A Scientific Approach to Thomas Pynchon's *Mason and Dixon*

Interactive Qualifying Project Report:

Submitted to the Faculty

of the

Worcester Polytechnic Institute

in partial fulfillment of the requirements for the

Degree of Bachelor of Science

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Date: April 28, 2011

Abstract

This paper is an analysis of how a writer of fiction with a strong sense of social and moral values uses the scientific history of the 18th century to convey his ideals in an historical novel. Through a constant showcasing of both scientific and historical embellishments, Pynchon builds his argument against the surveying of right lines upon the Earth. These lines, he believes, serve only to separate a people and allow a government to have greater control over its divided citizens.

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1 Introduction

Thomas Pynchon's fifth novel, *Mason and Dixon*, is a historically imaginative retelling of the expeditions of Charles Mason and Jeremiah Dixon. The pair of protagonists begin the story by traveling to Cape Town, South Africa for their viewing of the Transit of Venus, an astronomical phenomenon that occurs only once or twice in a person's lifetime. The story follows them from here to America, where they survey the eponymous Mason-Dixon Line. This line takes about five years to fully survey, and, as such, Pynchon devotes a great portion of his novel to the discussion of the events that occur as the two are performing their work.

Pynchon's goal, however, is not to give an entertaining and historical recount of their actions while surveying the line, but to use this story as a setting for conveying his own moral values. He chooses Mason and Dixon not because their story is most appealing, but because they live in a time period that involves a great flux of scientific concepts. Conveniently, Mason and Dixon travel between Africa, England, Scotland, St. Helena, and most major locations in America, allowing Pynchon the opportunity to introduce a wide spectrum of historical figures and characters of his own invention, each with their own contribution to the philosophical reasoning behind the story.

Pynchon sets his novel in the middle of the 18th century in an attempt to argue that the scientific advancements of the time were not always improvements to society, especially when they are controlled by the Royal Society, the scientific governing body of

the time. Many of the experiments and advancements of the time were funded and decided on by the Royal Society, with most collaborating scientists serving only to gather data while a select few performed the scientific analysis required. This was the case with the Transit of Venus, wherein each observer, despite playing a great role in the collection of necessary data, provided little contribution to the calculations made from the collected data.

The development of the Royal Society began a movement of science away from purely intellectual endeavors and towards improvements to society from a governmental standpoint. The invention of the pendulum clock, the determination of the astronomical unit, the accurate astronomical surveying of boundaries, and many other innovations of this time were all performed in order to more accurately regulate scientific proceedings and society. These advancements began to lead towards a greater level of control of a government over its citizens, as the people were guided by more objective, infallible boundaries rather than subjective ones. Because of the objectiveness, these boundaries could not be moved, and, particularly with the case of land ownership, they created a discrete separation of people. While this made governing and taxing people near these borders easier, it served more readily as a separation of people from their neighbors, removing any brotherhood or unity felt by those who shared the undefined and common land.

Pynchon moves through the history of Mason and Dixon with these motives in mind, often introducing characters and events that help to reinforce his scientific views. He makes many historical and scientific allusions to the important figures of that time, and often embellishes them to create a more fantastical and imaginative storyline capable of

conveying his themes and ideals. Although the plot technically focuses on the expeditions of Charles Mason and Jeremiah Dixon, Pynchon's true intention in this novel is to create a philosophical statement against the systematic and logical science that serves only to create more rules for society, rather than explore the depths of the subjunctive.

2 Literature Review

Wallhead, Celia M. "Mason and Dixon: Pynchon's Bickering Heroes." *Pynchon Notes* 46-49 (2000): 178-99.

This article, while not scientific in the astronomical sense, takes a sociological approach to the dialogue in Pynchon's *Mason & Dixon*. She is correct in noting that almost all of the conversation between the two historical protagonists breaks down into arguments over insignificant subjects. She argues that such bickering violates Paul Grice's Cooperative Principle, which states that certain maxims of conversation must be observed in order to achieve cooperative success. Pynchon uses their bickering to humorously elucidate some of his main points on duality and pre-revolutionary America. However, in the few times when the two are not quarreling, they manage to work together on their task of creating the West Line.

Madsen, Deborah L. "Narratives of the Visto." *Pynchon Notes* 46-49 (2000): 229-38. Print.

This article reviews *Pynchon and* Mason & Dixon, a collection of essays on the underlying messages within the story. Her commentary initially focuses on the lack of female authors and feminist topics in the collection, then moves on to remark that, while each essay is good in its own right, the collection lacks any dissenting viewpoints for the arguments presented. A few of these essays focus on the subjunctive America, commenting on many of the fantastic tales. A few also make note of the West Line as being a fault line or an uncertain line that paves the way for a more governed and controlled America.

Hill, Robert R. "Rationalizing Community: Victims, Institutions and Analogies." *Pynchon Notes* 52-53 (2003): 124-65.

This article begins by quite strongly opposing most history, since history is "hired" and often untrustworthy. He argues that Pynchon intends to make heard the many silent voices that were hushed by history. He remarks that although America places its ideals in liberty, Americans are able to justify slavery and participate in its trade. Pynchon, in an attempt to escape conventional history, presents his story through several different frames, with many characters taking turns telling stories. This gives the reader his own chance at interpreting events, given multiple views. He then speaks of many parallelisms between the oppression of women, slaves, Native Americans, and European colonists, and remarks that many Americans view great figures, including Jesus, as conquerors. This allows institutionalized and corporate America to be morally justified. He ends by making a few connections between Dixon's story of the Lambton Worm, the mythology of St. Helena, and the West Line visto.

Howard, Jeffrey "The Anarchist Miracle and Magic in *Mason & Dixon*." *Pynchon Notes* 52-53 (2003): 166-184.

This article takes a look at Pynchon's perspective on miracle and the fantastical events portrayed in the novel. Pynchon is described as being hopeful for the subjunctive, seeing it as a realm of possibilities. A major form of magic present in the novel is Feng-Shui, which reinforces the idea that the West Line is unnatural. By ending the novel with the hope of American Indian magic, Pynchon creates possibilities for a better, more natural and less controlled future.

McEntee, Jason T. "Pynchon's Age of Reason: *Mason & Dixon* and America's Rise of Rational Discourse." *Pynchon Notes* 52-53 (2003): 185-207.

This article remarks that, while Europe is in the Age of Reason, with rational discourse providing advancements of intelligence and logic, Mason and Dixon encounter a high level of nonsense and wild beliefs in America. The author believes that America may have not yet achieved an Age of Reason, shown by the fact that the "glaring negatives" of our history are often breezed over. Thus, Pynchon attempts to examine these aspects in a very loose historical novel. He makes several comments on the "irrational rationality" of the West Line, and of the atrocities (slavery) associated with it.

