

Permutation City Study Guide

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Plot Summary

Permutation City is a science fiction novel that takes place in the middle of the 21st century. Computer and medical technology have advanced to the point that it is possible to scan a person's brain and create a computer program that runs a complete copy of that person on a computer server, giving them something close to life after death. Because of the great expense, the process is mostly limited to those who can afford to pay for indefinite computing resources.

Paul Durham is an insurance salesman who offers protection plans to these wealthy copies. In 2050, Durham begins quietly promising virtual immortality to several wealthy copies in a virtual world called Permutation City. This city will exist independent of the world's limited computing resources and will never be in danger of shutting down. Durham bases his apparently impossible claim on his theory that the universe is constructed of random bits of information drawn from different times and places and put into a recognizable order by an observer. According to his theory, all he needs to do is design a "Garden of Eden" city with all of the structure and copies present and run it for a few seconds of computer time after which it will become a complete alternate universe, capable of running itself forever by building more and more computer clusters within its own universe.

Durham enlists the help of Maria Deluca, a freelance software programmer he hires to design a prototypical planet using a program called Autoverse which models chemical, physical and biological actions. He intends to run the planetary program parallel to Permutation City as an experiment to see if intelligent life can evolve completely within the Autoverse.

Durham launches the city and discovers his theory is correct. After 7,000 years living in the city, Durham awakens Maria's copy which she has reluctantly sent into the city. The planet she designed, called Lambert, has developed an intelligent form of life, an insect-like creature that thinks in swarms. Durham and Maria try to contact the intelligent creatures, who do not believe their story of having been created by a program.

Permutation City is put in danger when the Autoverse portion of the universe begins to corrupt the Permutation City program and recreate it according to the Lambertians theory of reality. Durham hurriedly creates a copy of the city and its residents and launches a new Garden of Eden city. In an last-minute effort to save one of the residents of the city, Durham and Maria are left behind and at the last moment launch themselves into a new universe together.



Prologue and Chapter 1

Prologue and Chapter 1 Summary

The Prologue is dated June, 2045 and opens as Paul Durham wakes up in his apartment in Sydney, Australia to a pleasant spring day. He thinks about going back to sleep but has a nagging feeling he has done something terrible but cannot recall what it is.

His realization of what he has done hits him with a shock. He is not the flesh-and-blood Paul Durham but a computer program running a scanned copy of his own brain. The program is also running a program that perfectly simulates the environment and gives him a view of the city outside his apartment.

He has copied himself to use as a subject in an experiment, but the feeling of being a copy is too overwhelming. He knows that people who wake up as copies typically react badly, unable to cope with the knowledge that nothing they experience is truly real. Many of them bail out within minutes of "waking," even those who have been scanned just before dying and whose real-world bodies have died. Paul himself has bailed out four times before.

He is angry at himself, scolding himself for having tried once again to perform an experiment for which he knows he does not have the strength to follow through. He speaks a password and a control window appears in mid-air. He opens some files on the touch screen and runs the program to bail out. A small metal box appears with a lever that is supposed to end the program, and he pulls it.

Instead of the program ending, a note appears from himself saying that he knew he would try to bail out so he had the feature disabled. He cries out in anger at himself.

His apartment is rendered in near perfect detail, but the outside world is less precise and has a defined limit even though it appears to stretch on to the horizon. Programmed people walk and cycle on the streets. Paul tries to step through the invisible limit of his world, but cannot. He is simply returned to a point at the very edge of the world.

He feels defiant and calls out to himself that he will only participate in the experiment as an equal collaborator, not as a guinea pig. A window appears with his own face in it. He tells himself that of course they are equal collaborators. They are searching for the same thing.

Part One is called "The Garden-of-Eden Configuration." The first chapter is dated November, 2050. Maria Deluca cycles toward her home in Sydney, avoiding a street where a large sewer main has broken, creating a stinking pit. She knows there is no money for street repairs but is angry because the pit is a health hazard.



She arrives at her house where she lives alone and opens her computer to check her mail messages. Her advanced mail filter has automatically classified her messages and tells her she has several "interactives" waiting. These are messages that are very complex programs that are difficult for junk mail filters to scan and analyze and can only easily be removed by interacting with a human. Maria's filter program, called "Camel's Eye," is able to simulate a mask of her face to show these junk interactives and make most of them go away, but there is one waiting that figured out its environment and did not run. She watches it and notices the face that appears looks very much like her boyfriend, Aden. The interactive was designed to show her a face that looks somewhat familiar in order to get her to watch the message. It turns out to be an advertisement for a group called "The Church of the God Who Makes No Difference," which Maria assumes is targeting her because her mother belongs to it.

Maria is a freelance computer programmer who has no current project. She tells herself she should start working on something but instead is drawn into wasting time on her hobby of working in the "Autoverse." The Autoverse is a simulated computer environment of a universe that has 32 basic elemental building blocks that can be configured to emulate cells and simple organisms. It has a three-dimensional interface where the user puts on special gloves that allow her to manually rearrange molecules and create new substances.

Maria logs on to the "Joint Supercomputer Network," which is also called the JSN, where computer time is sold at auction. She buys \$50 worth of time and begins working in the Autoverse. She summons up a molecule of "nutrose," a kind of sugar substance that is the food for an Autoverse organism called *Autobacterium lamberti*. She moves some of the atoms around on the molecule and feeds some of it to the virtual organism.

The organism dies, but she sets up an experiment where she puts varying mixtures of nutrose and this altered molecule, which she calls "mutose," into virtual cultivation dishes to see how *A. lamberti* reacts. She is able to zoom in and see how the organism tries to use the mutose as food and speed up and slow down the time rate in the Autoverse to watch what happens. In the middle of her experiment, however, she is kicked off the network when someone outbids her for access.

She is angry at being kicked off and she looks on the network to see who was the high bidder. She is astonished to see that something called "Operation Butterfly" has purchased nearly all the computing power of the JSN. Further research shows her that Operation Butterfly is a group that intends to perfectly model the weather over the Pacific Ocean in order to predict and perhaps even prevent dangerous typhoons.

Maria is disappointed she has been cut off from the Autoverse, but decides it is for a good cause. She reluctantly starts working on a new software project.



Prologue and Chapter 1 Analysis

The Prologue introduces the main character Paul Durham, who awakens in an uncertain haze and realizes he is actually a computer copy of his real self, running on a computer. His realization of this is gradual and confused, and the author reveals it slowly to the reader without fully describing all of the details or explaining why Durham has copied himself. Later in the book it will be revealed that Durham is mistaken. He is not a copy, but is actually his flesh-and-blood self, lying in a clinic with his brain slowed down to run at the slower speed of the computer environment, which is simulated within his brain. This blurring of reality and the question of what is real and what is not is a theme that runs through the book.

The prologue is subtitled "Rip, tie, cut toy man" which is an anagram of the book's title, Permutation City. Many of the chapters are similarly subtitled with anagrams. This makes reference to the central element of Durham's theory, which is that the parts of the universe can be re-ordered into new universes by any observer, just as the letters in a phrase can be rearranged to make new phrases.

The first of the two parts of the book is called "The Garden of Eden Configuration." This is in reference to the "seed" universe that Durham designs to test his theory that there are multiple universes that coexist, made up of bits of information from different places in time and space. The second part of the book, called "Permutation City" takes place in Durham's created universe.

Chapter One is subtitled "Remit Not Paucity," another anagram of the book's title. It introduces Maria Deluca, the second main character in the novel. Much of the chapter is taken up describing Maria's complicated experiments within a model universe computer program called Autoverse. The Autoverse will come to play a crucial role in the fate of the characters, and it is established here.



Chapters 2 and 3

Chapters 2 and 3 Summary

Chapter 2 is dated November, 2050. Paul Durham is in the virtual office of Thomas Riemann, a wealthy businessman who had himself scanned and copied when he was close to death. Durham tells Riemann he can offer him immortality for two million ecus.

Riemann has allowed Durham to visit him in his virtual office out of curiosity. To visit a copy, a flesh-and-blood person must be hooked up to the computer system and slow down his brain by a factor of 17 to interact with the computer copy that runs at a slower rate than the human brain. Riemann assumes that Durham is just another person looking for a handout or selling some new scheme to offer him secure servers that will run his copy program in an isolated and protected environment.

