Kate has developed a serious illness, and is diagnosed with a rare form of cancer. The cancer is Acute Promyelocytic Leukemia, APL for short (organization). APL is a rare form of leukemia, and it affects an estimated 1 in every 250,000 people (genetics home reference, the guide to understanding genetic conditions). APL is a cancer of the blood forming system due to a translocation of cells in the body. APL is diagnosed by blood testing. Symptoms of this cancer include abnormal bruising and bleeding, such as blood in the urine and nose bleeds (genetics home reference, the guide to understanding genetic conditions). The symptoms related to APL are exactly the symptoms Kate experienced in the novel. After Kate was diagnosed with APL the plan of treatment was discussed.

The first plan was to have the family tested to determine if there was a donor match to assist in the treatment of Kate. There were no matches, so chemotherapy radiation, and several other medications were the next plan of action. Over the course of a few years the treatments worked, but due to the rarity of this cancer a repeat in treatment proved to be ineffective. The family seemed to be running out of options, and then a doctor that specializes in genetics gave them a new option. The doctor basically told them that even though none of the current family members were matches for Kate, there could still be a chance that another member can be. The doctor told the family that the increase in genetic studies has provided information on designing babies. The family could consult with a geneticist and embryologist to produce a perfect donor match for their sick daughter Kate. With the help of fertility treatment and specialist the family was able to create Anna. Anna was born and immediately became a donor for her sister. She underwent extensive amounts of procedures to donate blood, bone marrow, and platelets to her sister. It isn't until Anna turns 13 that she no longer wants to be a donor for her sister. Anna decides she does not want to be a donor any more when her parents suggest that she should donate one of her kidneys to her sister. A young girl



giving up a kidney means giving up the possibility of ever having a normal life. Research has shown that a person can live a normal life with one kidney. However things that could potentially harm the remaining kidney must be eliminated, for example drinking alcoholic beverages and major contact sports. There is also a chance that the remaining kidney fails on its own and then that person has to begin Dialysis (John Hopkins What Kidney Donors Need to Know). There are several other complications associated with kidney donation that can lead to a troubled life down the road, and as a result to that Anna decides she will file a lawsuit against her parents for medical emancipation.

A medically emancipated minor, is a person who is found suitable to make their own medical decisions in the court of law. The minor can consult with their parent or other guardian for advice, but the ultimate decision is up to the minor (minor rights vs parent right). Anna hires a lawyer by the name of Campbell Alexander to take on her case. The court appoints a third party person named Julia who is to help the court decide what is medically best for Anna. The case goes to trial, and the truth behind the lawsuit is revealed. Kate asked Anna to stop being a donor for her so she could die. Kate has no desire to go on fighting the battle against her cancer. The court ruled in Anna's favor to emancipate her. After the trial is over, Anna is on her way to see her family at the hospital when she gets into a terrible car accident. The doctors pronounce her brain dead. Sara and Brian make the decision to take the kidney out of Anna and give it to Kate. The surgery is a success, and Kate goes on to live a life cancer free (Picoult, 2004).

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## **The book as a film**

The book was made into a film and there were some major changes. The characters were different; some that were in the book were not in the movie. The major difference would have to be the ending. In the book Anna dies tragically in a car accident. In the movie Kate dies after Anna is granted medical emancipation. The overall plot line was still very similar.



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### **Science and medicine**

Without science, there would be no medicine, and without medicine, there would not be a demand for continued scientific research.

Science and medicine make up the never ending cycle of life improvement. As time progresses new research is done to find a faster more affective cure for everything. This book discusses

genetics, anatomy and physiology, medical research, chemotherapy, and several other topics in science because it is important on getting the point of the book across, but how important are these topics in a real life situation?

**Genetics** is the study of genes. Geneticists study how traits are passed on from person to person. A person's physical traits like eye color, hair color, and height are all things that can be determined with genetic studies. Inheritable diseases can also be found with the study of genetics (genes in life, genetics 101). Genetics was founded by Gregor Mendel in the early 1800's. He performed an experiment with pea plants. The experiment provided information on the rules of heredity (deciphering the genetic code). Mendel used pea plants of different sizes and color and bred them. He found that when he bred certain plants together the plant would have characteristics of one of the plants. This finding gave way to the terms dominant and recessive gene traits (deciphering the genetic code). Genetics are used today to test for diseases like Down syndrome, cancer, Marfan syndrome, and several others. All of these diseases are inherited, and without the study of genetics information of these diseases would not exist (specific genetic disorders). A recent headline about the genetic disease Marfan syndrome was in the news. A young

basketball player entering the 2014 NBA draft was diagnosed with having the gene that indicated Marfan syndrome.

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## Marfan syndrome and how it affects every day people

<http://www.sbnation.com/nba/2014/6/22/5832132/isaiah-austin-marfan-syndrome-nba-draft>

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**Stem cell research** is another science discussed in this book. Stem cell research is a controversial topic because of how the stem cells are collected. Human stem cells have to be isolated from embryos (stem cell research). This means that a person has to donate their embryos to science, and that is an ethical issue for some people because it can be considered as killing a life. This is because tissue from a fetus is collected. The fetus will most likely never be brought to term because it is for scientific study, so that can be considered as murder. Despite the ethical issue of stem cell research it has proved to be beneficial because so many different tests can be performed with them (stem cell research). Stem cells have the ability to regenerate into several different things. A form of stem cells can be isolated from bone marrow and injected into another person to help their blood cells regenerate new blood cells. This is brought up in the book, when Anna was born the doctor took blood from the umbilical cord and used it to inject into Kate to help boost the creation of more blood cells and platelets. Anna also underwent bone marrow aspirations to collect bone marrow to donate to Kate (Picoult, 2004). Bone marrow aspiration and umbilical cord blood are examples of stem cell research because they are stem cells, and they were taken out of one person, and injected into another in hopes of improving a medical condition. After the injection the stem cells were able to repair tissue and regenerate as new tissue (stem cell research). This put Kate into remission. Without research on stem cells, the doctors would have not known to try this as a form of cancer treatment. Stem cell research will benefit in the long run

because it has the potential to help the medical field find out how a person got a certain disease, and then find out how to fix the problem, and cure the patient (stem cell research).

**Designing babies** is also a form of science discussed in this book.

Designing babies with specific genetic traits is a thing now, but is it moral. The scientific term for designing babies is called “The Principle of Procreative beneficence”; it discusses the rights a parent has to select a baby with the best expected outcome. (SAVULESCU, 2009)

This is a complicated process but it can happen. Generally it is not used to pick out a baby that can grow up to be the best looking person in the world, it should be used to select a baby that is maybe predisposed to a genetic disorder, but may have the chance of not having the issue (SAVULESCU, 2009). Go to

[http://onlinelibrary.wiley.com/doi/10.1111/j.1467-](http://onlinelibrary.wiley.com/doi/10.1111/j.1467-8519.2008.00687.x/full)

[8519.2008.00687.x/full](http://onlinelibrary.wiley.com/doi/10.1111/j.1467-8519.2008.00687.x/full) and read the article about designer babies.

Science is all around and it influences a lot of daily activity. The Book my Sister’s keeper is a book that discusses science in relation to medicine, while also throwing a mixture of ethical issues in as well.

Without the science research we have today, we will not be able to find a cure for diseases of tomorrow. Science and medicine go hand in hand, and will continue to do so for years to come.

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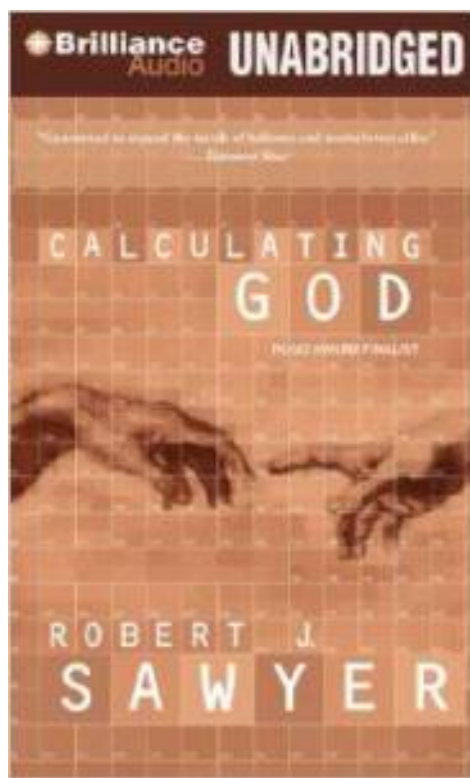


## STUDENT CONTRIBUTIONS

# CALCULATING GOD

JULY 2, 2014 | 1 COMMENT

Who is God? What is God? Is there a God? Is God an entity who not only created the world, but is also an active participant as religions would like us to believe? Can God be determined through the study of science and mathematics, or do the atheist scientists like [Richard Dawkins](#), [Stephen Hawking](#), and [Sigmund Freud](#) have the right answer? These are just a few of the questions brought up in Robert



J Sawyer's 2000 book [Calculating God](#). A book described by the Toronto Star Newspaper as a "highly philosophical, theological and ethical story," ([R. J. Sawyer, Interview with Robert Sawyer 2010](#)). *Calculating God* explores these questions and provides scientific reasons to support the theory of intelligent design.

*Calculating God* is rightly classified as a science fiction because the story revolves around an alien landing near a museum and wanting to study earth's paleontological history. It could also be classified as a work of science-based philosophical fiction, as many of the discussions between the [Royal Ontario Museum's](#) (ROM) Thomas Jericho and the alien Hollus are a debate about the existence of a God.

Is God a creator who designed the universe or does the universe just exist? The life-long atheist Jericho can't believe that a fellow scientist, albeit an alien one, believes in the notion of



*The Royal Ontario Museum*

intelligent design, and is again stunned to discover the second alien species brought by Hollus's people are also believers. This stunned feeling is reciprocated by the aliens because of Jericho's lack of belief, (R. J. Sawyer 2000, 34)

Sawyer uses the back and fourth between the humans and the aliens to argue the theories of Darwin, the big bang, DNA, the



anthropic principal, and many of the fundamental scientific constants to provoke the reader into thinking about the design of the universe. For example this exchange on page 61:

‘How do you know,’ I said to him, ‘that the universe had a creator?, Hollus’s eyestalks curved to look at me. ‘The universe was clearly designed; if it had a design, it must therefore have a designer.’ (R. J. Sawyer 2000, 61)

And Sawyer himself said of the book in a 2010 interview with [Philosophy Now Magazine](#) “if the designer did exist though, he was a scientist, pure and simple,” (R. J. Sawyer, Interview with Robert Sawyer 2010). It is with this quote in mind, the reader gets to think about the science of the world with a different view than is often given in other scientific approaches to explaining the history of the world.