Palmeri, Frank. "Aspects of *Mason & Dixon* (Review)." *Pynchon Notes* 54-55 (2008): 255-56.

This article is a review of Manfred Kopp's essay *Triangulating Thomas Pynchon's Eighteenth-Century World*. The review focuses on the three main sections of the essay. The first deals with the issue of history in a postmodern fiction, relating it to several similar books. The second section focuses on duality and the many references to pairs of characters representing opposites (including Mason and Dixon themselves). Finally, he talks of the extreme feelings of paranoia that Mason and Dixon have about not knowing exactly who or what they are working for.

Dick, S.J. (2004, May). The Transit of Venus. *Scientific American*, 99-105.

This article addresses the 2004 Transit of Venus. It gives a historical background of the Transit of Venus and includes scientific data and explanation of the regularity of the

occurrences of this event. It also addresses the idea of parallax and how the 18th century viewings of the Transit of Venus helped to determine the size of the solar system.

"Charles Mason." *Wikipedia*. Web. 15 Apr. 2011.

This article gives a brief biography of Charles Mason. It includes information on his work as assistant to Astronomer Royal James Bradley. It also details his work on the 1761 Transit of Venus, and his famous work on the Mason-Dixon Line. All information is succinct and contains very little elaboration, highlighting only key details.

"James Bradley." *Wikipedia*. Web. 15 Apr. 2011.

This article offers a brief biography of Astronomer Royal James Bradley. The article makes a brief mention of his discovery of the nutation of the Earth's axis, but spends the majority of focus on his discovery of the aberration of light. All information not dealing with the aberration of light lacks significant detail.

"Nevil Maskelyne." *Wikipedia*. Web. 18 Apr. 2011.

This article provides a short biography of Astronomer Royal Nevil Maskelyne. It touches briefly on his personal life, his measurement of a degree of latitude in Maryland and Pennsylvania through Mason and Dixon, and his involvement in the Schiehallion experiment, which was used to determine an average density for the Earth. The majority of the article centers on Maskelyne's Lunar Distance method, and the controversy between his solution to the longitude problem and Harrison's chronometer.

"Mason-Dixon Line." *Wikipedia*. Web. 19 Apr. 2011.

This article gives a detailed history on the Mason-Dixon Line. The article provides good information on the border conflict that gave rise to the need for the line. It also gives a fair amount of detail on the geometrical considerations that went into the drawing of this line, as well as the troubles Mason and Dixon had in doing this work.

3 Pynchon's Mason and Dixon

3.1 Transit of Venus

Thomas Pynchon begins the novel by detailing Charles Mason and Jeremiah Dixon's first joint expedition to the Cape of Good Hope. It is there that the two viewed the Transit of Venus, making observations that would later be used to determine the astronomical unit. Thomas Pynchon likely includes the tale of Mason and Dixon's trip to the Cape of Good Hope and observations of the Transit of Venus as a metaphor for the theme of the story as a whole.

Venus, the Roman equivalent of the Greek goddess Aphrodite, represents love and beauty. In the beginning of Pynchon's novel *Mason and Dixon*, the world is experiencing a good share of the ideals that Venus embodies. There is a great deal of enlightenment and scientific achievement leading into and continuing through the 18th century, including discoveries and inventions such as Fahrenheit's thermometer, Newton's Laws of Motion, Franklin's determination that lightning is electrical, and the general acceptance of Copernican's heliocentric model of the solar system. The scientific world of astronomy was growing as well, since Kepler's discoveries on the laws of planetary motion paved the way for a much greater knowledge of celestial studies.

Simultaneously, the colonization of America is blossoming as a world of possibilities, where anyone could buy land and create a future. The new land had colonies which embraced religious and spiritual freedom, and interactions with the Native Americans

yielded a greater understanding of nature. Pynchon enhances the magic of the new nation by coming up with fantastical tales and impossible occurrences as the eponymous duo travel westward. These fanciful side-plots and stories symbolize the unbounded potential and opportunity that America held in the eighteenth century. Pynchon sees the goddess Venus's beauty reflected in the hope of America's future.

However, it is not simply Venus that acts as a metaphor for the story, but the Transit of Venus. As Mason and Dixon create the West Line dividing American colonies, they are using great scientific achievements in theory and technology, not to unite people and advance the possibilities of the future, but to draw restrictive lines across the surface of the Earth. These lines, commissioned by the King and the rulers of Pennsylvania and Maryland, serve to divide the colonists and give these leaders more definitive power over those living near the borders.

The use of astronomical advancements for marking the Earth with lines to divide territories signals the end of the metaphorical Transit of Venus. This act begins the use of science for means of gaining power and control, and ends its period as strictly a pursuit of enlightenment. Thus, with Mason and Dixon's West Line, the Transit of freedom and scientific Venus comes closer to its conclusion. This idea that governmentally-controlled scientific advancements reduce imagination and possibility is one of the main themes that are embodied in this book.

3.1.1 The Royal Society

The astronomical studies performed on the Transit of Venus also serve to reinforce Pynchon's theme of increasing governmental power. The Royal Society, more formally known as The Royal Society of London for Improving Natural Knowledge, was a governmentally founded and funded society that began in the mid-17th century. The Royal Society had a small group of members that oversaw the rest, and often funded and directed many scientific experiments. While this seems an improvement to many, Pynchon sees that as a highly unwanted aspect that removes the creativity and imagination from scientists. Because the Royal Society funds its projects, it is much more financially and socially acceptable to work on one of their projects than an individual project. Also, because they are governmentally funded, they likely have better instruments and facilities than any lone scientist. This made many scientists at the time perform projects overseen by the Royal Society rather than any personal endeavor.

However, since the Royal Society is a government organization, they are much more likely to support projects that support the government: "useful" projects. This rules out most research done expressly for the purpose of enlightenment, and instead promotes projects along the lines of the pendulum clock and astronomical surveying. The former allows those in power to create stricter schedules for their subordinates, and more accurately defines terms such as "late" or "early," which can be used to penalize those that do not meet the proper time requirements. The latter allows for the creation of more accurate boundaries, so that local governments know exactly who to tax and how much land they own. Both of these serve to give those in power an even greater degree of power,

and require learned scientists to spend their time doing more repetitive, menial tasks, or looking for ways to slightly improve accuracy, rather than exploring new possibilities and discovering more interesting phenomena. While these may have been scientific advancements, Pynchon argues that they are not necessarily improvements to society, and instead are more likely detrimental.