Durham assures him he is talking about a different kind of security. The two men discuss the political situation in the world and the possible future of copies like Riemann. The cost of scanning a brain and running a copy program is so high that only a small percentage of the population can afford it. It also eats up considerable computer power which is under increased demand from projects like Operation Butterfly that aim to improve conditions for living people. The future of copies is uncertain, Durham says, and he can offer Riemann a guarantee that his copy will exist forever no matter what happens politically, or even if the planet is destroyed by an asteroid. Riemann is curious but Durham says he cannot tell him exactly how he intends to provide this immortality. Instead, he tells Riemann he wants him to conduct a small experiment. This experiment, he tells Riemann, will "show you exactly what you are." (p. 31)

Chapter 3 is dated June, 2045. Paul, the copy, sits in his computer environment speaking with himself, Durham, who appears on a screen. Because of the slowdown, Durham's words first sound like a high-pitched squeak before they are slowed down 17 times so that Paul the copy can understand them.

Durham has studied the history of the technology that has led to the capability of a full brain scan as well as the ethical and philosophical questions that arise when a computer copy is run. Debates have taken place over whether the copy has true intelligence or is simply a very complex automaton. The notion of what rights a copy has compared to humans is also an issue. Paul Durham is mostly interested in exploring the nature of the real world compared to that of copies and has questions only a copy can answer.

Durham instructs Paul, the copy, to count to ten in one-second intervals as close as he can estimate. He then slows down the rate at which the program is running and asks him to count to ten again. He continues to slow down the program rate asking Paul to count to ten. As Paul counts, he senses that about ten seconds has elapsed even though he knows that because the rate of the program has been slowed it is really



taking up to ten times longer. He wonders what is happening in the spaces in between the numbers he counts off, what gives him a sense of continuity where there is actually empty space and time.

Chapters 2 and 3 Analysis

The central story line of the first part of the book is set in motion in Chapter 2. Paul Durham has come up with a way for copies to live forever and he is approaching wealthy copies looking for investment in his scheme in exchange for giving them eternal life. This is spelled out in his meeting with Thomas Riemann, although the author withholds some of the details of Durham's plan so that it might unfold over the course of the rest of the first section.

Chapter 3 returns to the year 2045. The first part of the book shifts back and forth in time between the apparent present day and five years earlier as Durham is developing his "dust theory." This theory proposes that the universe is made up of bits of information taken from anywhere in time and space, and this bouncing back and forth from one time to another simulates a kind of detachment from a linear flow of time.

Durham's experiments on his deluded self suggest this strange relationship to time. As a copy, he experiences time passing just as a real flesh-and-blood person would, with no interruptions. As a computer program, however, his mind runs at a much slower speed than a real brain because of the limit in the power of the computer servers to process all the information needed to simulate his thoughts and feelings.



Chapters 4-6

Chapters 4-6 Summary

Chapter 4 is dated November, 2050. Maria meets her boyfriend Aden at a club where four bands are playing simultaneously with the people in the audience listening to the band they choose over headphones. Aden has news that he has been offered a job in the music department at a university in Seoul, Korea, and he seems to want Maria to come with him, but she is uncertain.

Maria returns to her home that night and logs back into the Autoverse. She checks on her cultures of *A. lamberti* and is astonished to see that a few of the organisms seem to be digesting the mutose. She tries to feed these adapted organisms some nutrose and they die. For the first time an Autoverse organism has adapted. She is elated. As one of a very few serious Autoverse users she knows she has discovered something extraordinary. She composes a letter to "Autoverse Review," a journal with a small circulation, outlining her process and attaching a copy of the genome of the strain with which she had started her experiment. She is so excited she can hardly sleep.

Chapter 5 is also dated November, 2050. A copy named Peer is slowly descending a glass skyscraper that extends infinitely upward and downward. He is in a blissful state when he is interrupted by his friend, Kate, who tells him that he was shut down for an extended period of time when Operation Butterfly took over the public networks on which their copies run.

Peer is indifferent. He does not care about the gaps or the slowdown of the public network because time always seems to pass at the same rate for him. He refers to himself as "Solipsist Nation," meaning he has fully embraced being a copy and the freedoms it offers rather than being stressed by the thought that he is not real flesh and blood.

Kate is concerned, however, because with more projects like Operation Butterfly in the future, they may find themselves shut down completely. She tells Peer she has learned a man named Paul Durham is offering very wealthy copies the chance for immortality, and that several of them have paid his price of two million ecus. She knows a person named Chandler whom Durham has hired to design a virtual city and Chandler has offered to let her and Peer be copied into Durham's city at a much lower price. He would scatter their programs throughout the huge program that runs the city so they would never be noticed. They would not be able to interact with the other copies living in the city, but would have full access to the libraries and features of the city. Paul is reluctant to move or duplicate himself, but he agrees to do it with Kate.

Chapter 6 is dated June, 2045. Paul the copy continues to participate in the experiment being run by his real-world self. Paul grows increasingly impatient with Durham, his real-world self. He asks to speak to Elizabeth, his wife, but Durham tells him it is impossible.



Durham has Paul count to ten again, but instead of simply slowing down the rate, he scrambles the program so that Paul counts only the even numbers then the odd numbers. To the external world, it appears that Paul is jumping back and forth between the numbers, but Paul's experience is normal. He senses himself counting from one to ten in order. This seems like a significant discovery, but Paul cannot put his finger on what it means exactly. He is eager to complete the rest of the experiment.

Chapters 4-6 Analysis

Chapter 4 returns to the character of Maria and her work in the Autoverse. She has accidentally discovered a strain of simulated organism that is able to evolve on its own, without outside manipulation. This is a breakthrough in the small but devoted group of Autoverse devotees, and is also what brings her to the attention of Durham, linking the two characters in the story.

Chapter 5 introduces the characters of Peer and Kate. They are copies who have taken an alternative view on their existence. Many copies seek to recreate their virtual existence as a copy of their flesh-and-blood lives with their former memories and association. As suggested by the experiences of Durham when he wakes up as a copy in the earlier chapters, this is often a stressful situation for copies who cannot reconcile themselves to the knowledge that everything they see and experience is simulated by a computer program. Peer and Kate, on the other hand, fully embrace their existence as copies and take full advantage of it. They create unusual and impossible environments, such as Peer's endless skyscraper, and briefly run copies of themselves to do more than one thing at a time. Peer often brings up a console that allows him to adjust his outlook and mood.

A small bit of Durham's scheme is revealed in Chapter 5, when Kate tells Peer that he has commissioned a well-known computer designer to create a large virtual city.

Durham's experiments continue in Chapter 6. Not only can time be slowed down for a copy without any effect on its perception, it can also be scrambled in time. This is the breakthrough realization for Durham and leads to the formulation of his "dust theory."



Chapters 7-9

Chapters 7-9 Summary

Chapter 7 is dated November 2050. Maria is visiting her mother, Francesca, who tells her she has a form of cancer that will eventually kill her. Maria wants her mother to be scanned before she dies so that her copy can keep living, but her mother says she has no intention of being scanned. They argue about it, with

Maria not understanding why her mother would not want to be scanned.

Maria returns home and runs through her electronic mail. She has several messages in response to her letter to the Autoverse journal, but only one truly interests her. It is from Paul Durham. He says he has read about her results with A. Lamberti and wonders if she is interested in being paid to take her research further. He leaves his number.

Chapter 8 is dated November, 2050. Thomas Riemann reflects on his meeting with Durham. He contacts one of his real-life assistants and asks for a report on him. Durham had been up front about his past, telling Riemann that he had spent time in a mental institution suffering delusions. He is able to look back and realize what was delusional, he told Riemann, but much of what he imagined he also believes to be real.

Riemann receives the report on Durham and goes over it. Durham had gone to college but had left to travel without completing his studies. After returning to Australia his mental condition deteriorated until he was admitted to a psychiatric hospital in 2035. His treatment concluded with corrective brain surgery in 2045. Since that time he completed a college degree and had been working for an insurance company that sold protection to copies.