## Biography of Robert J. Sawyer

Robert J. Sawyer is a Canadian science fiction writer of 21 published novels and other short stories. He is an award winning writer, and according to his biography on [his website](#) is also “the only writer in history to win the top science fiction awards in the United States, China, Japan, France, and Spain,” (R. J. Sawyer, Short Bio n.d.).



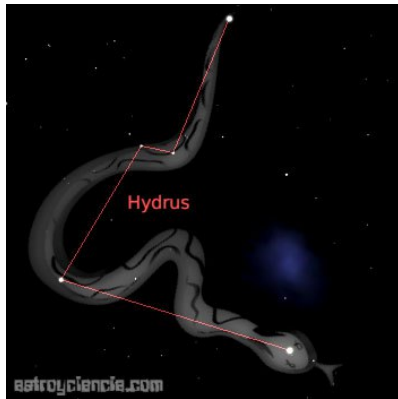
Robert J Sawyer

## Calculating God Summary

*Calculating God* is the story of an alien named Hollus who arrives one day at the ROM in Toronto asking to work with a paleontologist about the earth’s five mass

extinctions and their effects on the Earth's evolution. Hollus's landing changes the life and work of the book's protagonist Thomas Jericho, a ROM paleontologist who just discovered that he is dying of lung cancer.

Jericho is surprised by the alien's mastery of the English language, as Hollus tells Jericho she is from "the third planet of the star you call Beta Hydri," (R. J. Sawyer 2000, 25). [Beta Hydri](#)

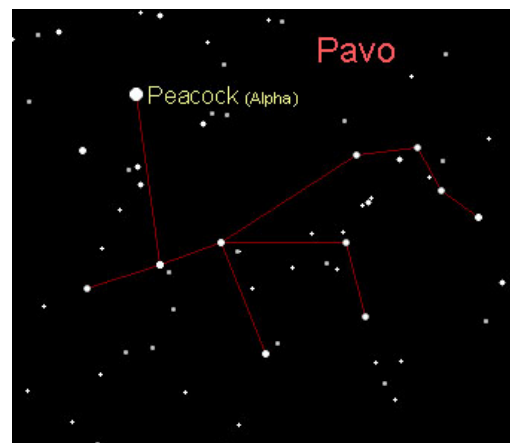


*The Hydrus Constellation*

is a star approximately 24.3 light years away from earth and the brightest star in the Hydrus constellation, (Wikipedia Beta Hydri n.d.). This galaxy is the ninth star system she and those traveling with her have visited, and the third with intelligent life on it. She tells the staff at the ROM she has arrived with 33 other scientists, half of whom are Forhilmors (Hollus's race) and the

other half are Wreeds, another intelligent alien species from the second planet of star [Delta Pavonis](#).

Delta Pavonis is located in the constellation Pavo, and is roughly 20 light years away from earth, (Wikipedia Delta Pavonis n.d.).



*The Pavo Constellation*

Upon her arrival to the museum, Hollus asks to be treated as a normal visiting scholar and have access to the museum's fossils and specimens in exchange for data about the aliens and their knowledge of the universe. The unexpected arrival of an alien triggers the museum, government and media to come together to learn more about the Hollus and her intentions. After the initial shock and media spectacle dies down, the two begin discussing the extinctions and working together. The interest in the

five mass extinctions is due to the fact that five similar extinctions occurred at roughly the same time on both the Beta Hydri and Delta Pavonis planets. For Hollus, the study of the fossils and the earth's history as well as their study of the Wreeds helps her and her people to better understand the history of their planet and the universe, (R. J. Sawyer 2000, 28-33).



*A drawing of Hollus and Thomas Jericho*

Hollus is described as looking similar to a large spider with six legs and two arms. "His torso was no bigger around than the circle I could make with my arms...[it] was covered by a long strip of blue cloth. But his hide was visible on the six legs and two arms. It looked a bit like bubble wrap, although the individual domes were of varying sizes," (R. J. Sawyer 2000, 23). Jericho determines that Hollus is endothermic, similar to mammals on earth; he also mistakenly identifies the

alien as a male and is not until much later in the book Jericho finds out that Hollus is a female.

During their work together at the museum the two learn that despite the differences in appearance and planets, they are both made up of similar DNA structures. It is also explained by Hollus that all three planets have roughly the same technological advances, give or take a few decades, and the same basic life needs. To both the Forhilmors and the Wreeds, this is one of the indications of intelligent design, (R. J. Sawyer 2000, 85).



Although much of the book is a dialog between Hollus and Jericho about science and God, there are other subplots supporting the main themes. Jericho's struggle with his terminal illness, and how it impacts both his family life and work. He is challenged to think about how God, if being real, could give him (and others) suffering and pain. Does God take an active part, a puppet master perhaps, in the ways of the world? The answer from the Forhilmors and the Wreeds is that God is merely the creator; not the God of religion and there to listen and answer prayers. However, they argue that God did play a role in the mass extinctions and paved the way for intelligent life to come about on all three planets.



*An example of a space ship traveling at the speed of light*

Near the end of the book, the Earth and the alien's planets face a possible sixth extinction; the universe is threatened by a star going supernova.

Something intervenes, and destruction is averted. After what the aliens and Jericho believe was the earth's salvation by God, Jericho accepts an offer from Hollus to travel with them to the creator's known location. Instead of spending his last days on earth suffering, he is cryogenically frozen for space-travel by the aliens and they embark upon a journey to find God. The last chapter of the book is the aliens and Jericho meeting and communicating, though in an unlikely way, with God.

### **Intelligent Design and *Calculating God***

There is a great deal of science discussed in *Calculating God*. Sawyer uses the five fundamental forces: gravitation, electromagnetism, the strong and weak nuclear forces, and (according to Sawyer) the yet undiscovered repulsive fifth force to disavow the random nature of life and to promote the idea of a creator, (R. J. Sawyer 2000, 72). Though Jericho remains skeptical, Hollus argues, "there is no

indisputable proof for the big bang and there is none for evolution. And yet you accept those. Why hold the question of whether there is a creator to a higher standard,” (R. J. Sawyer 2000, 101).

Hollus explains on pages 62-64 that if gravity was just different by just a few orders of magnitude on each side that the earth would have either never been created or collapsed under the extra gravitational weight.



*Gravity acting on a star*

Another example is that of the balance between gravitational and electromagnetism for the creation and balance of stars. According to Hollus, there aren't many ways to do this mathematically and if their gravitational strength was different by one in 1040 that no yellow suns could exist in the universe (R. J. Sawyer 2000, 62). He continues with the example that if the nuclear forces

which hold the atoms nuclei together was just slightly smaller, the protons would not allow for atoms to exist. If larger, only the hydrogen element would be formed.

This argument is similar to what is now known as the [weak anthropic principal](#) (WAP), which was introduced in Poland at the 500-year celebration of Copernicus' birthday (Physics SFSU n.d.). The principal was presented by [Brandon Carter](#),

the Australian theoretical physicist, and it's underlying theory was that "humanity did indeed hold a special place in the Universe," (Physics SFSU n.d.). It follows the works of the early [Greek philosophers Aristotle and Plato](#), who argued for the case of a designer or creator because of the complexities of man. These early men when they made the illustration for intelligent design, did not do so with the notion of the Juedo-Christian God, a feeling that

both the Wreeds and the Forhilnors agree with.

The weak anthropic principal also follows along with [William Paley](#) and his analogy of the eye and the telescope which was summed up as, “the eye is like a telescope; telescopes have telescope makers; therefore eyes must have eye makers,” ([Ruse 2006](#)). As it is now defined, the WAP states:



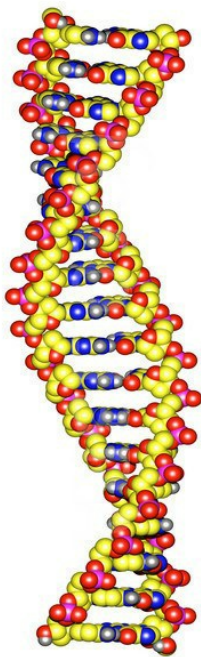
*Brandon Carter*

The observed values of all physical and cosmological quantities are not equally probable but they take on the values restricted by the requirement that there exist sites where carbon-based life can evolve and by the requirement that the universe be old enough for it to have already done so. ([Physics SFSU n.d.](#))

Another scientific argument for the idea of a creator is based on water. Hollus in the book talks about the importance of water because unlike most compounds; water does not contract when it cools and again does not expand when it is heated, but the opposite. If it acted differently, ice could not float because it would be denser as a solid. If ice can't float then the oceans would freeze solid, and as Hollus explains, no life would be able to live in the ocean and the underwater currents would not give way to spring thawing, (R. J. Sawyer 2000, 68). These properties are explained in greater detail by the [University of Idaho's Ground Water Hydrology](#) website, which agrees with the logic in Calculating God about the opposite thermal property of water, “the importance of this property cannot be overemphasized for its role on the ecosystem of earth,” (University of Idaho n.d.).



Through *Hollus*, Sawyer also uses evolution and DNA to make the case for intelligent design. The scientists in the book take samples of both *Hollus* and the *Wreeds* blood for a DNA test, and they are surprised to find how similar they are to human DNA. Upon learning this, Jericho tells *Hollus* that the geneticist “was expecting something more – well alien,” (R. J. Sawyer 2000, 97). But if the same designer created all of the life forms, not just those of earth, *Hollus* explained it made sense to have similar genetic code.



*A drawing of DNA*

When looking into DNA, there are only four letters A, C, G, and T that make up the sequences of nucleotides.