The observations of the Transit of Venus are among the projects laid out by the Royal Society. Charles Mason and Jeremiah Dixon are just two of the scientists participating in what is considered one of the earliest great scientific collaborations. However, despite the fact that dozens of scientists recorded observations of this event, only a select few performed the calculations and derivations required to determine the astronomical unit, which was the goal of these observations. As such, most of the scientists involved served only to collect data. Pynchon includes this part of the novel as a comment on how, because of the Royal Society's control over the experiments, scientists like Mason and Dixon were deprived of their creativity and insight and instead used as tools by the government for the furthering of their own agenda. With expeditions such as the observations of the Transit of Venus, the Royal Society separated astronomers and other scientists into an elite sect who performed the necessary analysis for most projects and a group that went out and did less enlightening field work and data collection. In doing so, they divided those who sought higher learning while offering little chance for most to explore their own ideas.

3.2 Time

The idea of time plays two important roles in this novel. The first is that, during the 18th century, clocks and timekeepers became significantly improved. Until this point in history, clocks were unable to give precise minute values, often having a great degree of error. However, in the middle of the 17th century, the pendulum clock was invented by Christiaan Huygens, which allowed for an accurate measure of minutes. Within only a few decades, clocks were again improved and made to include a reasonably accurate second hand (off by only a few seconds every week). (Milham, 1945)

This was a great scientific achievement, and it paved the way for many more scientific experiments wherein the accurate recording of time was necessary. While this in and of itself is an excellent improvement to society, Pynchon recognizes that there are negative consequences to this level of accuracy. He sees time as a restriction upon people, since it is used by those in higher positions to regulate the actions of others, in particular with schedules for work and recordings of events. He alludes to this in *Mason and Dixon* early on, saying, "Soon, during an interrogation, someone will wish to know the precise time that each question is ask'd, or action taken, by a clock with two hand,— not because anyone will ever review it,— perhaps to intimidate the subject with the most advanc'd mechanical Device of its time, certainly because Minute-Scal'd Accuracy is possible by now, and there is room for Minutes to be enter'd in the Records" (*Mason and Dixon*, p.156). Pynchon clearly sees the improvement in timekeeping as something that will be used for reasons beyond the furthering of our scientific knowledge.

The other major allusion to time involves a strange historical event. The British and America had been using the Julian calendar, which did not account for leap years correctly. The Julian calendar defined a year as 365.25 days, requiring one leap year every four years. It is now known, however, that a year is slightly less than 365.25 days, and because the Julian calendar rounded up, it was gradually becoming less and less accurate, by a little less than one day every century. While this value is relatively small, it eventually began to build up, and by the mid-18th century, the calendar was off by about a week and a half. This would be a problem for farmers who wouldn't have know when to plant their crops, and also for astronomers who would have noticed that constellations normally appearing on certain dates instead appearing several days earlier.

To fix this error, the Parliament passed an act that switched the Julian calendar over to the more accurate Gregorian calendar. The result of this is that those falling asleep on Wednesday, September 2, 1752 would wake up on Thursday, September 14, 1752, an eleven day gap. Pynchon includes reactions to this in his novel, with many citizens being outraged that the government was audacious enough to steal eleven days from its people. Mason, playing on the unrest of the denizens of a pub over this occurrence, tells a tale of a group of Pygmies that were brought in to colonize the stolen eleven days in order to prevent time from collapsing. He names the leader of the Pygmies "Count Paradiscom," which is Hungarian for "Count Paradise." This is a hint that Pynchon sees the fantastical eleven-day land as a utopia.

Later in the novel, Mason confides to Dixon that he had woken up in some type of alternate dimension, noting that the date was September 3, 1752. The picture he paints of

this void-world is certainly non-utopian. Mason is alone there, and the scenery he describes is eerie, the moon is always full, and he mentions the presence of a "Residue of Sin that haunted the place" (*Mason and Dixon*, p.558). Mason recognizes that, because of the lack of authority on him, he is free to do anything he wants. But Mason is not one for imagination and instead is overcome with Melancholy and boredom again.

Mason also mentions that he can hear others around him, but is unable to fully distinguish the voices and cannot see anyone. Pynchon likely intends these voices to most probably belong to the Pygmies that inhabit the missing eleven days of which Mason had spoken. However, Mason is a scientist in the Age of Reason, and lack the imaginative power to fully experience this land. As such, he is left alone and unable to make anything of the free and open opportunities that were presented to him.

Pynchon includes this tale in order to show that scientists who supposedly belong to the Age of Reason are under the command of the Royal Society and lack the freedom to pursue possibilities that are presented to them. Since they do not explore and perform their own experiments, instead deferring to the guidance of a governing body, they lack the imaginative creativity to truly make the best of opportunities to seek their own knowledge, and instead conform to what is considered best by their superiors.

3.3 America and the West Line

The second section of *Mason and Dixon* takes up well over half of the novel, and describes in great detail many of the adventures of the two protagonists during their

surveying in America. Pynchon uses this section more than any other in conveying the main themes of his novel, and fills it with dozens of subplots and new characters. The Transit of Venus section, in contrast, has a relatively small cast of characters and nearly linear storyline. In fact, as the party moves west, deeper into America, there is an increase in fantasy and a blurring between fact and fiction. While to some this may appear as if Pynchon is implying chaos with this trend, it is more likely that he sees this as freedom, especially when compared with the events that occur when the party is closer to the eastern coastal region.

When the pair is near the eastern border of America, they are met with many negative scenarios. The first, and most obvious, is that of the Paxton Boys massacre. The Paxton Boys are an infamous group who were upset with the actions of hostile Indians further to the west, and the lack of response by the Pennsylvania government. They decided to take matters into their own hands, and retaliated, not against the hostile Indians, but against a group of mostly Christian Indians that had lived peacefully with their Pennsylvanian neighbors for many years. This group of Indians had done nothing wrong, but because they were racially linked to the hostiles, the Paxton Boys saw them as suitable examples for their anger, and killed twenty-two members of this Susquehannock tribe.

Mason and Dixon visit the location of this event, and though they are originally barred from entering, they sneak onto the massacre site and are thoroughly disgusted with what the images they see. They then enter a bar that harbors men who were supposedly members of the Paxton Boys. They learn that the people there consider the massacre as an even exchange, and are again disgusted, this time by the lack of regret felt by these men.

While on the East Coast, the two are also met with an increased imagery of slavery. The idea of slavery is appalling to both of the protagonists, and they begin to dislike America because of it. While spending time in Baltimore, Dixon sees a slave-driver mistreating his slaves and steals his whip, threatening to kill the slave-driver.

These two scenes contain the greatest level of fear, disgust, and anger at Americans, but throughout the novel there is a general feeling of unease and unrest, from both the protagonists and the Americans in that region, which is teeming with thoughts of revolution. However, as the party travels west, the atmosphere becomes less negative and more neutral. The majority of unease and trouble falls upon the moral concern with West Line itself. As such, it is clear to see that the increased number of fantastical events is meant to represent the freedom and opportunity of the less-settled land. Because the western region of America lacks a strong governmental control, there is still a chance for a future wherein these fantasies are possible, and the citizens will be free.