Riemann wonders if Durham's proposal was really just an elaborate sales pitch for his insurance company, but he is still curious about Durham's claim that he could run a second copy of Riemann that nobody could ever touch. He also wonders if Durham's reference to showing him what he "really is" is a veiled reference to a crime Riemann had committed many years before and which nobody had ever connected to him. He shudders at the thought of the crime, but reassures himself that nobody could have learned about it. He is interrupted by a call from an assistant reminding him he has a board meeting.

Chapter 9 is dated June 2045. Paul the copy is becoming more deeply involved in his existence as a computer program. He thinks about the experiment that allowed scattered moments in time to be experienced as a continuous experience. He wonders if it might be possible to assemble any perceivable reality out of random bits of information scattered in space and time, needing only an observer to perceive an initial order of things. These bits of information might then become "conscious of themselves"



and create a "subjective world" made up of the "dust" of the universe scattered across time and space. (p. 78)

Paul is eager to continue his experiments. He no longer wants to bail out, but feels he is on the verge of discovering something great.

Chapters 7-9 Analysis

Chapter 7 provides some background information about Maria and the somewhat controversial practice of brain scanning to create copies. Maria's mother is opposed to the practice and even though she has been diagnosed with a terminal illness, she does not want to be scanned. Maria does not understand her mother's objection, but she will later have objections of her own to being scanned. The chapter ends with Durham contacting Maria about her discovery with the Autoverse organism and asking if she would like to receive funding to continue her work.

Chapter 8 reveals some background about Durham. He has had brain surgery to correct some kind of imbalance that caused him to have delusions. Later Durham will explain this period in his life to Maria and although he was delusional, he admits, he was not wrong about his theories.

Chapter 9 shows Durham more fully comprehending the implications of his experience as a copy and the seeds of his "dust theory" on which he bases the launch of Permutation City in the second part of the book.



Chapters 10-12

Chapters 10-12 Summary

Chapter 10 is dated November, 2050. Maria meets with Paul Durham at a coffee shop. He explains the project he has in mind. He wants her to use Autoverse to design a planet and stock it with conditions and micro-organisms that might one day evolve into separate species. Maria explains that this would be impossible, since it would take more computing power than exists in the whole world to run such a simulation until complex life evolved. Durham says he understands this, but only wants a "sketch of a proof" that such a thing is theoretically possible. He offers to pay her \$30,000 and give her another \$30,000 in computer time for the project.

Maria is skeptical of his motives, but he assures her he is serious and she will be paid. He gives her a chip with some of his notes about the project and she takes it with her.

At home, Maria tells Aden about the project. He is skeptical, as well, but Maria is excited at the prospect of being paid to work in the Autoverse. The two of them fight about Aden going to Korea, and Maria tells him she is not going with him.

Chapter 11 is dated January, 2051. Kate and Peer are meeting with Malcolm Carter, who explains he has been hired by Paul Durham to program an entire city for copies to inhabit. Durham is only offering admission to the wealthiest copies who can support his project, but Carter tells them he has a way to run their copies in the background in a way that can never be detected. For a much lower price, he can get them into Durham's supposedly eternal city. He invites them in to look around the city.

In a flashback, Paul remembers waking up as a copy after his real self apparently died in a climbing accident. He had been very depressed until he met Kate, who convinced him to embrace the possibilities open to him as a copy. He can simply choose to be happy by reprogramming his copy to be happy. This changes his outlook significantly.

Chapter 12 is dated June 2045. Durham continues his experiments with his copy, Paul. This time, in addition to scattering the numbers from one to ten over time, he also scatters the program over different computer clusters across the globe. The effect is the same. Paul experiences the numbers sequentially over a period of about ten seconds.

Paul excitedly tells Durham about his theory that the universe is a truly random place where any reality can be constructed from bits of information anywhere in space and time. It is like a "cosmic anagram" that can be rearranged just as Paul was rearranged from bits taken from different times and places. Durham argues with Paul and is alarmed at his theories. He says maybe it would be a good idea to suspend Paul for a while. Paul is outraged. He knows that if Durham shuts him down he will never restart him. The chapter ends with Durham reaching for something off screen.



Chapters 10-12 Analysis

Maria and Durham meet in person for the first time in Chapter 10 and Durham reveals a small part of his scheme. Maria is a practical, skeptical person who immediately realizes that what he seems to want would require more computing power than is physically possible. He brushes this objection aside but does not add that he believes he has found a way to provide virtually infinite computing power. Their first encounter is awkward, with Maria mistrustful of what seems to be her great luck to be paid to do exactly what she loves doing. Future events will deepen Maria's suspicion of Durham.

More of Durham's plan is revealed second hand in Chapter 11. Peer and Kate meet with the distinguished designer Malcolm Carter, who has been hired by Durham to create a large virtual city. He explains that he can program them into the city by scattering their programs around so they will never be detected. Carter's method is a practical example similar to Durham's dust theory. Peer and Kate would not exist as copies in a single place, running on a single machine, but would be assembled from bits of information scattered throughout the city.

In Chapter 12, the story returns to Durham's breakthrough in 2045. Paul, Durham's apparent copy, becomes more and more interested in what he can learn by being a copy. He presents his theory to what he believes is his flesh-and-blood original in the real world and is terrified that he will be shut down.



Chapter 13

Chapter 13 Summary

In Chapter 13, dated February, 2051, Maria is working on "Lambert," the name she has given to the infant planet she is designing for Durham. She convinces Durham that she should give Lambert a plausible "history" by programming a simple solar system surrounded by a cloud of Autoverse elements that will come together to form one large planet, Lambert, and three smaller ones. She spends hours every day tweaking and testing her design.

As she is about to log off one evening, she receives a warning message on her computer screen that an automatic analysis of traffic on her network suggests that her work is being monitored by a third party. Almost immediately, the doorbell rings.

At the door is a woman who introduces herself as Detective-Sergeant Hayden from the Computer Fraud Squad. Maria is startled, and asks her inside.

Hayden shows her a picture of Durham and asks if she knows him. Maria explains she has been hired by Durham to do some contract programming. Hayden knows she is designing a planet for Durham and asks her what else she knows about his project.

Hayden tells Maria that Durham is being investigated for fraud, but he refuses to talk to the police about it. He has been asking for large amounts of money from several copies making the apparently impossible promise of running their copies forever. Since Durham will not cooperate, Hayden tells Maria they are hoping she will help them by continuing to work with Durham and to report to them what he is up to. They suspect he plans to disappear with the money some of his clients have already paid him before he has to deliver on his promise. The people who have already paid Durham also refuse to speak about it, so it seems he has shown them something to convince them. Hayden wants Maria to help the police find out what it is and help them convict him of fraud.

Maria is upset that she has apparently been duped by Durham to participate in a scam. She agrees to help Hayden.

Chapter 13 Analysis

Chapter 13 is made up mostly of a description of Maria's work on the Lambert planet project. It describes some of the features of the Autoverse and demonstrates Maria's proficiency in using it.

Maria's visit from the police department puts her in a dilemma. She has been suspicious of Durham and the promise of being paid a good deal of money for a project that could never be run on any computer seemed too good to be true. On the other hand, he

seems earnest and he needs the money. In the end, she is convinced by the police detective that Durham is defrauding people and that she should help catch him.



Chapters 14-16

Chapters 14-16 Summary

Chapter 14 is dated February, 2051. Thomas Riemann is in his virtual environment watching news of a recent court case regarding the rights of copies. He follows the issue closely, since he has reason to be concerned should copies ever be legally considered a continuation of the flesh-and blood person they simulate. He had committed a crime while his flesh-and-blood body was alive.

Thomas goes over the crime in his mind. As a young man he had met a woman named Anna on a visit to Hamburg in 1983. He was the son of a wealthy bank president, she was a drug dealer. Soon he was returning to Hamburg to see her and taking her with him on trips around the world while hiding his affair from his conservative father.

Thomas was in love with Anna and was about to ask her to marry him one night in her apartment when she asked him if he would do her a favor. She wanted him to help a friend of hers launder some cash. Thomas had been infuriated at her request and they argued about it. In the argument, he had struck Anna and she had fallen, injuring her head badly.

She was bleeding and unconscious, but still alive. Thomas had taken her head and smashed it several more times against the wall until she had stopped breathing. He had climbed out her window, cutting his arm in the process, and escaped.

Although it would be possible to edit the entire episode out of his copy's memory, Thomas has not done this. He also keeps the scar on his arm to remind him of the crime.