According to the [Internet Encyclopedia of Philosophy](#)'s Design Arguments for the Existence of God, there are four possibilities “for origin of biological information. (1) chance; (2) a pre-biotic form of natural selection; (3) chemical necessity; and (4) intelligent design,” (Himma n.d.). The author, Kenneth Himma argues that intelligent design is most likely because it “is logically possible to obtain

functioning sequences of amino acids through purely random



processes, some researchers have estimated the probability of doing so under the most favorable of assumptions at approximately 1 in 1065.” While Jericho is thinking about DNA in relation to cancer and his conversations with Hollus, the reader is given arguments on the precision of the DNA code and the arguments for this being a creator, (R. J. Sawyer 2000, 167-170).

Throughout the many scientific arguments in the book, the reader as well as Thomas Jericho can argue that this is just one large coincidence, yet Hollus counters with, “It’s either coincidence piled on top of coincidence or it is a deliberate design,” (R. J. Sawyer 2000, 67).

## Conclusion

While the bulk of the science in this book are based around the questions of God and intelligent design, not all of the science is about that. *Calculating God* is full of classic science fiction ideas, including aliens, space travel, cryogenic freezing, and fusion powered space ships.

For many readers, the assumption that we are not alone in the universe is not a large step from their imaginations, but an alien showing up in Toronto has not yet happened in the history of science or the earth. Also the technology used to power the Forhilynor’s ship is clearly Sawyer’s inventiveness at work.



*An artist's drawing of Hollus*

However, it is the compelling arguments about intelligent design that provoke the reader to contemplate how science and God can move together. [Sawyer himself](#) has stated about the book that, “the science is carefully researched, and as we travel through the

plot we explore issues in evolutionary biology, cosmology, quantum physics, astronomy, and biochemistry” (R. J. Sawyer, *On Writing Calculating God* 2000). His research is clear with the in-depth arguments made by Hollus about the nature of the universe and life as we know it.

The arguments made by Hollus for God do not give the reader the impression that the God of this book is the God of religion; but however, the God of the beginning of the universe. “Look, I’m not a mystic. I believe in God because it makes scientific sense for me to do so; indeed, I suspect God exists in this universe because of science,” (R. J. Sawyer 2000, 98).

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*Adam and the Creator*

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## UNCATEGORIZED

# HOT, CROWDED EARTH: HARRY HARRISON'S 1966 NOVEL "MAKE ROOM! MAKE ROOM!"

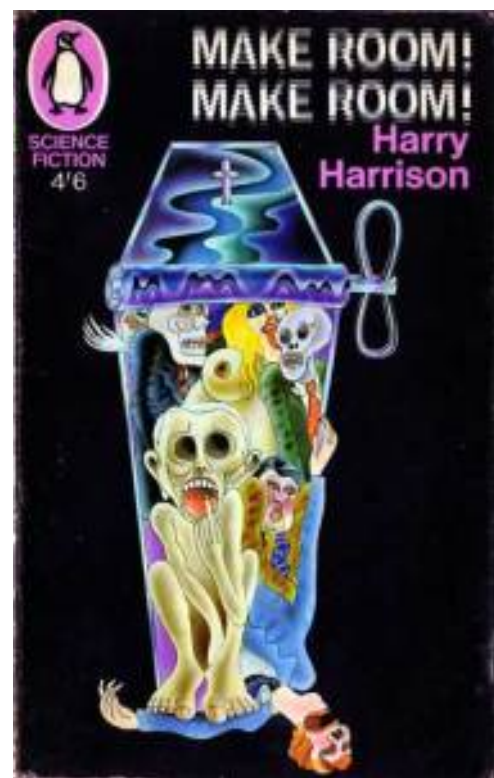
JULY 2, 2014 | 3 COMMENTS

## **Introduction:**

I chose to read Harry Harrison's 1966 novel *Make Room! Make Room!* because I find its dystopian view of population growth and the impact of human activities on the world rather interesting, and indeed somewhat depressing. I think the book is relevant to this

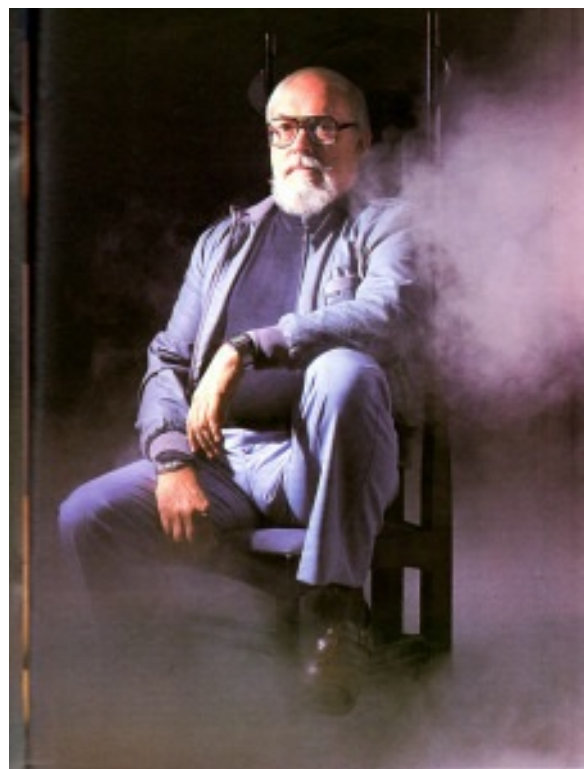
class because we've been talking about Malthusianism and about global warming and environmental harm, and this book shows one possible outcome if we aren't careful about how we live our lives on this planet. It also details the society born from a dense, resource-deprived population, which isn't really an example of Social Darwinism, but perhaps a look into psychology, which we've only briefly touched on.

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### **About the Author:**

Harry Harrison was born on March 12th, 1925, in the town of Stamford, Connecticut. He eventually made his way to New York City, specifically Queens, where he grew up.(1) After getting out of high school, he was drafted into the military where he “worked on secret military computers, as an armourer and gunnery instructor, and finally – promoted to sergeant – became a Military Policeman”.(2) His service left him with a hatred for the military and war.



In one interview, Harrison said he was inspired to write the book from reading a number of scientific journals, and doing a bit of research on his own about population growth and resources.(3) In another, he says this: “The idea came from an Indian I met after the war, in 1946. He told me,

‘Overpopulation is the big problem coming up in the world’ (nobody had ever heard of it in those days) and he said ‘Want to make a lot of money, Harry? You have to import rubber contraceptives to India.’”(4) The setting of the book is in 1999 because it was still fairly close to the time in which he wrote the book, enough so that it was believable. One of the characters in the book, Soloman Kahn, had a birthdate and military life similar to Harrison’s, but the character was not meant to be a reflection of him.

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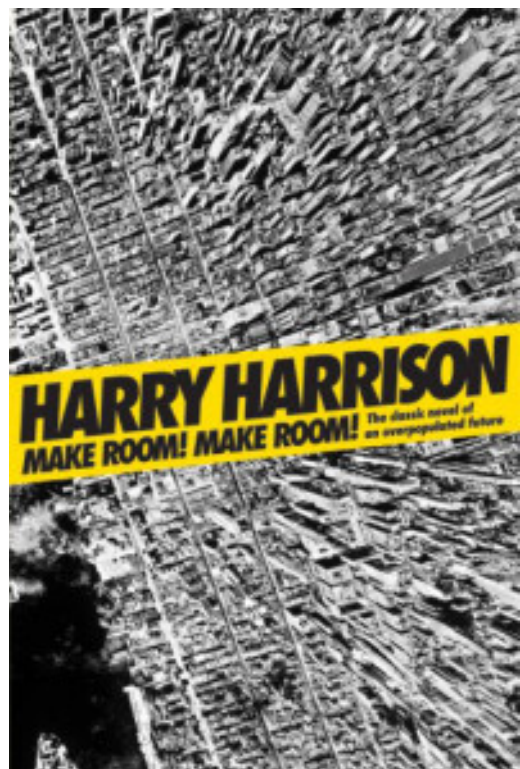
### **Book Summary:**

The book takes place in a dystopian future in New York City, year 1999. In this future, the world population has skyrocketed, resources are scarce, and the world is heavily polluted and hot, with little water to go around.

The story starts off from the viewpoint of a police investigator, Andy Rusch. It chronicles his day beating back the crowd in the streets, and breaking up a stampede on a store that had a sale on “soylent steaks”, which are rare and highly sought after among the poor. Once that is broken up we get to the point-of-view of a kid named Billy Chung, who managed to make off with a box of soylent steaks in the confusion. After he finds a place

to hide and eats his share of them, he decides to sell the rest so that he can pay his way into a job delivering telegrams.

It is during Billy’s first delivery that we meet another couple of important characters in the story, Michael O’Brien, and his girlfriend, Shirl Greene. These two live among the rich in a closed-off community, and it is when Billy goes in and notices much of the



security is disabled that he gets the idea to rob the place.

The robbery goes wrong when Mr. O'Brien walks in on Billy searching through a jewelry box, and attacks. Billy fights back by striking O'Brien across the head with the tire iron he used to break in, and the blow ends up killing O'Brien. It is O'Brien's death that sets the stage for the rest of the book.

Andy gets stuck with the task of investigating O'Brien's death, and during the investigation, he develops a relationship with O'Brien's "girlfriend" (really, something similar to a concubine, the prettier women were bought and sold like furniture), Shirl Greene. Since Greene has no place to go and has a contract permitting her to continue living in O'Brien's suite until the contract ends, the two end up living together in opulence for a month.

After the month is up, Shirl moves in with Andy and his roommate, Soloman Kahn, much to Shirl's dismay since she had gotten used to a life of luxury. Andy remains obsessed with solving the murder case and hunting down Billy Chung, while his roommate Soloman becomes involved in protests against the overturning of a bill to implement population control by limiting birth rates. Soloman eventually grows sick from the stress and dies, and after he does, an entire family moves in to replace him, which gets on both Shirl and Andy's nerves, and Shirl leaves and goes back into her life as a concubine. Andy eventually hunts Billy down and accidentally kills him, causing him to get demoted, and the book ends with the US population hitting a record high 344 million citizens at the century's end.(5)

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### **Comparison with Movie:**

*Make Room! Make Room!* was adapted into the movie *Soylent Green*, which came out in 1973. The movie parallels the book pretty closely, just with different names for the characters, the murder victim being changed from a malicious businessman in the book to a kind soul in the movie, and a twist ending in the movie. Whereas the book has a

rather unexciting ending, the movie leads on to the investigator doing some research about the victim's past associations, finds he was associated with the company that makes Soylent products, and goes to investigate the company. He finds out a rather gruesome fact: Human corpses are used to make their Soylent Green product, and the movie just ends with him screaming "Soylent Green is people!" while being carried off.