As the party moves further and further west, the entropy of the party is increased. They meet many wild and unpredictable characters, and, as such, the capacity for the conveyance of information is increased. Pynchon links this with the free and ungoverned portion of America because he views this liberty and lack of control as a great land of opportunity, and a possible return of scientific expeditions for the purpose of enlightenment. He disagrees with eastern America and Europe, wherein scientific studies are commissioned and controlled by either governmental associations or the wealthy. He uses this as a comment against today's society, where almost every study performed is at least partially funded and overseen by the government. Pynchon believes that the science

and technology of today does not further our society, but instead allows those in charge to have a higher level of control over its people.

The novel ends with Mason's return to American with his family. His sons Doctor Isaac and William are speaking to Mason, though whether Mason is actually with them is unknown. They both express their excitement in coming to America, and their desire to meet Indians and fish with them, learning their secret ways. Jeffrey Howard sees this as Pynchon's belief that possibility still exists for a more nature-centered future, with the Indian magic symbolizing Pynchon's hope for the subjunctive.

3.4 Feng Shui and Sha

The unnatural energy of the line is brought to the forefront by a borderline crazy Chinese man named Zhang. Zhang is a student of Feng Shui, an art focused on following the flow of positive energy inherent in natural surroundings. Zhang follows a particular view which believes in a dragon that lives beneath the surface of the Earth. As such, any line that does not follow the path of nature, paths which are set out by this dragon, is a line that crosses through nature and cuts the dragon. This releases a negative, killing energy, known as Sha Chi, which constantly harms those traveling on any such path. The West Line, being as straight, large, and unnatural as it is, holds an immensely strong current of Sha Chi, since it serves as a very deep cut across the dragon.

Zhang can easily feel the Sha Chi on the line, and is deeply disturbed by it. Through his insistent denouncements of the West Line, all members of the party, including Mason

and Dixon, begin feeling a general negative atmosphere from the visto, causing the two leaders to question whether their work will result in more good or evil. Pynchon creates this tension and doubt in an attempt to further his own thematic beliefs that the West Line served as an unnatural scar in the Earth, acting only as a barrier separating groups of people.

3.5 Right Lines

Even without the belief in Sha Chi, it is easy to see that the West Line is in contrast to the more natural borders. Most borders between towns, colonies, and even countries are made by rivers, mountain ranges, the edge of a forest, or some other easily identifiable landmark. These geographical features never follow a straight line, if viewed on a large enough scale Thus it can be seen that this line, with its perfect straightness, is not only something that divides a people, but is also a scar in the Earth that goes against any division found in nature. There is no way for the average person to know where the 39°43′N parallel is, and therefore the party must create the visto. In doing so, they place heavy stone markers every mile, and chop down thousands of trees to make a noticeable path for marking their line. Without considering the theological and symbolic effects of the line, it is easy to see that the destruction of nature associated with the creation of the line begins the line on a negative note.

Pynchon makes his view on the negativity of right lines obvious from the start. Even before Mason and Dixon leave for America, Pynchon claims that right lines go against nature, saying "the Flow of Water through Nature… might be re-shap'd to drive a Row of

Looms, each working thousands of Yarns in strictest right-angularity,— as far from Earthly forms as possible,—… ev'ry stage of the 'Morphosis, would have its equivalent in Pounds, Shillings, and Pence" (*Mason and Dixon,* p. 207). Here, he not only claims that right angles are completely removed from the natural, but he associates each alteration of nature with a financial cost. By linking government-controlled money to this unnatural and negative process, he is creating a dark outlook on authority and commerce as well as scientific technology.

Most importantly, however, right lines, such as the West Line, are created to more accurately define borders between people. Before the Mason-Dixon Line, there was an area along the edge of Maryland and Pennsylvania that was essentially shared and ungoverned. People on this land were symbolically a part of both colonies, and part of a much more unified nation. However, once the Line was drawn, every person knew whether he was a member of Pennsylvania or Maryland, and none were considered part of both colonies. As such, America was a much less unified country and instead a separated and demarcated set of individual groups of people. This reduced the unification of the people and enhanced the idea that each person was separated from those around him, and yet governed by the same major body which held a strong control over its people.

3.6 Fantastical Subplots

As the novel progresses, the main storyline becomes heavily laden with subplots, many of which contain elements of pure fantasy and science fiction. Many of the stories

tend to blur the line between actual scientific technology and science fiction, such as a story wherein a professor attaches wires to the head and tail of an electric eel and uses them to light his cigar.

3.6.1 Jesuits in Mason and Dixon

Throughout the novel, Pynchon creates a great deal of suspicion towards the Jesuits. They are seen as an occult society attempting to infiltrate the expedition and enforce their own agenda. As an elite intellectual group, they were also prominent inventors of the time. Pynchon plays with this idea, introducing several inventions that balance on the border between possible and science fiction. There are many minor inventions, such as an air pump used to blow glass into a sphere the size of a barn for the Lepton Castle dining room, and a coffee mug or thermos. The main invention, however, is a telegraph described as a 5x7 lattice of lights which can be used to signal other stations from a great distance.

The view of the Jesuits as an advanced scientific society, with technology more similar to the 20th century than the 18th, allows Pynchon to create a negative view towards science, when coupled with their suspicious behavior. The Jesuits are hinted at many times, and halfway through the novel is a strange narrative of a woman who is kidnapped and then taken to a cult-like camp in Quebec, composed of a combination of Chinese, Spanish, and French Jesuits. Here, the woman meets a lecturer named the Wolf of Jesus, who embodies most of the negatives characteristics attributed to Jesuits in the novel.

The Wolf of Jesus lectures that their agenda centers on imprisonment, stating, "Walls are to be the Future" (*Mason and Dixon*, p. 522). His belief is that, since there is a lack

of faith, love, or even consent willingly given to authority, the solution is to build walls, which "projected upon the Earth's Surface, becomes a right Line" (*Mason and Dixon*, p. 522), which the Wolf of Jesus believes will give him power. He dislikes America because, despite being an open harbor for people of all types, Jesuits like himself could not live an easy life there. This is because the people of the new land are not devout Christians, but instead a melting pot of beliefs. The Wolf of Jesus sees this as heresy, and believes that the amount of work required to correct these theological errors in Americans would leave no time left for what he deems "la Obra." Meanwhile, the students to whom he is lecturing question him on the Chinese ideal of Feng Shui. The Wolf of Jesus dismisses this because it is too easy and therefore is most probably the work of a demon.