Chapter 15 is dated April, 2051. Maria goes to Paul Durham's apartment to talk about her latest work in the Autoverse. He tells her he has released her payment based on his trust that she is doing an excellent job. He mentions that her phone might be bugged, which brings up the subject of her visit from Detective Hayden. She decides to tell him about her visit from the fraud squad. She is angry with him for having lied to her and used her as an accomplice in his scheme.

Paul explains that he is not defrauding anyone, that the copies who have paid him know exactly what they are getting. She is skeptical and still angry, but he asks her to listen to his explanation of what he is really doing. He lied to her before because he was afraid she would not believe him. He begins to tell her about his experiment roughly six years earlier in which he made a copy of himself and prevented it from bailing out. He was not the original of the copy, however, he was actually the copy.

Chapter 16 is dated June 2045 and returns to Durham's experiment on himself. Paul awakens in a hospital bed with tubes in his body and slowly recognizes the face of Elizabeth. He is happy that his real-world self did not shut him out and has let Elizabeth



come visit him in his computer environment. He is soon confused, however, because he coughs and tastes acid in his throat, as if he is flesh and blood.

Elizabeth explains. He is the flesh and blood Paul Durham. He was not a copy, but had been visiting the computer environment in order to gain the experience of what it was like to be a copy. The experiments were fake. Elizabeth had been standing in for Durham, using the computer to make her look and sound like him.

Paul thinks over his experience, which has blurred the lines between the "real" universe and the universe of a copy. His "dust theory" that a copy could assemble a continuous pattern of existence from bits of information scattered through time and space might also apply in the real universe. If this is true, he speculates, then there is no reason that once a pattern is established it must come to an end simply because a program is no longer being run.

Chapters 14-16 Analysis

Thomas Riemann's horrific crime is described in Chapter 14. As a young man he killed a young woman in anger after accidentally injuring her when he could have possibly saved her. Riemann the copy takes comfort in the fact that the person who committed the crime is dead and that as of yet copies have not formally been recognized as individuals. Riemann's situation raises one of the themes that runs through the book that asks to what extent a perfect copy of a person is the same as the original person. Although there is no legal way for Riemann's copy to be held accountable for the murder, and although he can wipe the memory of it from his computer mind if he desires, Riemann chooses to remember it. He also chooses to keep a scar on his arm that he received while escaping the scene of the crime.

Chapter 15 centers on a confrontation between Maria and Durham. Her "undercover" operation lasts only a few minutes until she tells him about her visit from the police soon after he confides in her that he thinks he is probably being watched. She is surprised when he tells her he has released his payment to her for her work early, before she has completed it, since she suspected if he was a con man he would not pay her at all. To gain her trust, Durham begins to tell her about his experiments five years before.

Chapter 16 returns to 2045. Paul, the copy, awakens to find he is not a copy but the original who put himself in an induced state that simulated being a copy. This twist in the story brings up the question of what is real and what is not, and how the real and simulated universes might be interconnected.



Chapters 17-19

Chapters 17-19 Summary

In Chapter 17, dated April, 2051, Durham explains his theory to Maria. He explains he once believed he was the 23rd incarnation of Paul Durham, having run 23 copies of himself, each one creating a new Paul Durham with a separate future than the previous one. Although he has been cured of his mental illness, he still believes that it should be possible to create a self-sustaining universe in which copies can live free of limitations of computer processing power.

The worlds in which his previous copies lived did not continue on after they were shut down, he explains, because they were created in the context of an ongoing universe that already existed. What he needs to do, he tells Maria, is create a "Garden of Eden," a starting point that could only have been created new and not emerged as a result of conditions that preceded it.

He has designed a universe with a multi-dimensional computer system that can replicate itself forever, increasing its power exponentially. He has 15 wealthy copies who have given him money to be included in this new universe, with a 16th still thinking it over. He will include the contents of the world's libraries and as much data as possible, including Maria's Autoverse planet running on its own cluster of servers, and a large meeting place called Permutation City. He will only need to run the whole program for a short burst of time, then shut it down, after which time, if his theory is correct, it will continue to assemble itself and grow on its own by taking "dust" from time and space and organizing it according to the conditions set in motion in the Garden of Eden configuration.

Maria is intrigued, but still angry and skeptical. Durham offers to pay her \$600,000 to include her scan file in the Garden of Eden, but she refuses, even though the money would allow her to afford to have her dying mother scanned.

In Chapter 18, dated May 2051, Peer and Kate discuss whether to take Carter's offer to stow away in Permutation City. Kate tells Peer she is going to send a clone of her copy, and after some thought Peer decides to send a clone of himself along with her.

Maria has changed her mind in Chapter 19, dated June, 2051, and has herself scanned to include the file in Durham's launch of his experimental universe. She goes to Durham's apartment to watch him run the initial program he hopes will prove his theory correct. At the last minute, Thomas Riemann decides he wants to come along, and wires his money to Durham.

Durham starts the program and runs it until he uses up all his money on computer time. The program shuts down and he deletes everything from his computer. He and Maria celebrate with champagne and after some awkwardness they sleep together.



Chapters 17-19 Analysis

The basic outline of Durham's complete theory is spelled out in Chapter 17. He believes that it is possible to create a new universe out of the "dust" of the cosmos simply by defining it. It only takes a single observer to set out the rules of order and to put them in motion, after which the universe will follow those rules forever, assembling itself from bits of information in time and space. This revelation sets up the second half of the book, which takes place inside this universe that Durham successfully launches.

Chapter 18 is another surreal episode involving Peer, the copy who fully embraces his fully-customizable existence as a copy.

Chapter 19 is a crucial turning point in the story as Durham, with Maria present, launches his Garden of Eden universe. The event is somewhat anticlimactic, since there is no way for them to know if it successful or not. At the last possible moment, Thomas Riemann sends a scan file to Durham to be included in the launch. This will be explained further at the end of the first part.



Chapters 20-22

Chapters 20-22 Summary

Chapter 20 is subtitled "Can't you time trip?" Peer is on his virtual skyscraper, descending. Kate had lied to him. She had not sent a clone into Permutation City; she had simply transferred her copy, leaving him alone. This does not bother him, because he has programmed himself not to be bothered.

Chapter 21 is dated June, 2051. Maria wakes up after an uneasy dream in Durham's bed. It is empty. Sensing something wrong, she goes looking for him and finds him dead in the bathroom. He has killed himself with a knife.

Maria is uncertain what to do. She goes to his computer to see if his scan file is still on it, but he has deleted everything. She tries to make herself believe that Durham continues to live in Permutation City, but cannot quite grasp it. She hears footsteps, then pounding at the door.

Chapter 22 is also dated June, 2051. Thomas Riemann sits in his office watching a recording of a clone of his diseased self as he is about to die from disease. In real life, as Thomas had been about to die, he left orders to have his mind scanned and his body not awakened. He has now created a clone that will wake up believing it is the flesh and blood Riemann who has just been scanned. He watches the clone's program run, reliving the guilt over killing Anna. The clone dies, as it is programmed to do, and he sends the file to Durham to be resurrected in his immortal city.

Chapters 20-22 Analysis

Chapter 20 finds one copy of Peer alone after Kate has left with his other copy to enter Permutation City. He simply programs himself to accept this.

Chapter 21 is a chilling twist in the plot when Maria finds Durham dead in his apartment after a gruesome suicide. Her first instinct is to see if he has a scan file still on his computer. This is the last encounter with the flesh-and-blood Maria in the novel until the epilogue. The scene parallels the scene of Thomas Riemann's crime.

Chapter 22 returns to Thomas Riemann just before he sends his scan file to Durham. He has found a way to repent his crime. He creates a copy of himself that believes he is the flesh-and-blood Thomas, awakened after being scanned just as he is about to die. The copy "dies" at which point Thomas stops the program and sends the file to Durham to be awakened in what the copy will think is the afterlife.



Chapters 23-24

Chapters 23-24 Summary

Part Two is called Permutation City. It begins with Chapter 23. Maria wakes up and sees Paul Durham, who quietly informs her that she is a copy. She is angry that he has wakened her, and does not believe they are in the world he created, but he assures her that his theory was correct and that she is running in the universe that was created by the Garden-of-Eden configuration. The world is now called Elysium, he tells her.