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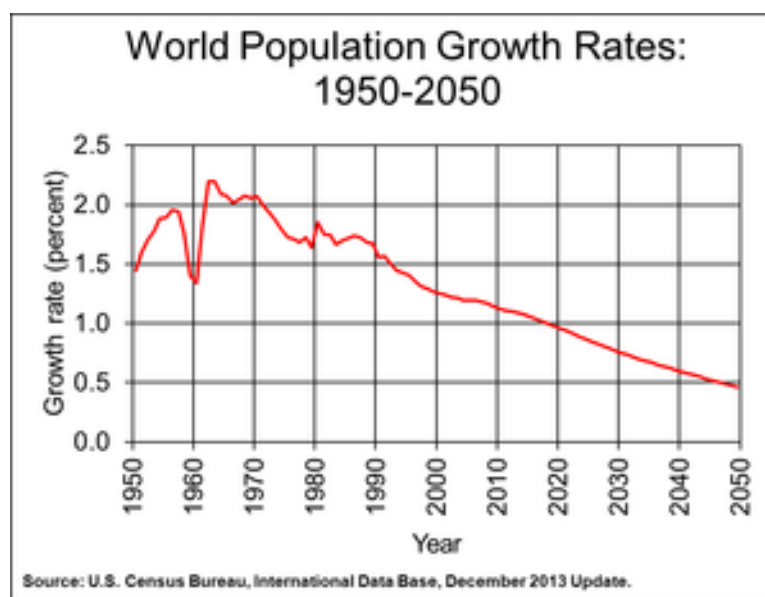
### Science behind the book and why it's relevant:

While it is obvious at this point that the future chronicled in the book hasn't come to pass and probably won't for quite some time if it ever does happen, there are some things documented in the book that either are currently happening, or have some basis in scientific research and Malthusianism stating how those things could happen.



I'll first talk about something we aren't really seeing, and that is this idea that the population explodes to the point of their not being enough room and nowhere near enough resources for everyone. We have discussed a few times in class the concept of Malthusianism, a concept first proposed by Reverend Thomas Robert Malthus, which basically states that population growth is exponential, whereas the availability of resources is arithmetical, meaning that at some point population growth exceeds the availability of resources and the population begins to die off until it reaches sustainable levels again.

While it is certainly true that the population is growing at an exponential rate, that rate has steadily been decreasing in recent years, as we can clearly see in our handy graph from the [US Census Bureau](#):



The book also mentions the idea of trying to limit population growth through government policy, which I think is again linked back to Malthusianism, in that it is assumed that reducing the population will restore the balance of resources to population size so there are enough to go around. It just so happens this is exactly what China has been doing in the real world for quite some time with its one-child policy, since China too struggles to get enough resources to feed its population. Since this policy has been enforced since around 1980, we can already see some of its effects: Because of chinese



cultural preference for males, there is now a higher percentage of males in china than in the rest of the world; the ratio of males to females was at 1.17 as of 2001, compared to a ratio of 1.03 to 1.07 for the rest of the industrialized world. A particularly concerning consequence however, is that the average age of chinese citizens is going up since they aren't having enough children to replace themselves, and this ever-increasing group of older citizens needs the smaller group of younger citizens to support it, which places a huge burden on the young.(6) China still has problems with food supply and, particularly, water supply despite the policy.(7)



I'd also like to discuss the psychological effect living in a huge population can have, although I don't think it really pertains to anything we've discussed in class, except perhaps to a very small extent, Social Darwinism. In the book, we see the population riddled with crime, with a low value on human life, and with heavy segregation of the rich from the poor (they literally walled themselves in). A long time ago, I found an interesting video describing a study done by Dr. John B. Calhoun on a population of mice. They were placed in a "utopian" environment, where they had no natural predators, and unlimited access to food and water, and were just allowed to grow in population size boundlessly.

In the beginning, everything goes as expected in the experiment: the mice define their territorial boundaries and begin to reproduce

at an exponential rate. However, after a while, the crowded mice began to fight constantly, and population began to level off, and different classes of mice began to develop. There were certain mice who always got into fights, who had chewed-up tails and tended not to live very long. There were mice that were always picked on. Then there were “the beautiful ones”, which were physically perfect, but had withdrawn from society and spent their time eating and grooming rather than breeding and interacting with other mice. Eventually, the society becomes completely dysfunctional, and the population plummets until eventually dies off completely.

Calhoun suggests that this is an example of what will eventually happen to human society if we keep on breeding without bound, in fact, we could already be in the middle of it, with our declining population growth.(8)000



The book doesn't explicitly single out the topic of global warming, but it is sort of implied that it has happened in the book's fictional world. In the book, we see extremely high temperatures, even in August, which would seem to suggest some sort of global warming has taken place. This is one of the things from the book that we can actually see happening in real life, albeit not (yet) to the extent described in the book. Before the book was written, even, we already had the dust bowl, where we outstripped our land's resources and suffered from it.



We learned in class that the possibility of global warming due to our CO<sub>2</sub> emissions has been known about since 1896 when Svante Arrhenius first realized it, and it is likely that Harrison was familiar with the idea as well, especially considering that the President Lyndon Johnson had spoken about the issue the year before the

book was first published. Also, by the late 80's at least, we knew that climate change is taking place, and by now we have quite a bit of data on it, so 1999 was a pretty reasonable date for the book's setting in that regard.(9)

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### **Conclusion:**

I think that, although the book was way off on its description of world population and climate from the actuality of the world in 1999, it still hits close to home on a couple of points. It accurately assessed that the world would heat up, the violence and mob mentality in the book is reflected to some extent in experiments on animal populations, and the measure of population control has already been implemented in China at least, even though the world's population is on the decline and it really doesn't seem to be necessary at this point. I think, if we were to go along the road to limitless population growth and limitless consumption, the story could very well become a reality.

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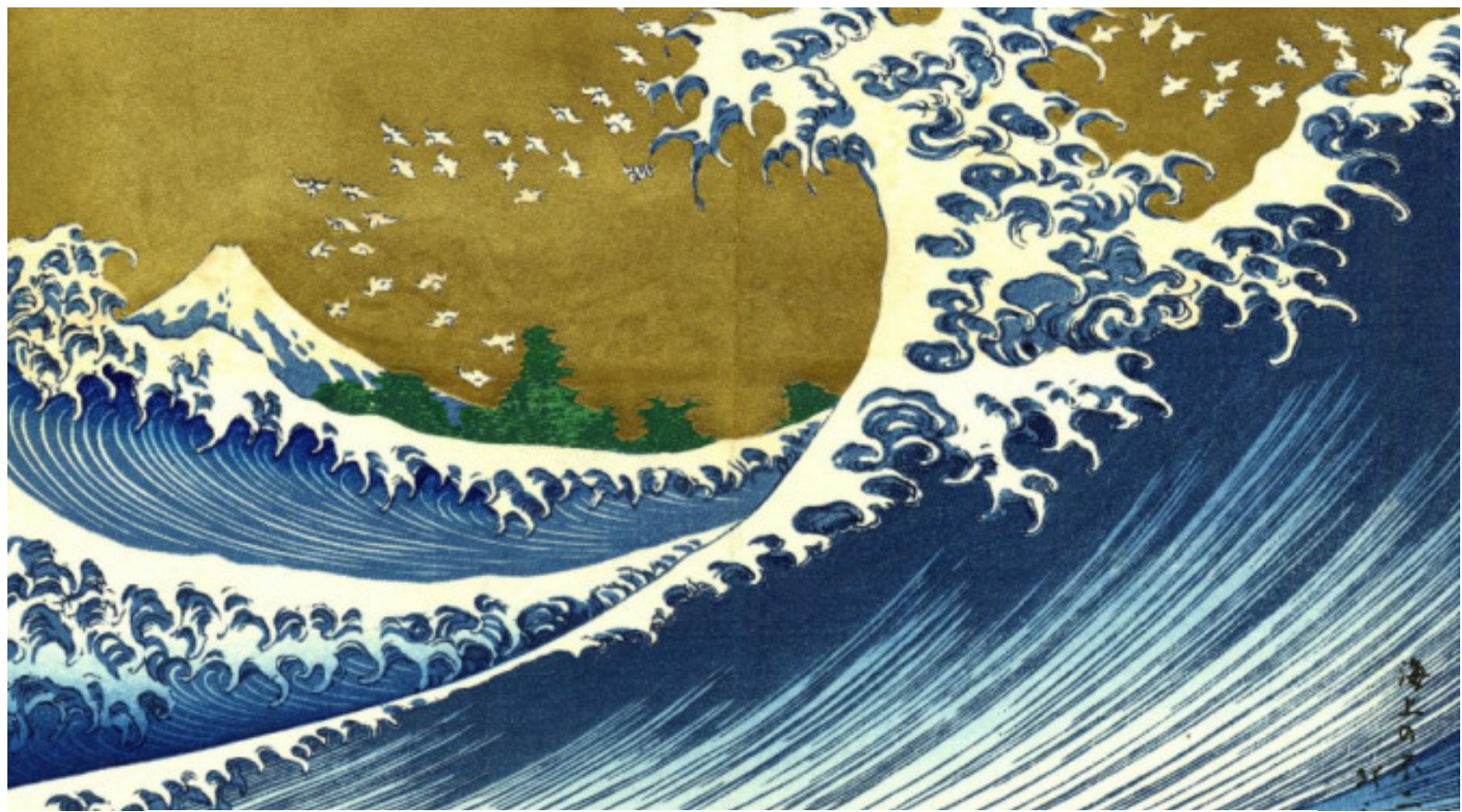
## STUDENT CONTRIBUTIONS

# OAK RIDGE TENNESSEE

JULY 2, 2014 | LEAVE A COMMENT

[Oak Ridge Tennessee](#) Here is a link to a gallery of historic photographs taken at Oak Ridge during the time of the second world war. I thought it was relevant to our class because Oak Ridge was a major contributor to the Manhattan Project. It is interesting to see in many of the pictures how seriously secrecy was taken. There are also good pictures of things we have covered in class such as a calutron.