The Wolf of Jesus is used by Pynchon to represent many of the negative ideals of the Jesuits. They are seen as an advanced, secretive society of extreme scientific and theological prowess, and yet they are held with a great deal of suspicion and mistrust. Here, their ideals line up directly with those with which Pynchon disagrees. The Wolf of Jesus hopes to separate and control people, specifically with the use of walls which, when placed upon the Earth, form right lines. Pynchon, on the other hand, believes in the hope for an ungoverned yet united people, without the need for borders and right lines. As such, he heightens the suspicion and negative feelings towards the Jesuits in order to create more of a negative outlook towards the Wolf of Jesus's ideals by the reader.

Eventually, the woman being held prisoner by the Wolf of Jesus meets a Chinese man named Zhang, who was also being held captive by the Jesuits. The Wolf of Jesus discovers that Zhang understands Spanish, and is therefore privy to some of their secrets

and must be silenced. The Jesuits decide the best way to do this is by murdering Zhang, and Zhang decides to make his escape with the help of this woman. The two manage to get away and eventually join the West Line party.

Once with the party, Zhang begins to spread fear of the Wolf of Jesus, saying that he could be hiding among the party, pretending to be any of the members of the party. He attests to a secret agenda of the Jesuit society. He claims that the Jesuits feel a need to reconfigure the natural world, and have a goal of imposing right lines upon the Earth in order to gather the energy produced by them. They are therefore very attracted to the idea of the West Line, seeing it as a huge possibility for the gathering of energy and allowing them to advance whatever mission they need the energy for. When coupled with the fact that right lines are viewed as conduits for negative energy, the Jesuit desire for the line points towards Pynchon's negative outlook on the government-created secretive society, and by extension on the government- and corporation-sponsored science and technology of today.

3.6.2 Jenkins's Ear

In the early 18th century, there was a good deal of hostility between Great Britain and Spain. These conflicts heated up as Spanish ships began boarding British mercantile ships passing through their waters. One particular ship belonged to Captain Robert Jenkins, who was boarded by the Spanish Coast Guard and accused of piracy. Jenkins's men were put "to the torture" (Ship News this Month, 1731) and he was relieved of his candles and instruments. His ear was then cut off, coupled with a threat that the Spaniard who did so

would do the same to the King of England if he were to enter their waters as Jenkins had. (Ship News this Month, 1731)

Jenkins delivered this message to the King, along with his severed ear, which eventually led to the outbreak of war between the two nations. This conflict became known as the "War of Jenkins's Ear" and lasted nearly a decade. Pynchon embellishes this historical event, writing about a museum dedicated to the ear. Mason finds his way to this museum, which has an uncomfortably small opening, and is forced to take part in the exhibit. He is asked to speak directly to Jenkins's ear, which is displayed in a glass case. Mason does so, and is informed that the ear is actually listening to them, and can't get enough to hear.

This subplot shows Pynchon's ability to blur the line between fact and fiction. The circumstances, while improbable, are not entirely implausible, and Pynchon uses this as a way to comment on how history is written. While a great deal of history is fact, it is hard to tell when and where embellishments occur.

3.6.3 Vaucanson's Duck

One of Pynchon's biggest embellishments in this novel involves Vaucanson's Duck. In a great moment of scientific achievement, Jacques de Vaucanson created a highly anatomically correct duck, with over 400 moving parts and the ability to both consume food and defecate. This duck was one of the first robots, and was considered a shining example of the glory of French science.

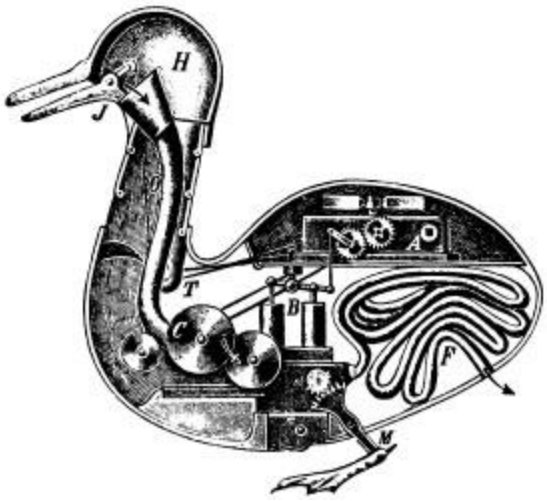

Figure 3.1: Vaucanson's Digesting Duck

This representation of Vaucanson's duck is not an actual diagram of the duck, but rather an American observer's guess as to the possible interior of the duck (Vaucanson's Digesting Duck, 1738).

Pynchon takes this duck one step further, making it a sentient being capable of movement, intelligent thought, and speech. The duck was humiliated by Vaucanson's exhibitions of him, particularly when she was opened up "and show'd to anyone who wish'd to stare (*Mason and Dixon,* p. 668)". The duck is even more offended by the fact that Vaucanson refuses to make a mechanical mate for her, so that she wouldn't be alone. Thus, the duck escapes Vaucanson, and she moves on to terrorize a famous chef renowned for his duck dishes, presumably out of revenge for her brethren. The chef, Armand, was warned to be wary of the duck, since, because of her high maneuverability, she had the ability to kill with her beak. This duck moves so quickly, in fact, that she is invisible to the unaided eye. Yet, while she forces Armand out of his glory in France and into a small American inn, she no longer seems to harbor hatred for the chef. Instead, she appears to have fallen in love

with him, giving Armand a desire to flee her all the same. The duck, along with Armand, joins the West Line visto and become part of the ever-increasing main cast of the novel.

The duck is one of many examples in this novel of factual physics that Pynchon dissolves into the supernatural. For many of these instances, it is difficult to determine the point at which Pynchon makes this transition. To readers unaware of their history, the idea of the mechanical duck itself may seem like fantasy. And while most readers draw the line at the creation of sentient life, many of the duck's acts beyond that point border on the edge between the scientifically possible and impossible. This duck serves as one of Pynchon's vessels for portraying what might have been, had science and imagination in America been given the full freedom it deserved. Instead, however, the scientists of the time, including both Charles Mason and Jeremiah Dixon, are living in the Age of Reason. As such, the two protagonists have a high level of skepticism of the possibility of this duck's existence, even when faced with high level of evidence supporting its presence (such as a dagger being removed from a man's hand when he attempts to stab Armand). Mason and Dixon finally submit to their belief in the duck when, after denouncing claims of her existence, Mason's hat is mysteriously removed from his head and flies high into the sky, only to drop back down to him when he admits he was wrong.

Though they do eventually believe in the duck, it is the protagonists' reluctance that points to Pynchon's true meaning and reason for the duck. These men in the Age of Reason are already readily rejecting imagination and scientific possibilities that do not fall within their own sphere of knowledge and experience. In doing so, they are attempting to define what is possible and impossible and giving up on the latter before fully examining it.