He has awakened her because he and some others are preparing to make contact with the Lambertians, an intelligent insect-like creature that has evolved on the planet Maria designed. The program has been running for 7,000 years, he tells her, on the ever-increasing clusters of computers in Elysium. Maria is something of a hero to the other residents, having been responsible for the design of Lambert.

Maria wants to be shut down, and Durham tells her she can be, but he asks if she wants to be present when they make first contact with the Lambertians.

Chapter 24 is subtitled Rut City. Peer is in a virtual woodshop in Elysium, carving table legs. He has programmed himself to enjoy this task immensely and has made hundreds of thousands of table legs. This is his method of coping with immortality. He randomly picks up hobbies or interests and focuses on them intently.

Kate calls him to the town hall of Permutation City to observe a meeting of the Elysians. They observe as the Elysians debate whether to make contact with the Lambertians, who have now reached the point where they have modeled the creation of their own universe. It is decided that contact will be delayed until the Lambertians reach the point of realizing that their universe must have been created by an intelligent being, at which point the Elysians will reveal themselves.

Chapters 23-24 Analysis

Part Two leaves the original universe behind and takes place in the new universe, called the TVC universe after the computing model on which it is based, that Durham has launched successfully. Seven thousand years have passed within this universe when the story resumes, just as Maria is awakened in Chapter 23. Unlike the first part, most of the chapters in Part Two do not have subtitles or dates, only numbers.

Maria is upset at being awakened inside Durham's new universe, called Elysium. This is an interesting contrast to her apparent earlier enthusiasm for living on as a copy. She is reluctant to accept her situation and tells Durham she wants to be shut down. He entices her to stay by telling her that her Autoverse experiment has been very successful.



Chapter 24 is subtitled "Rut City," which is more wordplay by the author. It is not a full anagram of "Permutation City", but only uses part of the letters. The chapters with this subtitle in Part Two concern Peer and Kate, who have stowed away inside the program running the city. They can use the resources of the city but cannot interact with the other copies in it who are running independently of the city. They live in an abbreviated version of the city, as the subtitle suggests.

The subtitle has a second meaning that makes reference to the theme of immortality. The copies in Permutation City have already been running for 7,000 years and since Durham's theory seems to be correct they face the prospect of running forever. Peer has coped with this enormous expanse of time by programming himself to focus intently on small things for a long period of time. In Chapter 24, his focus is on carving table legs, which he does repeatedly for years and years. He lives in a self-imposed "rut."

Chapter 24 also provides some needed exposition about Permutation City and its relationship to the Autoverse that runs within it. The citizens of Elysium are made up of the 18 "founders" who were there at the launch, and several more copies that have been generated by a special program. They have a consensus type of government that meets to discuss important issues such as when they should make contact with the intelligent Lambertians.



Chapters 25-27

Chapters 25-27 Summary

In Chapter 25, Thomas Riemann's copy is in his virtual suburban mansion. He is continuously haunted by the memory of his killing of Anna. To distract himself and give himself an illusion of control he mutilates his body, but his flesh heals. He has read all the books in his library hundreds of times and torn them to shreds, but each time he does they reappear. He believes he is in hell.

In Chapter 26 Maria is slowly adapting to life as a copy in Permutation City. She takes an apartment, but does not try to recreate anything from her flesh-and-blood past, not wanting to admit to any connection between her real self and her copy. She repeatedly tells herself that she hopes her real self had been able to convince Francesa to have herself scanned. She spends her time going through the information databases and the history of the planet Lambert. After a time she contacts Durham and tells him she wants to join the expedition to Lambert.

Maria meets with Durham, an Elysian named Repetto and one name Zemansky. They explain the nature of the intelligent, insect-like creatures that have emerged as the most intelligent beings on the planet. They live in swarms and form theories by communicating through dance. Theories that make sense result in recognizable and regular patterns in their swarms. To this point, she learns, they have correctly theorized that their planet orbits around a sun and is made up of 32 basic elements. They have not yet reached the point where they have proposed any theories of creation. They have no such thing as myths. They only form ideas based on what they observe. Once their theories run up against the wall where they cannot explain where the stuff of their universe comes from, only then have they been authorized to step in and inform the Lambertians of how they were created. Repeto explains they have modeled how a Lambertian swarm might react to this revelation, but none of the experiments have resulted in acceptance of the information.

Chapter 27 is subtitled Rut City. Peer is making table legs when he feels a change coming on. He gradually loses interest in woodworking when his environment changes around him as he has programmed it to do from time to time. He now finds himself in what looks like a 19th-century laboratory with many cabinets and drawers full of beetle specimens. His new hobby, he tells himself, must be to draw and categorize the thousands of specimens.

He receives an urgent message from Kate, who comes to speak with him. She tells him that he had "disappeared" for almost a month. He thinks she means that she simply lost track of him, but she corrects him. His program was missing for 29 days. He did not suspend himself, he tells her.



Kate picks up a pad of paper and shows it to Peer. It has several sketches of beetles in it already, but he has no recollection of making them. It also has a name at the top of the page. It is a name he does not recognize or remember using. It is as if he has been dropped into someone else's environment.

Chapters 25-27 Analysis

Chapter 25 shows Thomas Riemann's copy in his private part of Elysium, unaware that he is a copy and believing he is in an afterlife. The example of Riemann's copy provides an illustration of one extreme in the theme of a copy's relation to the real world. At one end of the spectrum are copies like Peer, who define themselves as copies and take full advantage of their environment and capabilities. In the middle are more copies who look at their virtual life in comparison to their lives as "originals." This copy of Thomas is unaware he is a copy, and so has no frame of reference. He knows he is not his flesh-and-blood original, because he remembers dying, but he believes he is in some kind of horrific afterlife.

In Chapter 26, the events that will set up the end of the book are set in motion when Maria agrees to take part in the expedition to Lambert. Much of the chapter is exposition bringing Maria and the reader up to speed on the planet Lambert and the unique way in which the intelligent life there communicates and creates scientific theories.

Chapter 27 returns to "Rut City" where Peer suddenly loses interest in making table legs. This in itself does not alarm him, since he has programmed himself to change his obsessions from time to time. He is alarmed, however, when Kate informs him he disappeared from the computer servers for several days. He also does not seem to recognize his new surroundings as having been selected by himself. It is as if they belong to someone else, he feels. This is an early clue that the TVC universe has become corrupted and draws tension in the story line. The source of the corruption will be explained by the end of the book.



Chapters 28-30

Chapters 28-30 Summary

In Chapter 28, Maria continues to study the Lambertians, their theories and their methods of communication. Still upset with Durham for having awakened her copy, she insists on knowing exactly why he woke her. She imagines he wants her to convince the rest of the Elysians that they should make contact with the Lambertians now rather than wait. They would presumably listen to her as the "mother" of the planet.

Durham explains that this is not why he woke her. The real reason is that he needs access to Lambert through her private portion of the universe that was reserved for her. Each of the original residents of the universe were given their own private section to do with what they wanted, with Permutation City in the center as a common meeting place. Nobody can get into the private areas without the owner's permission. He wants to use Maria's section to launch the expedition to Lambert secretly.

The reason for the mission is urgent, he tells her. The Autoverse universe has started to affect the laws of the Elysian universe. They have tried to slow down the Autoverse but cannot slow it down past a certain point. They have tried to shut it down completely but they cannot. It poses a danger to Elysium, he tells her, because it may re-write the laws of the Elysian universe. The two universes are in conflict. They must go to Lambert and convince the Lambertians that they are their creators. If they cannot, and the Lambertians come up with their own theory, then that theory may become the fact of the two universes and obliterate Elysium.

In Chapter 29, Thomas is lying on the grass by his mansion, reliving the day he killed Anna. As he goes through the scene again, he pauses this time at the point where she has fallen and been knocked unconscious. He tells himself that it would have taken so little energy to have called an ambulance. He would have had to face up to the scandal with his family, but she would have lived. This time, he does call an ambulance and rides with it taking Anna to the hospital, holding her hand and hoping she will live.

In Chapter 30, Maria, Durham, Repetto and Zemansky look for ways to get to Lambert. At first they have difficulty, as they have lost control to create things directly in the Autoverse. They find a way and send robot copies of themselves to the planet surface while they also sit in Maria's apartment in Elysium.