## STUDENT CONTRIBUTIONS

# NIHON CHINBOTSU / JAPAN SINKS

JULY 2, 2014 | 1 COMMENT

*“I have but one more question for you. For a scientist, what is the most precious thing?” “Intuition,” answered Tadokoro without hesitation. “Mmm?” The old man cupped his hand to his ear. “What is it?” “I said intuition sir,” said Tadokoro. “You may think it’s strange, but for a scientist – especially for a natural scientist – far and away the most precious gift he can possess is that of keen intuition. Without it, he’ll never make a notable break-through.” (Komatsu 51)*

## Introduction

The intuition is the accident that is happening in the Japanese archipelago. Geophysicist, Dr. Yusuke Tadokoro sets to embark on research. Tadokoro and his team of researchers come to discover a



strange flow and crack running through the ocean floor. Tadokoro was convinced with his hypothesis and continues to collect data. They came to a conclusion of one. That was within two years, in the worst case, most of the [Japanese archipelago](#) will sink beneath the surface of the sea.

*Mr. Komatsu's premise in "Japan Sinks" was that the tectonic plates that grind beneath the Japanese archipelago undergo a sudden colossal shift, setting off a chain reaction of volcanoes that spew torrents of lava, tsunamis that inundate cities, earthquakes that shatter the countryside and the deaths of millions of people. (New York Times, 2011)*



"Nihon Chinbotsu"

[Japan Sinks](#) was written in 1973 by Sakyo Komatsu and then later translated by Michael Gallanger in 1976 and published in the United States.

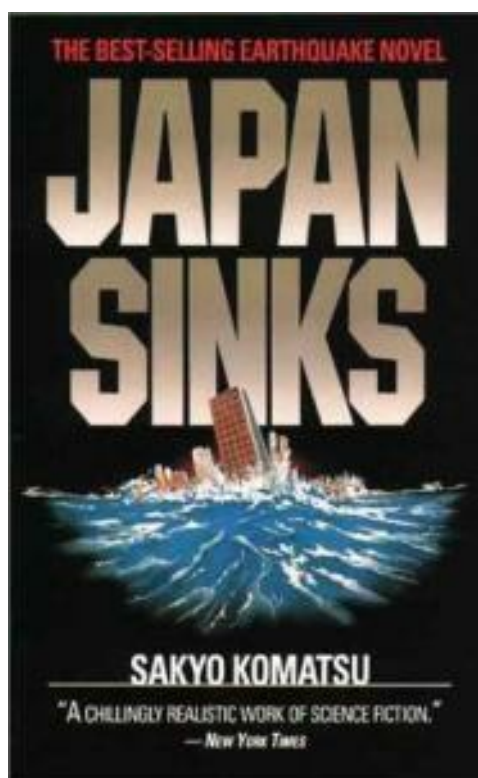
## Biography

[Sakyo Komatsu](#) was born in [Osaka](#) in 1931, and attended [Kyoto University](#) where he studied Italian literature. After college, he was involved in writing for magazines and doing work for stand-up comedy acts. He began his true writing career in the 1960's and his most popular works outside of Japan are *Japan Sinks* and [Sayonara Jupiter](#). Both of which have been turned into various forms of comics and movies. In 2011 on July 26th, Komatsu passed away at the age of 80 years old from pneumonia in Osaka.



????, Sakyō Komatsu

## Book Summary



*Japan Sinks* starts off with the account of a small island sinking overnight. There was a fishing boat anchored at this island in the northeast part of the Ogasawara chain for the night, the fishermen woke the next morning to find themselves in the middle of an empty sea.

While still not totally sure what to think of the recent findings, massive earthquake and volcanic eruptions soon become more frequent throughout Japan. After this is

reported, the Japanese Weather Service sends a vessel to investigate. Onodera, the engineer who pilots the deep-sea submarine, and Dr. Tadokoro set out to scan the sea floor near the sunken island. They find that the island had indeed sunk overnight.

Upon help from the Japanese government, further research, and with the disaster situation worsening, Tadokoro warns that the Japanese archipelago may sink to the ocean floor. This information is kept as top-secret as further research and planning goes on to avoid

public chaos. As events become even more intense nationwide, a plan to evacuate all of the Japanese people to other countries begins.



A plan known as “plan D” is formed, top scientists and government officials are assigned to this plan to continue research. Their findings revealed that due to a change of mantle convection around the Japan Trench, the Japanese archipelago will sink into the sea in

about two years at the earliest. As time passed, further research revealed that there was only less than one year left before all was



lost.

Talks continued to go on between nations such as Australia, China, Russia, Africa, and the United States to

accept Japanese citizens as refugees. Suspicion throughout the international community began to rise, Japanese bonds were being sold out, which started to leave Japan feeling helpless and abandoned.

Japan eventually becomes submerged in the sea while still being torn from East to West. The some 70 million Japanese that were fortunate to evacuate, had become a “wandering people” scattered all over the world. The Japanese citizens had



great trust in their government and complied with evacuation procedures even though they were not completely aware of the situation. Throughout all of this, more earthquakes and volcanic eruptions continued violently, killing millions.

## **Plate Tectonics**

### **Vibration and Movement**

There are plates of varying sizes that make up the Earth's surface. The six pieces of the large-scale plates; their names are derived from the name of the continent, such as "North American plate", "Africa plate", and "Antarctic plate".



Some plates may be small in size when compared to others, but in terms of shaping the earth they are very important in the same way. Juan de Fuca plate is also a minimal

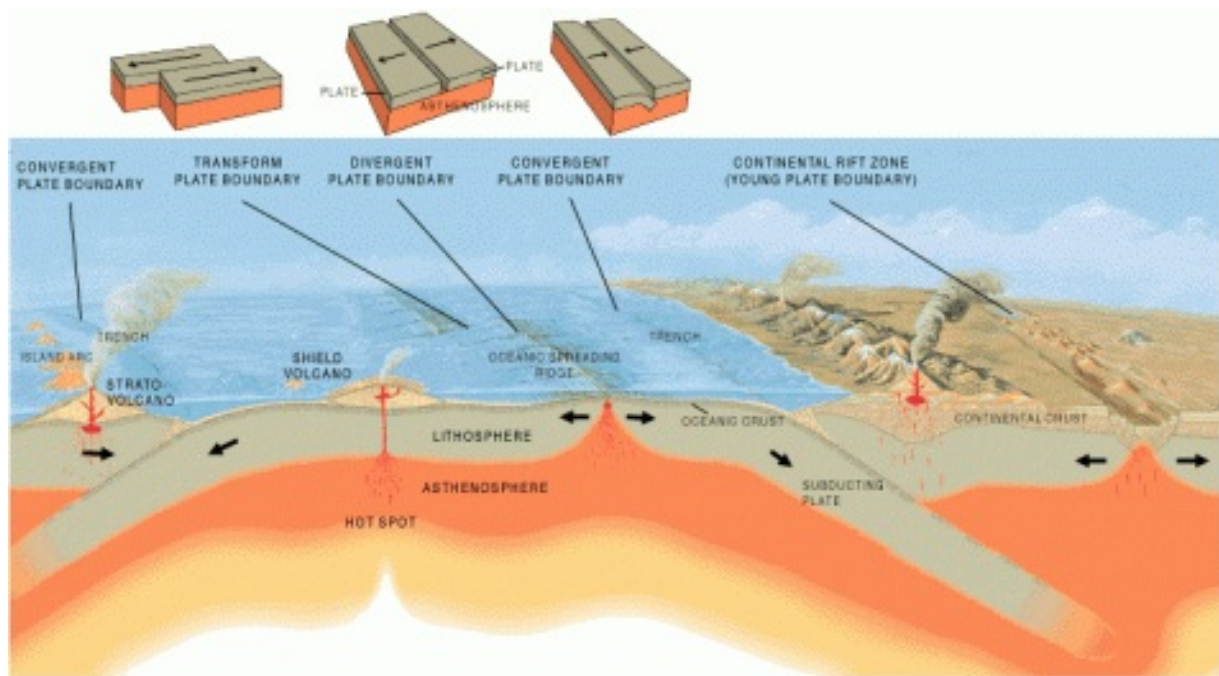


Map of Plate Boundaries, click [HERE FOR INTERACTIVE MAP](#)

one, but the impact of volcanoes that dot the Pacific Ocean America Northwest Coast are numerous.

A plate constitutes the outer shell of the earth called the lithosphere. The lithosphere, is the top of the mantle and crust, and the like. Convection lava in the lower layer and turbulence, will force the plate to move like a conveyor belt. Most of the geological activity is due to the interaction of these plates or separate collisions of broken plates.

Boundaries of geological structures can be divided into three types by the motion of the plate. It is three types of transformations that will cause a strike-slip plate while interacting and diverging, When this happens the plates are gradually divided.

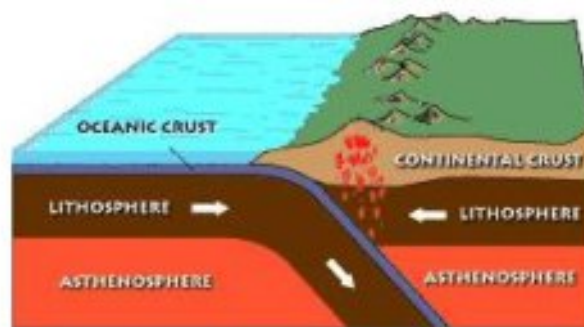


Artist's cross-section illustrating the main types of plate boundaries

## Convergent boundary

This is where the plate is a landmass between the collision. This boundary is formed by the mountain ranges of the myriad of wrinkles that could be in the crust. Asia and India collided together about 55 million years ago, it was pushed slowly and formed the Himalayan mountain system which is the highest on Earth. Such squashing continues, forcing mountains to rise even higher accordingly. Everest, may become higher tomorrow than it is today.

Convergent boundary occurs at the place when it dives beneath the continental plate in a process that involves the oceanic plate, known as



Convergent Boundary

subduction. Thereby, the upper plate is lifted, and mountains are formed there as well. In addition, there are also occasions when the plate of concern slips and melts, and it ends up becoming a spewing

volcanic eruption. For example, some of the Andes mountains in South America were so formed.