Pynchon has trouble with this point of view, since it is the beginning of the use of science for technological and societal advancement only, rather than for enlightenment. Since scientists are no longer exploring every possibility, like Vaucanson did with his duck and other automatons, they are restricted in the studies they can perform.

3.6.4 Symmes's Hole

Another fantastical idea that Pynchon uses in this novel is the theory of a Hollow Earth. This proposed construction of Earth included two holes at the North and South Poles which led into the inner Earth, though what existed inside was not fully agreed upon. A common belief was that there was life that existed on the inner shell of Earth. This idea became known as Symmes's Hole, after the American man who often spoke publicly on the topic and proposed expeditions to the North Pole.

While it was not a widely accepted belief, it did hold a strong allure for many scientists and adventurers because of the chance of undiscovered lands and possibilities. This belief ties strongly into Pynchon's ideals. He clearly views the Hollow Earth theory as an 18th and 19th century hope for freedom and opportunity. Thus, when Mason, being a scientist in the Age of Reason, denounces the idea as idle fantasy, he is reinforcing Pynchon's belief that science had begun to progress in a direction that stymied imagination and possibilities, and instead focused on government-approved expeditions (such as the drawing of the Mason-Dixon Line).

Towards the end of the novel, however, Dixon goes on a voyage to the North Pole and encounters the entrance to this region. Upon entering, he finds that people can fly and perform magic with the use of "Tellurick Forces, including that of Magnetism," (*Mason and Dixon*, 740), which is apparently just one of the Earthly material-based forces that exist, despite it being the only one recognized by those on the outer surface. Dixon learns that the people of this land are the factual roots of the myths of elves and gnomes. Dixon speaks with a resident that points out two very important ideas that Pynchon places great importance on.

The first idea is that there is a disparity between the residents of the inner surface and the outer surface. Because those on the inner surface are standing on the inside of a sphere, the ground they are standing on is very slightly concave. This means that each person is pointing slightly towards every other person. Therefore, if a line were to be drawn directly up from each person's head, the lines would all converge at the center of the Earth. As such, everyone is drawn slightly more together, and more towards the center of the planet on which they live, which symbolizes a greater unity in the people, an ideal that Pynchon believes in strongly.

People living on the outer surface, in contrast, are standing on the outside of a sphere, which is a convex surface. As such, every person on the sphere is pointing slightly away from all others. Nobody's head is pointing towards the center of Earth, but instead towards the stars and empty space. This imagery of people on the surface of a sphere symbolizes not unity, but instead an individualism of each person, as if in standing up straight a man is declaring his independence from those around him. This separation of

each man from his fellows strikes a strong dissonance with Pynchon's beliefs, and his use of Symmes's Hole proves to further drive the main themes of this novel.

The second idea is that the land beneath the surface of Earth only exists because its existence has not yet been disproved and thrown out by scientific calculations. Dixon is informed by a resident of this land that "once the necessary Degrees are measur'd, and the size and weight and shape of the Earth are calculated inescapably at last, all this will vanish. We will have to seek another Space" (*Mason and Dixon*, p.741). Because the people that live in this land live on their concave surface, they are unsure if they will be able to handle the individualism of living on the outer surface of the Earth. Therefore, the future of their existence is unknown.

Because Pynchon describes these men with such positive ideals and advanced scientific knowledge (including a telescope capable of seeing any location within the sphere, even directly across, with utmost clarity), it is clear that they are intended to represent positive ideals and a good, strong community. Thus, when it is made clear that the Royal Society's scientific expeditions will eventually destroy the existence of these people's homeland, the expeditions are no longer positive advancements of society, but instead systematic reductions of imaginative possibilities.

The Royal Society is determining exactly where and how scientists will perform their work, as well as to what purpose. They choose which astronomers get to go to which locations and use them as data-collecting tools. While the observations of the Transit of Venus showed a great deal of scientific collaboration, it was all planned out specifically by the Royal Society in order for them to gather the information they needed to determine the

size of the solar system. Most of the astronomers that went out on expeditions to view the Transit of Venus did not take part in the calculations that came after the fact, and instead served only to collect the data for those calculations. Pynchon views the Royal Society's take on science as a situation wherein a small group of people have a level of control over a much larger group, which is a situation that goes against Pynchon's ideals. As such, he portrays the Royal Society's scientific advancements as methods of destruction for the potentially utopian society living on the inner surface of the Earth.

4 Background

4.1 Instrumentation

Throughout Mason and Dixon, Thomas Pynchon makes many references to the scientific instrumentation used during the expeditions described. While many of the instruments used are commonplace and widely known, such as the telescope and compass, there are some that are of a more specified use and therefore more obscure to the common reader. Pynchon writes about the detailed use of some of this equipment in order to further establish the scientific ground for the novel, making it more historical and allowing him to make comments on the scientific history of the expedition, rather than just about the surveyors.

4.1.1 Plumb Line

A plumb line, or plumb bob, derives its name from the word "plumb," which is the quality of being perfectly vertical. The device involves a long string with a weight on the end, the bottom of which is pointed in order to more easily divine the point directly below, or the nadir of, the instrument.

Figure 4.1: Plumb Line

This device is often pointed at one end in order to more explicitly show the nadir of the location of the observer. (Photograph of Plumb Line)

A plumb line, like the one shown in Figure 4.1 above, is particularly useful for making measurements on any inclined surface, since the perpendicular to the ground does not point directly up and away from the center of the Earth, towards the zenith, but is instead offset from the true vertical by the degree of inclination. The plumb bob is usually lowered to about ¼ – ½ inches above the ground to mark the location of the survey point (Brinker & Minnick, 1995). When Mason is on the island of St. Helena with Nevil Maskelyne, the latter questions the accuracy of measurements made using his plumb line out of concern of the nearby mountains. By the mid-eighteenth century, the idea that all objects with mass gravitational attract each other was well known, though the Cavendish experiments for the

calculation of these quantities would not occur until the end of that century. This effect, however, means that an object of large enough mass, in this case a mountain, could have a very small but quantifiable effect on the plumb line, pulling it slightly towards the mountain. As such, corrections must be made for this effect in order to obtain sufficiently accurate measurements.

4.1.2 Zenith Sector

A zenith sector is a telescope that is designed to look 180 degrees away from the nadir, or towards the zenith. By slowly adjusting leveling screws on the sector, the telescope can be pointed towards the zenith with a high level of accuracy (Wilford, 2000).