They communicate with the Lambertians using a "mouthpiece" swarm that Repetto controls to translate their words into movements the Lambertians will understand. They greet the Lambertians and tell them they are the creators of their universe. The Lambertians asks for more information and at Durham's insistence, Repetto gives them the laws of the TVC universe that runs Elysium.



The Lambertians consider this for a time, then respond chillingly that they reject the theory. It would lead to an infinite universe, they conclude, which is impossible.

The expedition hurries back to Elysium to decide what to do. Outside Maria's apartment, the buildings of Permutation City appear to be melting. They look at the grid of computing clusters represented on a monitor and watch as it begins to shrink.

Chapters 28-30 Analysis

Despite her growing interest in the Lambertians, Maria continues to hold a grudge against Durham for running her copy in Chapter 28. The intention of the author here seems to be to increase tension between the characters that will be resolved by the end of the book.

The tension continues to build in the central storyline as Durham explains that the laws of the Autoverse are somehow changing the laws of the TVC universe. They have only partial control of the Autoverse now, and can no longer shut it down or slow it down beyond a certain point. Durham seems not to have anticipated that his theory might work against his immortal universe. Once the Lambertians become intelligent observers they have the same capability to order their universe out of the dust of other possible universes according to their own rules of order. Since their rules are different than the TVC rules, they cannot both exist unless the Lambertians can be made to understand the TVC rules and accept them.

Thomas Riemann finds a kind of redemption in Chapter 29. After having relived his murder of Anna thousands and thousands of times, he finally consciously chooses a new ending for it. Instead of killing her after her accident he calls an ambulance and saves her life. In a later chapter it is suggested that he finally "dies" at this point.

Chapter 30 is the climactic scene with the Lambertians as Maria, Durham and two others desperately try to convince them they have been created within an eternal universe that runs according to a separate set of rules than the Autoverse. The Lambertians reject the theory, however, as they recognize such a universe would never end and this is an impossibility to them. This puts an interesting point on the author's theme of immortality. Since the TVC universe does eventually come to an end, the question of whether it would have gone on forever is still left open.



Chapters 31-32 and Epilogue

Chapters 31-32 and Epilogue Summary

Kate and Peer are together in Chapter 31. The Elysians have gone and they appear to be alone in the city. Kate suggests slowing down their rate to move into the future of Elysium to see if they ever come back. Peer programs it, but the city simply stays the same. The Elysians do not come back.

Kate is depressed. She needs to live among people, she tells him. Peer says they will launch their own universe. He will populate it with copies of himself as different people to keep her company. That is what he has been doing anyway, changing himself into a different person one after another for centuries. He will simply create them all at once. Kate is touched by the idea.

In Chapter 32, Durham sits at a console preparing to launch a new Garden of Eden configuration. Maria is with him. They have evacuated all the residents except one, Thomas Riemann, who has never come out of his private area and never let anyone in. Durham is able to crack the code to get into Riemann's property and he and Maria rush in to find him. Maria finds him lying on the grass outside his mansion, unconscious.

As the clock ticks down toward the launch, they try to carry Riemann back into the central area to evacuate him, but his body disappears as it moves through the portal. The rules have changed so that he cannot leave his own property.

They miss the launch and are alone in the crumbling universe that is being taken over by the Lambertian universe. Durham urges Maria to launch her own Garden of Eden. She will be able to continue on and create new people to populate a new world. She insists that he come with her, but he refuses. He has copied himself too many times, he says, and could not stand another. She convinces him that there are new things to discover, such as the higher rules that seem to be resulting in one universe taking over another. Durham makes an adjustment to his program to make himself happy with this prospect, and agrees to join her.

In a short epilogue, dated November, 2052, Maria is standing before a lifelike mural of a garden laying three wreaths for her parents and for Durham, all of whom had been cremated with no grave. She looks at the painting of the garden and imagines it is real until she is interrupted by a friend who is on his way to volunteer to fix a sewer leak. She joins him and soon her eyes are watering from the smell.

Chapters 31-32 and Epilogue Analysis

Chapter 31 skips ahead in time slightly to a time after the Elysians have evacuated the universe in a relaunch of the Garden of Eden. Peer and Kate are alone. They travel far into the future to see if the Elysians ever come back, but they do not. Peer's suggestion

that he become a multitude of people all at once is a twist on the notion that time need not unfold linearly in a virtual universe. He has been different people for 7,000 years, only he was just one at a time. There is no reason he cannot be all of them at once.

The final chapter returns to the point at which the contact expedition has returned and alerted the Elysians they must evacuate and relaunch the TVC universe. Durham gets the new Garden of Eden running, but has only minutes to get the last resident, Riemann, out of his private area. This episode provides some dramatic tension as he and Maria race the clock to get back in time to relaunch themselves, but in the end they are too late.

Like Peer and Kate, Paul and Maria decide to launch their own universe as a kind of electronic Adam and Eve. Durham seems to have found acceptance of his existence as a copy and becomes willing to change his attitude deliberately.

The Epilogue returns briefly to the real world of Sydney where Maria still lives after the deaths of Durham and her parents. In a poignant scene, she stares at a lifelike mural of a garden, imagining what it would be like to walk straight into it. This image stands in contrast to her copy, who is destined to live in a Garden of Eden of her own. Maria is still in the real world, however, a fact that is made apparent by the unpleasant smell of the broken sewer line.



Characters

Paul Durham

Paul Durham is one of the main characters in the story. He is a middle-aged man from Sydney, Australia. As a young man he drops out of college and travels before spending ten years in a mental institution suffering from delusions. He is cured after brain surgery, released from the institution and finishes college. He becomes an insurance salesman, selling insurance to copies against the loss of their computer facilities.

During his period of mental instability, Durham develops his theory that the universe is made of bits of information taken from various places and times. He extends his theory to predict that it is possible to create a new self-sustaining universe out of this "dust." He successfully proves his dust theory by creating such a universe.

The flesh-and-blood Paul Durham commits suicide shortly after launching his universe without ever knowing if it is successful. His copy, who lives on in the universe he launched, is instrumental in saving the residents of the universe when its program becomes corrupted. At the end of the novel, Durham's copy goes on to create a new universe with Maria Deluca.

Maria Deluca

Maria Deluca is a young computer programmer and software designer who lives alone in a house in Sydney, Australia. She earns a living completing freelance projects and spends most of her spare time working in a cellular automation environment called the Autoverse. When she publishes a letter about her research in the Autoverse to a small journal she comes to the attention of Paul Durham, who hires her to design a prototypical Autoverse planet on which it might be possible for life to evolve.

Maria's planet, called Lambert after the designer of the Autoverse, is included in Durham's Garden of Eden launch, along with a dormant scan file of Maria which he promises not to awaken. Maria's copy is awakened, however, after the universe has been running for about 7,000 years. Durham awakens her to be part of the first team to make contact with the intelligent creatures that have evolved on the planet she designed.

Maria is uneasy living as a copy, and has not fully accepted it when it is suddenly discovered that the universe is in danger from the Autoverse, which is imposing its own rules of order on it. In a rush, Maria and Durham work to save one last resident of the collapsing universe before launching into a new "Garden of Eden" together.



Thomas Riemann

Thomas Riemann is an affluent German businessman who has had himself scanned and copied and continues to operate as a businessman. He is approached by Paul Durham to invest in his theoretical immortal universe and decides at the last minute to send a copy of himself along.

As a young man, Riemann became romantically involved with a drug dealer in an affair he kept secret from his wealthy family. While alone with her in her apartment he quarrels with the woman, named Anna, and knocks her down. She hits her head and is knocked unconscious. Rather than call for an ambulance, Riemann slams her head repeatedly against the wall until she dies. He escapes out the window, cutting his arm badly in the process. He is never associated with the death.

Riemann carries the guilt of his crime even into his life as a copy. He keeps the scar on his virtual body and keeps the memories of the occurrence in his mind. The copy of himself he sends into Durham's universe is programmed not to be aware it is a copy but to believe it is the man who committed the murder and who is now facing the afterlife. This copy gradually goes insane after thousands of years alone, reliving the episode over and over.