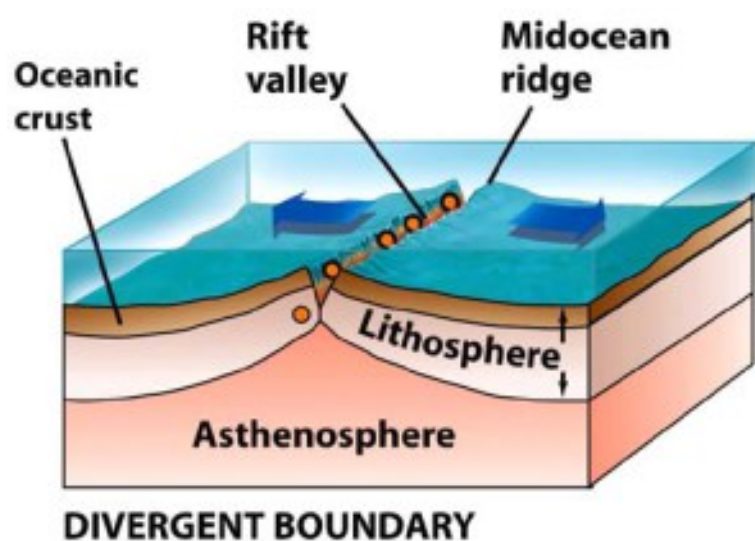
The convergence between the oceanic plate, the plate of one dives beneath the other plate, deep trenches such as the Mariana Trench which is the deepest North Pacific Ocean is formed on the planet most of the time. The collision of this type may have enacted underwater volcanoes that are thought to have made up the island arc like Japan.

- Learn about the tectonic similarities between Japan and the Pacific Northwest U.S. in this [interactive animation](#).

## Divergent boundary

In the divergent boundary of the ocean, magma has risen to the surface from deep in the Earth's mantle. Mountains and volcanoes occur along this seam. The shape of the seabed changes by this process, a huge basin to expand. This mid-ocean ridge system of one connects the world's oceans, the ridge is known to be the world's longest mountain range.

Where the plate is pulled in opposite directions of each other on the ground, a huge rift Great Rift Valley (such as the Great Rift Valley of Africa) is formed. The plate continues its



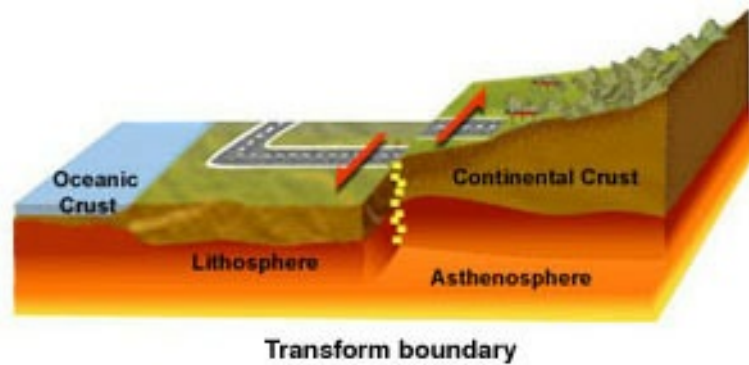
*Divergent Boundary*

separation as it is, this shows how that East Africa is separated from the continent several million years later and a new land mass was formed. The boundary between the plates at that time were a mid-ocean ridge.

## Transform type boundary

The San Andreas Fault in California, is a typical example of a transform boundary type. You are rubbing two plates along a strike-slip fault. This spectacular terrain such as mountains and oceans are not born at the boundary like this, but it is caused by a major earthquake triggered by irregular movement in most cases.

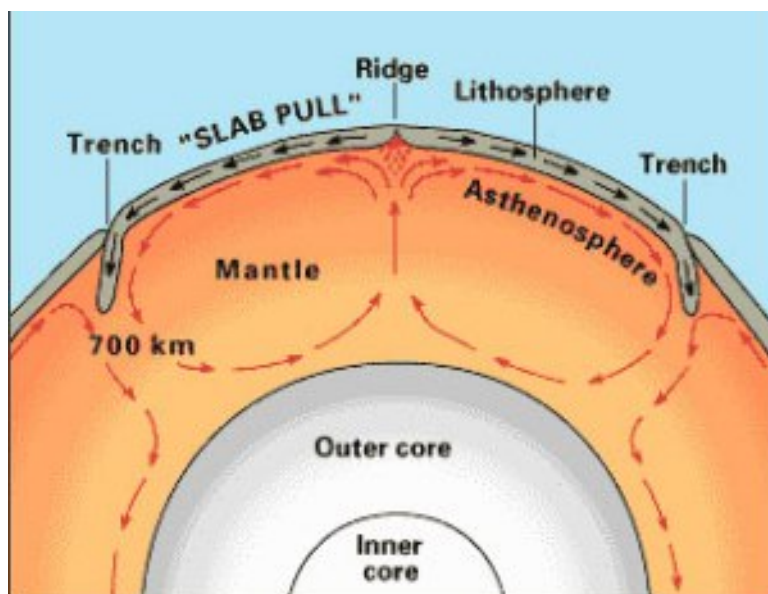
The earthquake of 1906 that devastated San Francisco is one example.



*Transform Boundary*

## Mantle convection

Mantle, is made up of solid stone; hard in the sense day-to-day. However, (hereinafter referred to as the rheology field to study the mysterious nature of such materials) it behaves like a fluid like when viewed over a long period of time.



*Mantle Convection*

It is believed to release the extraterrestrial heat of the earth's interior and the cooling heat of the core. With the heat generation in the mantle, convection starts at a slow rate. Originally

mantle convection

is what receives the continental drift theory of Wegener and Holmes of the United Kingdom and has been proposed as a driving force for continental drift. At present, it is not considered to be caused by mantle convection and it is compatible and just plain plate motion. However, it is important to rule that the convection is present in the mantle, and with the various geological phenomena occurring within the mantle, including the Earth's surface, there is no doubt that it is a process that exists. Research has been actively conducting experiments and numerical simulations to prove this. One way to demonstrate the progress of the study the earth's internal structure would be to consider an earthquake wave (mantle tomography), the convective motion is what is happening and is what has been brought to light in recent years.

- [This Dynamic Earth: the Story of Plate Tectonics, by the USGS](#)

## [How Shifting Plates Caused the Earthquake and Tsunami in Japan](#)



## Deep Sea Submarines

In a [deep-sea submarine](#), there is a spherical pressure hull. High-strength steel has been used previously for the hull, but titanium has mainly been used since the 1980's. Power is supplied from batteries, which in recent years are lithium batteries.

These vessels are usually equipped with different forms of cameras, robotic arms, according to the purpose of its use. It is possible to send images and sounds to the mother ship with ultrasound, but there is a limit to



*Wadatsumi*

the transmission capacity band. Compared to past compression techniques, they may have improved to some extent in recent years, but still the problem is not completely solved. In recent years, the motor is a mainstream AC induction motor. With discharge characteristics that are excellent even at low temperatures, for long life cycles that contribute to cost reduction. Gasoline was used previously as buoyancy material, but this hardened with epoxy resin micro balloons silica is used presently. Mercury was used in the past for adjusting the inclination of the hull, but the model which moves the center of gravity by moving the ball tungsten connected as beads instead of mercury as Turtle and Sea Cliff in recent years some. The ball of tungsten enters on one side of the ball made of buoyant material is continuous with half a ball of tungsten, to compensate for the volume that you moved in that the buoyancy, material enters the tank on the opposite side by the same

number. Manned submersible boats were built various countries until the 1970's.



*Alvin*

The performance of remote-controlled unmanned spacecraft technology has vastly improved since the 1980's, resulting in the number of manned submersible boats used to be reduced.

Operating expenses, including the support of the mother ship, such as remote control unmanned spacecraft is to be less than 1/10 as compared to the manned submersible with a diving capacity of deeper capability. Further, it has become possible to fly drones in the sky with the advancement of

technology, that was previously impossible without being manned. In addition, the operation to control the unmanned submersibles compared to manned submersibles has helped in the investigation of the Titanic at the ocean floor. Self-ROV, which do not require the manipulation of a cable in recent years have been developed, and it has become possible to continuously navigate over long distances.

## Relevance to the Novel

This convection and moving and colliding of the plates is the basis of how Japan is sunk under the sea in the book. When the plates collide, it basically pulls and forces the other down with it. This causes the plate, with violent changes happening rapidly, along with the whole Japanese Archipelago that is a part of it to become submerged. The use of deep-sea submarines manned by researchers, was a very useful tool to investigate the depths first hand.

[Japan is Sinking! Or is it?](#)

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UNCATEGORIZED

# SAVED BY THE SLAUGHTERHOUSE: KURT VONNEGUT JR.'S SLAUGHTERHOUSE-FIVE

JULY 2, 2014 | LEAVE A COMMENT

## Introduction

The development and use of weapons of mass destruction brought an end to the long, brutal war of World War II; however, it also started the race towards nuclear armament and the fate of humanity. This very thing is what Kurt Vonnegut Jr. predicted would happen in his 1969 novel, *Slaughterhouse-Five*. In this book, [Vonnegut explores](#) the concept of Einsteinian space-time and its perceptions during that era, the use of science to amplify the destruction of humanity in warfare, and the harsh effects of war on the human mind.

## Biography

### Kurt Vonnegut

Jr. was born in 1922 in Indianapolis, Indiana. William Rodney Allen of the Kurt Vonnegut Memorial Library notes that Kurt Jr. was the youngest of three children born to Edith and Kurt Sr. Vonnegut.



*Kurt Vonnegut Jr. claimed that smoking was a "fairly honorable form of suicide."*

His father was a well-to-do architect and his mother was from a wealthy family, however, his family fell into ruins once they were hit by the Great Depression (Allen). This event turned Kurt Jr.'s life upside-down, as he witnessed the despair of his parents in response to this tragedy. His father's abandonment of hope and his mother's choice to abuse substances and commit suicide established the cynicism that Kurt Jr. then carried for the rest of his life (Buckley).