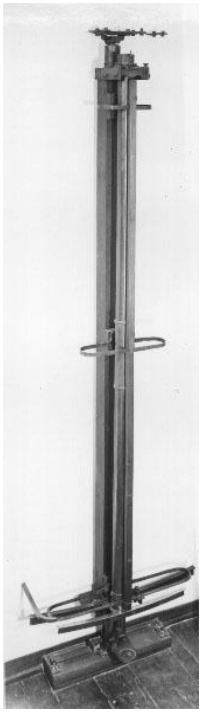

Figure 4.2: Zenith Sector

This telescope is used to directly view the zenith in order to determine the observer's geographical location based on the stars above. (Photograph of John Bird Zenith Sector)

Mason and Dixon used a zenith sector built by John Bird, one of the most respected instrument makers of the time and creator of the one shown in Figure 4.2 above, in their plotting of the West Line. This telescope measured roughly six feet tall, and, as it could not be raised, required the two to lie on their backs in order to use it (Linklater, 2002). In combination with star charts which showed how the stars above would change based on latitude and date, they used this sector as a way to measure the exact latitude of each location. Since the Earth moves relative to the stars, the stars appear to be moving westward. By carefully and repeatedly viewing a number of stars at each location and observing the time at which they crossed the meridian, Mason and Dixon were able to determine the exact latitude of their location at the time of observation, and correspondingly move the party north or south to compensate. (Wilford, 2000)

4.1.3 Gunter's Chain

In order to take horizontal measurements and move the line westward, the party included a number of men devoted to the duty of laying out a Gunter's chain of 66 links, each measuring 7.92 inches (The Cassell English Dictionary, 1990). Normally, chains are made up of 100 links, totaling 66 feet, or four rods.

Figure 4.3: Gunter's Chain

A Gunter's chain is a surveying tool of regulated length used to measure distances. (Photograph of Gunter's Chain, 2003)

This chain, shown in Figure 4.3 above, was carefully laid out on level ground and used to determine the exact distance they had traveled along the West Line. These measurements were very slow; the ground was not always level (Wilford, 2000). In the case of sloped ground, the chain measurements would be taken along with angular data determined using a surveyor's level. Since hills were not of uniform slope, the angle above the ground of each link along the hill must be taken for maximum accuracy using a level. This work involved a great deal of trigonometry and was very time-consuming. However, this was all done in order to find the flat-ground distance traveled, since changes in elevation were not of any importance for the surveying. This trigonometrically calculated distance gave them numerical data to determine how far west the party had traveled during that day, with

occasional astronomical observations made to verify the chain measurements. (Wilford, 2000)

4.1.4 Astronomical Measurements of Longitude

Astronomical measurements of longitude could be determined using star charts. Since the stars are essentially fixed in the night sky, they make for excellent observation points. The location of stars in the night sky at any point in the year can be determined with a high level of accuracy beforehand. Since the difference in longitude between two points on the globe is directly related to the difference in local time, star charts, which give the location of stars in the night sky on certain dates and times, are very useful in the determination of a location's longitude. (Chiat)

At the time of the expedition, an alternative, though similar, method was also available to the surveyors. Nevil Maskelyne's lunar distance method allowed for fairly simple and accurate longitudinal measurements to be made based on the location of the moon in the night sky. Any observer, when viewing the angle between the moon and a nearby star, calculates the same angle, regardless of location. After corrections are made for parallax, an observer can compare this angle with a lunar chart listing the relative angles as observed in Greenwich to determine the local time in Greenwich. By comparing that with the local time of the observer, it is possible to calculate one's longitude. This method was particularly popular because it required only a quadrant or sextant and an almanac, both of which were relatively cheap at the time. (Norie, 1828)

4.1.5 Surveyor's Quadrant

The surveyor's quadrant (along with the sextant and octant) was a device used for the measurement of angles. The instrument was a full quarter of a circle, heavily graduated with marks and lines in order to precisely determine the angle between points of interest.

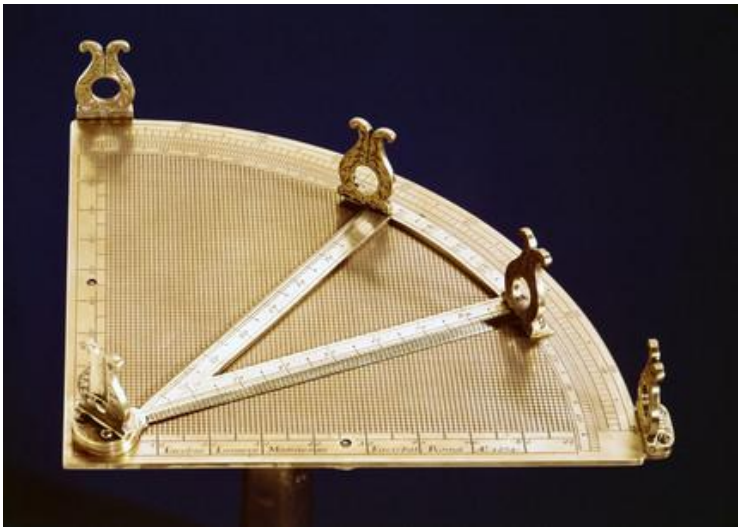

Figure 4.4: Surveyor's Quadrant

This tool was used for measuring the angle between two objects from the observer's location. (Surveying Quadrant, 1674)

As shown in Figure 4.4 above, this device often included several sights through which a surveyor may look. There were also moveable sights in the middle which allowed a surveyor to carefully line up distant objects for more precise measurements. In the case of multiple moveable sights, they are often rigidly fixed at a certain angle with respect to each other for faster measurements of more common angles. (Surveying Quadrant, 1674)

4.1.6 Sector

A sector, not to be confused with the zenith sector, is an invaluable instrument to a surveyor. It is a device used to make many different calculations quickly without bringing a book full of look-up tables and functions. It is used as a fast and accurate way to take square and even cube roots of common numbers, and to perform trigonometric calculations. This device is fairly complicated in practice, and as such, a surveyor must be taught how to use it and spend a good deal of time familiarizing himself with it before he can make the fast, on-site calculations of which the device is capable.