Peer

Peer is a copy of a young man named David Hawthorne who died in a climbing accident. He has fully embraced his life as a copy and lives in a surreal environment of his own choosing. He subscribes to a philosophy called "Solipsist Nation," which calls for copies to cut off ties with their original selves and live as independent virtual beings.

Peer and his companion, Kate, run on publicly available computer networks until they are given an opportunity to stow away in Durham's Permutation City as background operations in the larger program. Peer makes a clone of himself to enter Permutation City, thinking that Kate has done the same thing, but he finds out afterward that she simply moved her program into the city, leaving one of his clones alone.

Peer copes with being immortal by programming himself to take up various hobbies, such as carving table legs, which he focuses on intently for years and years before discarding the hobby and taking up a new one.

Since they are part of the city's program and not independent like the other residents of Permutation City, Peer and Kate can only interact with one another and not with the other residents. When the residents leave the city at the end of the novel, Peer and Kate are left alone. Peer launches a new universe for them to live in where he will recreate himself as many separate individuals to keep Kate company.



Kate

Kate is Peer's companion. She encourages him to join her as part of the background program in Permutation City, where they are surprised to learn they have virtual immortality. Kate passes her time intently observing the residents of the city, with whom she is unable to interact directly. She is left alone with Peer at the end of the novel and the two of them launch their own "Garden of Eden" together.

Elizabeth

Elizabeth is Paul Durham's companion. She helps him perform some of his experiments in 2045 that lead to the discovery of his dust theory. She is not present in the parts of the book dated five years later and her disappearance is not explained.

Aden

Aden is Maria Deluca's boyfriend. He is a musician who is offered a prestigious post at a university in Korea. He invites Maria to come with him, but she declines after they fight over the matter.

Detective Hayden

Detective Hayden investigates fraud claims in Sydney. She believes Durham is defrauding wealthy copies by promising them immortality in exchange for \$2 million. She enlists the help of Maria Deluca, who she has learned is working for Durham. Maria agrees to help her, but informs Durham of her visit.

Malcolm Carter

Malcolm Carter is a designer of virtual environments in which copies can live. He is hired by Durham to create Permutation City, intended to be a central meeting place for the residents of Durham's universe. He approaches Kate and Peer with an offer to program them into the city for a fee much less than the \$2 million that Durham is charging others.

The Lambertians

The Lambertians are an intelligent life form that evolve on the planet Lambert, which was designed by Maria Deluca. They are insect-like in appearance and fly in swarms, communicating through motion and dance. They have evolved to understand complex mathematics and physical sciences according to the rules of the Autoverse, the program within which they operate. When Durham and Maria attempt to contact the Lambertians



and explain how they came into existence, they reject the information as impossible, thereby endangering the existence of Elysium.

Francesca

Francesca is Maria's mother who is dying of cancer. Despite Maria's entreaties, she refuses to have her brain scanned so that she might live on as a copy.

Anna

Anna is a young drug dealer from Hamburg who becomes romantically involved with Thomas Riemann and is eventually killed by him.



Objects/Places

Sydney

Sydney is a major city in Australia. It is the home of Paul Durham and Maria Deluca

Permutation City

Permutation City is the central area of Elysium, the universe launched by Paul Durham. It is designed by Malcolm Carter.

Elysium

Elysium is the name given to the TVC universe launched by Paul Durham at the center point of the novel. It exists of several private areas surrounding the central Permutation City. It also contains the Autoverse, a separate world that runs within it.

Lambert

Lambert is the name of a virtual planet designed by Maria Deluca with the intention of testing whether life could evolve on its own under the rules of the Autoverse. Intelligent life does evolve, and Maria and Paul Durham journey to Lambert to contact the inhabitants.

Autoverse

Autoverse is a cellular automation program that allows users to experiment with physical and biological processes at a simplified atomic level. A version of the Autoverse operates within Elysium and eventually threatens to corrupt the rules that order Elysium.

JSN

JSN stands for Joint Supercomputer Network, a worldwide network of computers. Access to the network is sold at auction to the highest bidder.

TVC Universe

TVC Universe is a fictional cellular automaton named for the initials of Turing, von Neumann and Chiang, three computer scientists whose work leads to its development. It is a multi-dimensional universe in which cells can combine and recombine in unique ways. Elysium is a TVC universe.

Copy

A "copy" is the computerized version of a person based on a scan of their brain. Copies live within virtual environments also created by computers. They have memories, intelligence and are for the most part complete simulations of real people. They can interact with one another and with flesh-and-blood people connected to their network. Although copies operate at a rate of time much slower than the human brain, they do not experience time passing any differently than real people.

Dust Theory

The Dust Theory is Paul Durham's theory that the universe is constructed from bits of information gathered from different times and places and experienced as orderly by various observers. His theory holds that multiple universes can exist at once and that new universes can be created intentionally.

Hamburg

Hamburg is a city in Germany where Thomas Riemann meets and eventually kills the young woman named Anna.



Themes

Immortality

The scanning of a human brain and programming of a "copy" of that person to live inside a virtual environment appears to be a way to achieve immortality, to live on after one's body dies. In the practical sense, however, the virtual copy is still tied to the physical world because it requires a physical computer on which to run. It is still a way to live beyond death, but not necessarily a way to live forever.

The novel examines this issue by raising questions of what political ramifications might arise around the existence of copies. For example, when computing power is limited, should keeping copies "alive" be given priority over projects that might help the real world? In the real world, Operation Butterfly is a large project that aims to predict and control devastating storms. When it begins to outbid other users for access to computer servers, copies such as Peer and Kate, who run on public computer networks, become worried.

Paul Durham devises a theory that multiple universes exist simultaneously, and that if one deliberately launches a virtual universe that has rules which allow it to expand according to orderly principles, it will order itself and continue to exist even if the computers that are used to launch it are shut off. This theory offers the potential of true immortality by creating a self-sustaining and self-creating universe that expands forever.

The author examines the potential down side of living forever, suggesting that it might be impossible for a truly human mind to endure it. The character Peer, for example, endures immortality by programming himself to take up different hobbies which he focuses on intently for long periods of time before abandoning them and moving on to the next. His companion, Kate, endures by invisibly observing the Elysians as they go about their lives. At the end of the novel, Paul Durham, faced with copying himself yet again and launching into immortality only decides to do so after adjusting his own program to make the idea look inviting.

At the other end of the spectrum is the copy of Thomas Riemann, who has been placed in Elysium without knowing he is a copy. He believes himself to be in some kind of afterlife, but does not know he can adjust his own program to accept his fate and assuage his guilt over the crime he committed while alive. He goes insane and mutilates himself, finally "dying" in a fit of desperation.

The Nature of the Universe

Central to Durham's immortal universe is his "dust theory" of the universe. The theory is suggested to him when he notices that he is able to scramble the order in which the thoughts of a copy occur, but that the copy experiences the thoughts in the proper linear order. Slowing down or scrambling the order of events make no difference in the



experience of the copy. Furthermore, the bits of data that make up a copy's program are themselves scattered across many different interconnected computer servers around the world.

The copy's universe can exist from bits of information plucked from different times and places. Durham extends this observation of the virtual universe to describe the real universe. All matter is, at the level of quantum particles, uncertain until some information is observed about it, which "freezes" it in place. All that is needed for a universe to come into existence is for it to have some observer that has an expectation of order. The actual bits of information can come from any time or place, meaning that multiple universes can be constructed simultaneously out of the same "dust."

Durham proves his theory is correct by designing an orderly system that will create ever-expanding computing power in which copy programs can be run. He himself is the observer who brings the order out of the random bits of information and launches the "Garden of Eden" which does indeed continue to exist and order itself out of the dust of the universe after the computers in the "real" world are shut down.

Identity

Issues of identity arise when a person creates what is intended to be a virtual copy of themselves, another being that shares the same personal identity and memories of the original. The novel introduces some of the political questions that might arise should such technology ever be possible. For example, what rights does a copy have compared to a flesh-and-blood person? Is it ethical to let a copy cease running once it has started?

The case of Thomas Riemann introduces another angle to the question, which is whether a copy might be held accountable for the actions of its flesh-and-blood original. Riemann committed an act of murder while alive but was never caught. He has himself copied and retains the memories of the crime, as well as a scar that he received while escaping the scene. He keeps these memories and the scar even though it is completely possible to erase the memories and give himself a virtual body in any form he prefers. For Riemann, the memories and the scar maintain a continuity with his flesh-and-blood self that makes his life as a copy seem more genuine.