Although an admittedly lousy student that dropped out of several colleges, Kurt Vonnegut Jr. studied chemistry and worked for many school and local newspapers during his teenage years, where he picked up a few of his writing techniques (Allen). At the age of twenty, Kurt was shipped off to fight in World War II for the army. Soon after his arrival in Europe, Vonnegut was captured by Nazi soldiers in the Battle of the Bulge as a prisoner of war. Vonnegut was later sent to Dresden, Germany as a POW, where he stayed in a slaughterhouse (Allen). On February 13, 1945, American and British airplanes dropped tons upon tons of bombs and incendiaries across the city, leveling Dresden and killing countless civilians. During this atrocity, Vonnegut and his fellow POWs took refuge in the underground slaughterhouses' meat locker, surviving only to

emerge to a murderous scene that changed their lives forever.

Soon after the Dresden firebombing, the Soviets came to the city and Vonnegut was liberated. After the war, Vonnegut took an advertising job with General Electric and married Jane Cox, with whom he had three children (Allen). Vonnegut began writing stories again and eventually published his first novel, *Player Piano*, in 1952. In 1957, Vonnegut's beloved sister died of cancer, only a couple of days after her husband drowned in a horrible train accident (Allen).

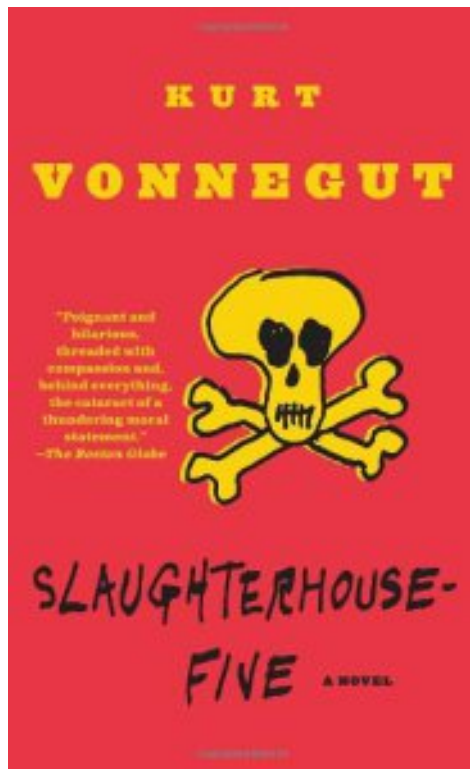
Vonnegut then adopted three of their children and decided to focus on writing novels so that he could support his family. Within the next twelve years, he went on to publish *The Sirens of Titan*, *Mother Night*, *Cat's Cradle*, *God Bless You, Mr. Rosewater*, and then *Slaughterhouse-Five* (Allen). In these books, Vonnegut established his style of writing, in which he describes grotesque events in a sort of satirical fashion.

Vonnegut's life never really seemed to stray too far from gloominess. Once his children grew up and left the house, Vonnegut's marriage came to an end and he moved to New York City (Allen). Kurt published two more books in the mid-1970s, but they were unsuccessful and he then fell into a writer's block (Allen). At the end of the decade, however, his writer's block had left as he entered into another marriage. He continued to write prolifically about the hopelessness he had for humanity and he later taught as an English professor at universities (Allen). In his latter years, Kurt Vonnegut Jr. was a powerful spokesman against the use of nuclear weapons and on protecting the biosphere. In 2007, Vonnegut died from falling down the stairs of his own home (Allen).

## Summary

Kurt Vonnegut Jr. published his antiwar novel *Slaughterhouse-Five* in 1969. The story is based on the author's own accounts in World War II, as he, then a POW, survived the firebombing of Dresden by the Allied Forces. The novel begins in first person, as the author discusses his involvement in the Dresden firebombing and his

difficulties of recounting his experiences into a book for many years. Vonnegut then tells of how he met with an old wartime friend as they returned to Dresden for their first time in 1967. Vonnegut tells some of the things about his postwar life and his earlier attempts at creating an antiwar novel from his experiences. On his way to Dresden,



*Slaughterhouse-Five*

Vonnegut stays the night at a hotel in Boston. There, here reads about the story of Lot's Wife and the destruction of Sodom and Gomorrah from the bible and loses his perception of time.

After the first chapter, the third person narration by the author dominates, as he tells the story of Billy Pilgrim. The narrator tells us, "Billy Pilgrim has become unstuck in time," and then shifts randomly through [time with Billy Pilgrim](#), as he has no control of which moments in

his life he is transported to. Billy is described as a weakling from Ilium, New York, where he learned to practice optometry before being shipped off to war. Time continues to shift and the story tells about Billy's postwar breakdown and recovery, marriage and family, a plane crash he'd survived, and the death of his wife. After recovering from his plane crash, Billy returns to New York City, where he talks about being abducted by aliens on a radio show. Billy continues to write to newspapers to tell of his abduction and the lessons he learned from the aliens of T ralfamadore until his daughter comes to care for him. He tells of his experiences in World War II and in Luxembourg, where he has his first time-shift while leaning against a tree. He sees himself pre-birth and after death, and then shifts to being thrown in a pool by his father to learn to swim. He continues time shifting to various family moments and minor events, and then back to behind enemy

lines where a fellow soldier, Robert Weary, is shaking him awake. The other soldiers had deserted him, but Weary stayed behind to save him and blame him for their abandonment. Time then shifts to Billy giving a speech in 1957 as president of the Ilium Lions Club, then shifts again to his and Robert Weary's capture by German soldiers. Billy continues to fall asleep and time-shift at inappropriate times, and we learn that he has trouble staying awake throughout the day but has sleeping problems at night.

In the story, Billy becomes a POW just like the author, and they survived the firebombing of Dresden together, as the author makes himself a character in the story. In a postwar moment in 1967, Billy is a prosperous optometrist with his son serving as a Green Beret in the Vietnam War and his daughter planning to become married soon. That night, the story shifts again to Billy as a POW, where the Germans are forcing the prisoners onto boxcars. Billy becomes separated from Weary and he is stuck in his crowded boxcar for two days before it even starts to move. Once the train finally begins to move, Billy appears at the night of his abduction to Talfamadore. It is the night of his daughter's wedding day and Billy cannot sleep because, having already traveled through time, he knows he is soon to be abducted. He later sits down to watch a World War II documentary and watches the movie both forward and backward, noticing how opposite the stories are when reversing the chronology of events.

Walking outside to meet the arriving saucer, Billy asks the aliens *why* it is him they are abducting. The Talfamadoreans claim this question to be characteristic of humans, telling Billy there is no *why*. There just *is*. The Talfamadoreans are described as looking like toilet plungers,

and saucer then jolts away from Earth and Billy is sent back in time to the boxcar. After nine days of being on a boxcar, people are dying all around. On another boxcar, Weary is telling everyone of Billy Pilgrim and how he is the man responsible for his fate. Just before Weary dies, a vicious Paul Lazzaro swears vengeance on Billy for Robert



Weary's death. Ironically, the trains arrive at the prison camp the following night and the prisoners are led to a mass shower. While showering, Billy shifts to a number of other times, including to when he was on the saucer. The T ralfamadorians explain to Billy their understanding of the universe and predeterminism. They tell of their perception of time as the fourth dimension and that each moment is pre-structured so no free will can possibly exist. The T ralfamadorians also explain to Billy how time is not a linear progression, rather a collection of moments that occur an innumerable amount of times.



*T ralfamadorian*

On T ralfamadore, Billy is put into a zoo, where he is displayed as an exhibit. Billy then shifts to times in his childhood and then back to his prison camp. The Americans are housed with a group of British prisoners and they watch a performance of *Cinderella* later that night. During the performance, however, Billy bursts into hysterics and is taken to the camp's hospital where he is sedated. When Billy awakes, he has traveled to 1948, where he is in a mental ward in New York for his postwar psychiatric problems. In the bed next to him, Billy meets an ex-captain that introduces him to the novels of Kilgore Trout. Billy falls in love with Trout's science fiction and can't seem to talk about anything else when his fiancée comes to visit him. The story then goes back to Billy in the zoo, where the T ralfamadorians are telling him that there are actually seven different sexes of humans required for reproduction, but Billy is not able to perceive the other five because they only exist in the fourth dimension. Billy is also told how the universe will end by a T ralfamadorian accidentally exploding it, explaining that that is how it has happened every time. Later, Billy is introduced to another

human, Montana Wildhack, who was brought to T ralfamadore to mate with Billy. The two begin sleeping together and then the story shifts to 1968. Billy meets a boy whose father was just killed while fighting in Vietnam. In an effort to comfort the boy, Billy tells him of what he learned about time in his visit to T ralfamadore, and appears insane to everyone around him.

At the POW camp, Lazzaro is beaten up after trying to steal from an Englishman. Lazzaro claims he will make sure that the man is murdered after the war and tells Billy the revenge is the sweetest thing in the world. He reminds Billy of how he'd made a promise to kill him, but Billy does not worry because he has apparently seen his murder numerous times. He then goes on to recount his death. He is giving a speech about the concept of time in 1976 and China has just dropped a hydrogen bomb on Chicago. He explains that the US has been divided into twenty-two different nations so that it cannot threaten the world. He says that immediately after giving his speech, Lazzaro walks up and shoots him with a laser gun. The prisoners are later shipped to Dresden to be housed in a slaughterhouse. Upon his arrival, Billy is astonished with the architecture and beauty of the untouched Dresden. He later tells of the malnourishment of the prisoners, but seems oblivious to the harsh conditions.

The plane crash that Billy survives is told in greater detail, and we learn that Billy's father-in-law is in the plane with several other optometrists. Billy is the only person that survives the crash and his

wife rushes to go see him in the hospital. On her way, his wife gets into a car accident and later dies from carbon monoxide poisoning after reaching the hospital. When Billy awakens in the hospital, he finds himself next to another patient that is writing about the successes of the Dresden firebombing. When Billy tells the man that he was there during the bombing, he is ignored, as the man knows Billy will only speak of it as a horror. Billy then transports back to Dresden, where the Germans have begun to flea because of the



*Every death in the novel is followed by the phrase: "So it goes."*

imminent invasion by the Russians. Outside of the slaughterhouse, Billy has his first brush with reality as he breaks down upon the sight of suffering horses. He then appears in New York City, where he goes into a bookstore and happens to find

books by Kilgore Trout that are strikingly similar to his own alien abduction experiences. He also sees a pornographic magazine with Montana Wildhack on its cover. In New York, Billy sneaks onto a talk show and tries to talk about time and his abduction story but gets kicked out. Billy then shifts back to T ralfamadore, where he sees Montana nursing his and her child.

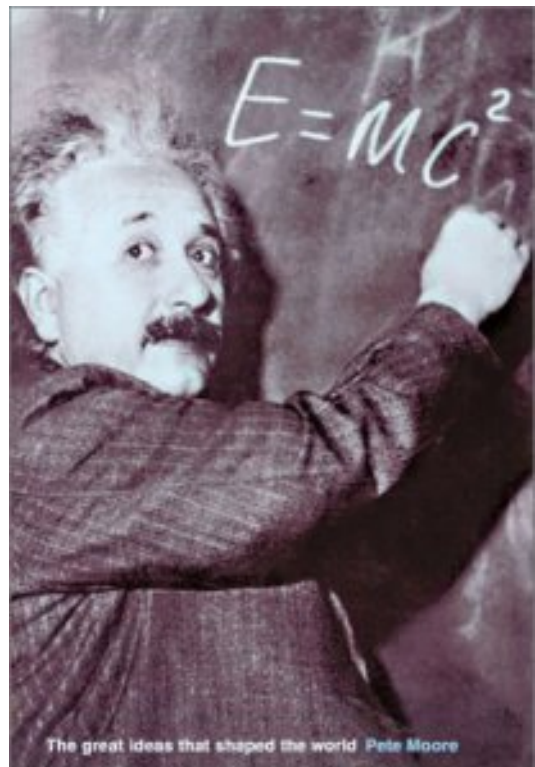
In the last chapter of the novel, the narration shifts between first and third person. The T ralfamadoreans are interested in asking Billy about Darwin, but not about Jesus Christ. The story shifts to just before the ending of the war with the POWs, including Vonnegut and Billy, forced to gather and burn the thousands of dead bodies that were left strewn across the city after the bombing. Before long, the Germans leave the city in fear of Russian invasion and the POW are finally liberated. The scene in Dresden is described as silent other than the song of a bird, as nothing is appropriate to say in such a horrific time (Vonnegut).

Here is a comical video that I found represents the book surprisingly well. **WARNING:** It is a goofy video with several cursing bleeps.

## Sciences

One of the principles of science that is clearly brought into question in this novel is the concept of time.

Kurt Vonnegut's college career in the 1940's was a time when Einstein's theory of relativity and new ideas in physics were very popular. As a result, it is likely that these ideas were fresh in the author's mind during his times of horror in war and led to the development of his ideas of time. The author facilitates the concept of time into this story as a mechanism in coping with the grief of war and death. He uses the Tralfamadorians explanation of time in order to accept all of the death that surrounds him, as they claim that all moments are predetermined.



Kurt Vonnegut posits the deterministic view that all moments in

time are pre-structured and follow a strange loop, in which each moment is just as permanent as any other and can be revisited an infinite amount of times. He questions the principles of the Christian religion and suggests that no free will exists, and therefore neither could a superior being. This is exactly the reason [his book has struggled with banning](#). In *Slaughterhouse-Five*, Vonnegut also uses his concept of time to pursue personal happiness. The author dances along the edges of immortality as he claims that even after death, which you may experience multiple times, you can revisit the joyful times in your life. This is a very important aspect depicted by Vonnegut, as he is applying his twist to Einstein's theory of relativity and rejecting Newton's assumption of absolute time. Viewing time as something other than a linear progression was not an easy task for most people, as it is still difficult for most to do so today. By manipulating time to be holistic as he did, however, Vonnegut gave the public a new consciousness of time and allowed them to see it from a different perspective, although not necessarily the correct one.

The firebombing of Dresden on February 13, 1945 "killed 135,000 people, mainly civilians – twice the number killed at Hiroshima – in a period of several hours" (Farber). Through *Slaughterhouse-Five*, Vonnegut was able to communicate to the public that the atomic bombs were not the only things that brought mass destruction upon the world; rather mass destruction was caused by war as a whole. Vonnegut expresses his view of war as meaningless destruction by ending his book at the bomb scene, where no conversation or sound could be heard other than the senseless chirping of a bird (Vonnegut). Through Vonnegut's use of China dropping a hydrogen bomb on Chicago, he also displays his concern that the development of such powerful weapons will only promote nuclear war and the fate of humanity. The author clearly portrays science as morally evil, as he depicts scientists of the time as dedicating their efforts towards hurting society rather than advancing it.



Here is a video documenting the Dresden bombing. WARNING: It contains graphic content.

One of the reasons that drove Vonnegut towards criticizing scientists was through the use of their money. In an [interview found in the 1972 Chicago Tribune](#), Vonnegut explains his view that there should be a reduction in the expenditure towards technology, especially in weaponry. Vonnegut goes on to discuss how so much wealth was being poured into weapon development at the time and how the effort was also burning through the nation's fuel resources (Wolf). Not only was Vonnegut [concerned with the billions of dollars spent](#) in creating weapons that would destroy mankind, but also spoke openly against the mission to the moon on a broadcast with Walter Cronkite, claiming that this thirty-three billion dollars was being wasted when it should be put towards the poor and the improvement of society (Buckley). As his book became increasingly popular throughout the Vietnam War, Vonnegut was able to effectively impact the public opinion on the use nuclear weapons and greatly increased the anti-war effort.

As Stephen Farber explains in his [1972 New York Times article](#), "the



*Aftermath of Dresden firebombing.*

fleeing civilians back into the inferno, while most of those who thought they were safe in underground shelters were baked alive or suffocated by poisonous fumes”

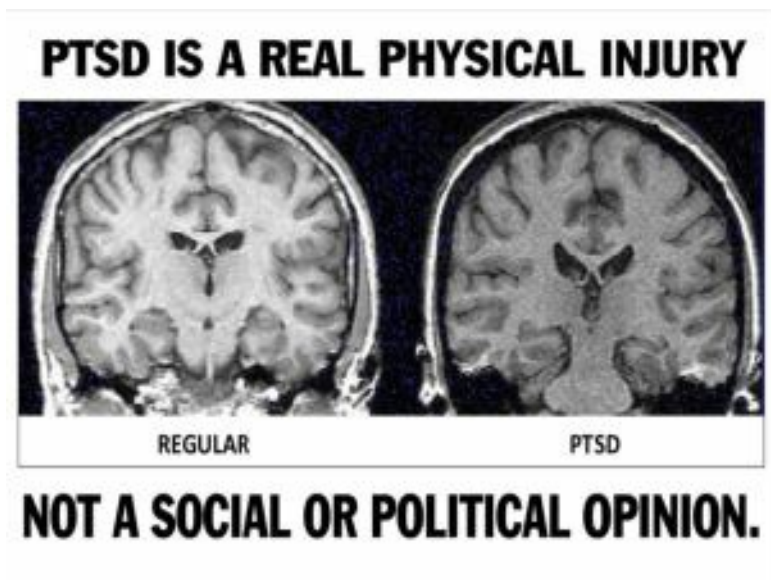
(Farber). This article criticizes *Slaughterhouse-Five*, claiming that it failed to tell the true monstrosity that actually occurred during the bombing. Vonnegut’s brief descriptions of the scene through his use of fragments in time, however, bring the social effects of the horrors of war to light.

After their miraculous survival of the [firebombing in Dresden](#), Vonnegut and his fellow POWs were forced to excavate the countless bodies of the dead civilians and burn them, a sight that haunted them forever (Allen). Rather than actually describing all of the horrors of the bombing, *Slaughterhouse-Five* focuses on the effects of warfare on human psychology and mental wellbeing. When initially reading this novel and the tale of Billy Pilgrim, the reader likely thinks that the book has turned into a fantasy that they are expected to believe to be true to the story. Not after long, however, one learns that this character must be completely out of his mind, just as the others believe him to be (Vonnegut). Through this depiction of the postwar effects on the mind of Billy Pilgrim, Vonnegut made his anti-war effort in the novel very apparent.

In an [interview with Andrew Pomerantz](#), veteran and chief of mental health at Vermont’s VA, Pomerantz claims *Slaughterhouse-Five* to be the best book to ever be written about PTSD. Pomerantz says that he reread the book after war before going home to prepare himself for interaction with the general public (Pomerantz). The story of Billy

Pilgrim clearly demonstrated that many soldiers returning from the horrors of WWII experienced post-traumatic stress disorder (PTSD), although this disorder had not yet been discovered at the time. As Steve Bentley points out in [“A Short History of PTSD...”](#),

this type of breakdown during World War II was referred to as names such as “combat neurosis” and “battle fatigue,” and also claims that out of the estimated 800,000 American soldiers who actually saw direct combat, over thirty-seven percent (not accounting for those that died) had such serious psychiatric trauma that they were permanently discharged (Bentley). The atrocities that these veterans witnessed followed them everywhere, and the lack of public appreciation for their efforts only heightened the issue. This disturbance amongst veterans did not go unnoticed by others however, and medium such as *Slaughterhouse-Five* effectively spread awareness of the psychiatric problems experienced by soldiers and encouraged development in the field of psychiatry.



## Conclusion



Kurt Vonnegut Jr. combined the destructiveness of war, its effects on society and the human mind, and his non-linear concept of time to spread his anti-war effort through his most acclaimed novel,

*Slaughterhouse-Five*. In this novel, Vonnegut slams the scientists of his time for their contributions towards the creation of weapons of mass destruction and correctly predicted that this would threaten the existence of humanity in the future. Vonnegut's novel led to a better understanding of the concept of time amongst the general public at the time, to further develop the field of psychology and enhance the care of war veterans, and to the education of his readers on some of the consequences of continued weapon development.

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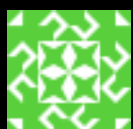
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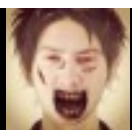
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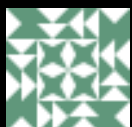
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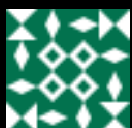
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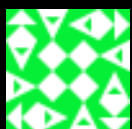
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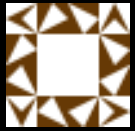
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