At the other extreme is the character Peer, who completely abandons his identity when he becomes a copy after his original self dies in an accident. He changes his name and fully embraces the virtual environment in which he can alter his surroundings, exist in more than one place at a time, and alter his own mood and memories to suit his pleasure. Once inside the endless universe launched by Durham, Peer assumes multiple identities over thousands of years. After the universe is shut down, he launches a new universe with Kate in which he creates himself as multiple people all at once to keep Kate company.



Style

Point of View

Permutation City is told from various points of view as the author examines issues of immortality and identity from different sides. The two main characters, Paul Durham and Maria Deluca, are both proponents of brain scanning to create virtual copies of humans that can be run on computers. For Durham, copying raises issues of the nature of reality and identity and he formulates a theory that allows copies to run forever without a pre-existing physical computer server. Durham invests his copy with his own identity to the point that after launching his potentially immortal copy he kills himself.

Maria Deluca repeatedly tries to convince her terminally ill mother, Francesca, to have her brain scanned before she dies from cancer. Maria argues that the scanned copy will be the same person as Francesca, with the potential to live on happily after her body dies. Francesca offers a different point of view. She does not want to live on as a simulation of her self and chooses to die without being scanned. Maria herself, for all her attempts to convince her mother to get scanned, is reluctant to be awakened as a copy within Durham's immortal universe. She is angry when he does run her copy.

Other secondary characters provide alternate points of view regarding scanning, copying and their relation to reality. By giving each character a unique point of view, the author is able to examine more fully the central questions of the novel.

Setting

Permutation City takes place in the future, in the middle part of the 21st century. It alternates in time between the years 2045 and 2050. The portions of the story that take place in the real world are set in Sydney, Australia, where Maria Deluca and Paul Durham live and work. The city is crowded and apparently there is little public money to fix things like a broken sewer pipe. The main form of transportation is the bicycle. It is a time when the demand for computer network service has exceeded the world's supply, so public access is auctioned to the highest bidder in real time. Wealthy individuals and companies own their own private computer servers.

Portions of the story also take place in virtual worlds created by a computer program and inhabited by "copies," which are programs created from the brain scans of live people and run on a computer. These copies are conscious and feel they have the same identity as their originals. Their environments are simulated, and are only generated as necessary to interact with the copy.

The second half of the book takes place in the universe created by Paul Durham, called Elysium by its residents. It consists of several private areas surrounding a central portion called Permutation City. The residents of Elysium are copies of the original founders, plus new people who have been generated by the founders.



Within Elysium is a smaller universe called the Autoverse, which is a small planetary system that runs on its own computers and by a different set of computing rules than Elysium. Within the Autoverse is a planet called Lambert, which is a grassy planet inhabited by several simple animals plus one species of insect-like creature that has evolved intelligence.

Language and Meaning

Permutation City is written in the past tense from the point of view of an omniscient narrator. The thoughts and motivations of the characters are explained as the events of the story unfold.

The novel is in the genre of futuristic science fiction, and so uses invented terms to describe things that are not yet in existence. The "Autoverse" for example is a virtual universe that users can perform experiments in. The author also uses common words that are applied in new ways, such as "copy," which refers to a computer-programmed version of a person based on a scan of their brain.

The novel is based on some speculation about some complex concepts in computer science, and much of the narrative and dialogue consists of descriptions of these ideas. The author uses the technique of having one character explain the concept to another character who is not as knowledgeable about it in order to convey the idea to the reader. This technique makes for some long passages of dialogue that do not advance the story but explain the deeper ideas the novel hopes to explore.

Structure

Permutation City is divided into 32 numbered chapters, a prologue and an epilogue. It is also divided into two parts, the first entitled "Garden of Eden" and the second called "Permutation City."

Part One, "Garden of Eden," describes the world of the mid 21st century and follows the two main characters, Paul Durham and Maria Deluca, as they meet and begin to work on a project to launch a virtual universe that will run on its own forever. At the end of the first part, Durham commits suicide after he has launched a copy of himself into the "Garden of Eden" program intended to bring this universe into existence.

Part Two, "Permutation City," takes place within this virtual universe that Durham has successfully launched. This section describes the hurried work by Durham and Maria's copies to save the residents of the universe after they discover it has been corrupted.

The story also follows secondary characters through both parts. Chapters alternate between the main characters and these secondary characters. Subtitles to most of the chapters provide the month and year to orient the reader, as the story moves back and forth in time. Subtitles are also associated with the characters who are the subject of

each chapter. although they do not make any direct reference to the subject of the chapter.



Quotes

"He closed his eyes and let his mind grow blank — and then caught himself, suddenly uneasy, without knowing why. He'd done something foolish, something insane, something he was going to regret, badly."

Prologue, p. 5

"The prospect of embarking on another such project wasn't exactly electrifying — but she had no real alternative. And once the recession was over and people started buying again, it would have been time well spent. First, though, she needed to cheer herself up. If she worked in the Autoverse, just for half an hour or so — until nine o'clock at the latest — then she'd be able to face the rest of the day . . ."

Chapter 1, p. 18

"Thomas regarded him uneasily. Although he'd had all the ravages of surgery edited out of his final scan file, he'd kept a scar on his right forearm, a small memento of a youthful misadventure. He stroked it, not quite absentmindedly; conscious of the habit, conscious of the memories that the scar encoded — but practiced at refusing to allow those memories to hold his gaze."

Chapter 2, p. 31

"Paul sat in his study, in his favorite armchair (unconvinced that the texture of the surface had been accurately reproduced), taking what comfort he could from the undeniable absurdity of being afraid to experiment on himself further."

Chapter 3, p. 34

"Peer anchored the soles of both feet and the palm of one hand firmly against the glass, and rested for a while. He tipped his head back to take in, one more time, the silver wall of the skyscraper stretching to infinity above him. Cotton-wool clouds drifted by, higher than any part of the building — even though the building went on forever."

Chapter 5, p. 50

"He knelt over her, one knee to either side, took her face in his hands, then closed his eyes. He brought her head forward, then slammed it back against the wall. Five times. Then he held his fingers near her nostrils, without opening his eyes. He felt no exhalation."

Chapter 14, p. 126

"Peer seemed to be making love with Kate, but he had his doubts."

Chapter 18, p. 147

"He should have had a chance to accept his guilt, to accept his mortality. And to absolve his successor. That hadn't been allowed to happen. But it wasn't too late, even now. A software clone could still do it for him — believing itself to be flesh and blood. Revealing



what the mortal, human self would have done, if only it had known that it was dying."
Chapter 22, p. 175

"Before she had a chance to think, Durham stepped into the room. For a moment, she was too shocked to make a sound — then she screamed at him, 'What have you done to me? I'm the Copy, aren't I? You're running the Copy!' Trapped in the launch software, with two minutes to live, Durham said quietly, 'Yes, you're the Copy.'"
Chapter 23, p. 183

"As the City slowly imprinted itself upon her brain — every dazzling sunset leaving its golden afterimage burning on her nonexistent retinas, every journey she made wiring maps of the nonexistent streets into her nonexistent synapses — Maria felt herself drifting apart from her memories of the old world."
Chapter 28, p. 222

"The four of them stood by the window, speechless, as the City rapidly and silently . . . imploded."
Chapter 30, p 243.

"Maria left three wreaths propped against the illusion mural at the end of the cul-de-sac. It was not the anniversary of any death, but she placed flowers there whenever the mood took her. She had no graves to decorate; both her parents had been cremated. Paul Durham, too."
Epilogue, p. 260



Topics for Discussion

Discuss the different notions of identity in the novel. Is a copy different than its original?

What are some of the ethical questions that are raised by the possibility of creating virtual copies of humans?

How do the various residents of Elysium cope with immortality? Is it something truly desirable?

The author uses the term "Garden of Eden" several times to describe the creation of new universes. In what ways are these universes like a Garden of Eden? How are they different?

What role does religion play in the novel? Is it an important consideration for the characters?

Durham's universe is meant to be immortal, but it comes to an end in a way. Does this invalidate his theory?

How do Thomas and Peer differ in their attitudes toward life as a copy?