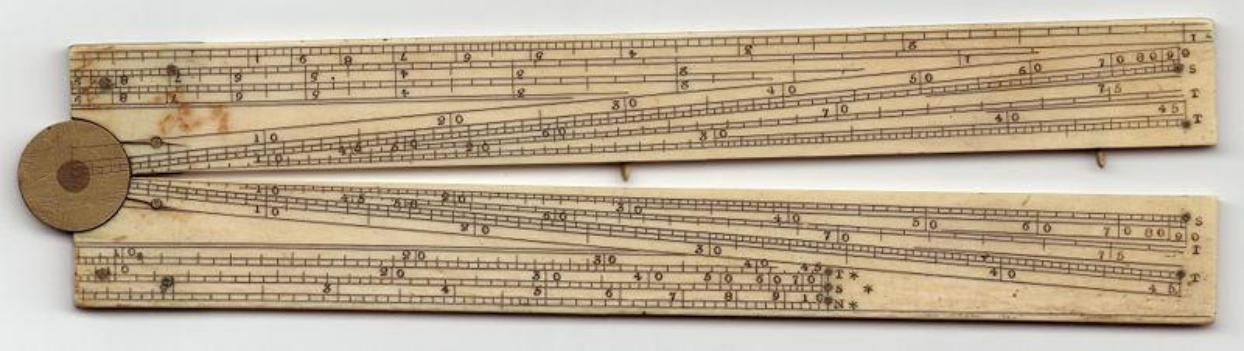

Figure 4.5: Sector

A sector is a tool used to quickly make calculations in several fields of mathematics relating to surveying. (Compas de Proportion)

As shown in Figure 4.5 above, a sector involves two rulers, each heavily graduated with diverse scales, joined together by a circular hinge. This device can often be used to measure angles if a surveyor's quadrant is unavailable. (Heather, 1871)

4.2 Important Figures in Mason and Dixon

4.2.1 Charles Mason and Jeremiah Dixon

Charles Mason and Jeremiah Dixon are the two main protagonists of this novel. Though each has done his own separate work, the two are most notable for the two expeditions laid out in Pynchon's novel. The first is their viewing of the 1761 Transit of Venus, wherein they managed to take particularly good observations due to ideal weather conditions. The pair was originally supposed to travel to Sumatra for these observations, but instead viewed the Transit from the Cape of Good Hope after an attack by a French warship delayed their passage. These observations were later used to determine the Earth's orbital radius about the sun. (Charles Mason)

Mason and Dixon are most famous for the series of lines they surveyed in order to determine the borders between Pennsylvania, Delaware, Maryland, and Virginia. Because the land granted to Pennsylvania and Maryland left some of the border lands as belonging to both colonies, new, official borders were required. Mason and Dixon were chosen to survey these lines, which were broken down into four segments. The longest segment, known in the novel as the "West Line," was a line along the latitude line that intersected a point 15 miles directly south of the southernmost point in Philadelphia. (Danson, 2000)

A second segment required the two to first map a twelve-mile radius circle drawn about the major city of Delaware: New Castle. Before their work, there existed a surveyed line known as the "Transpeninsular Line" in southern Delaware. The second segment of

Mason and Dixon's line involved drawing a "tangent line," a line that touches the circle at exactly one point, to the western half of their twelve-mile circle that intersected the middle point of the Transpeninsular Line. This part was particularly hard, because any error in finding the middle point of the Transpeninsular line would result in a significant change in the location of the tangent point, changing the entire geometry of the line. (Danson, 2000)

From this tangent point, the third segment involved surveying a line directly north that intersects the West Line. (Danson, 2000)

It was determined that any part of the twelve-mile radius circle that fell to the west of this northerly line would also be a part of Delaware, and as such the final segment of Mason and Dixon's line required them to survey that part of the circle (Danson, 2000). These lines, known collectively as the "Mason-Dixon Line," eventually served to symbolically divide the United States of America into the North and South, separating the Free states from the slave owning states. (Mason-Dixon Line)

4.2.2 James Bradley

Charles Mason's mentor James Bradley served as the third Astronomer Royal, which placed him as the director of the Royal Observatory in Greenwich. Bradley grew to fame in his discovery of the aberration of light, a physical phenomenon that can be attributed to the finite speed of light. If an observer is moving relative to a light source, the light's apparent position is offset from its true position. This is because the observer has changed his

position relative to the source during the time it takes for light to travel from the source to the observer. (James Bradley)

Bradley made his discovery during an attempt to observe whether or not stars had detectable parallaxes, wherein he viewed a particular star on several nights in December 1725. Bradley noticed that with each night of observation, the star appeared slightly more southerly (along the order of about one half second of arc) than it had the previous time. He continued these observations and noticed that the star continued to move south until March, when it began to slowly move back north, returning to its original position in June, about half a year after the first observation. This apparent motion of the star is due to the aberration of light, since the Earth (and as such, any observer on the planet) changes its velocity during its orbit. (Hirschfeld, 2001)

Bradley's discovery helped to solidify two major scientific ideas at the time: the Copernican heliocentric theory and Ole Rømer's discovery of the finite speed of light. Our solar system could not be geocentric, since the observed aberration required Earth's velocity to be non-zero and changing, with equal and opposite velocities every 6 months and repeating velocities every year (which conveniently fits the heliocentric model). Likewise, since the same star had different apparent positions as Earth's velocity changed, light must not be able to travel instantaneously. (Hirschfeld, 2001)

After achieving the post of Astronomer Royal, Bradley announced his second major discovery: the nutation of the Earth's axis. During the Earth's precession of the equinoxes (think of a top spinning about at an angle), which takes about 26,000 years, Earth's rotational axis tends to rock or sway. This is known as the axis's nutation, and it is due to

the relative positions of the sun and moon in relation to the Earth. Since each of the massive bodies pulls on the Earth with appreciable gravitational forces, their changing relative positions push and pull the Earth's rotational axis back and forth slightly. (Bradley, 1748)

These two discoveries were extremely important for the future of astronomy, as they pointed out a pair of major issues that could cause discrepancies in observations. Because of Bradley's discoveries, corrections could be made for differences in observations due to the time between the observations.

4.2.3 Nevil Maskelyne

The fifth English Astronomer Royal, Nevil Maskelyne, also plays a prominent role in Pynchon's *Mason and Dixon.* Maskelyne had attempted to view the 1761 Transit of Venus from the island of St. Helena, but was unable to make any observations due to inclement weather. However, it is on this island that Maskelyne made the discovery for which he is most well-known. (Nevil Maskelyne)

At the time, the determination of longitude at sea was a major issue, since heavy fog obscured the surrounding land, causing ships to crash into rocks because the accuracy of their longitude measurements left their distance from land unknown. Maskelyne proposed a method of determination of longitude using the position of the moon. Maskelyne would calculate lunar distances for the following year and publish these values in a nautical almanac, which could then be used as part of a series of calculations to determine longitude. Once he was Astronomer Royal, Maskelyne made his observations from the

Greenwich observatory, which led to that location's choice as a common base for longitudes, the Prime Meridian, a century later. (Sobel, 1995)

This lunar method was not as accurate as Harrison's Chronometer, which eventually won the Longitude prize. However, because of the Board of Longitude's bias towards scientific solutions, Harrison's Chronometer was not immediately the victor. When Maskelyne rose to his position as Astronomer Royal in 1765 after the deaths of Bradley and Nathaniel Bliss, which put him on the Board of Longitude, he opposed Harrison, considering his own method much better. The Board's bias was heavy enough that Harrison was declared the victor only by an Act of Parliament. Even though Harrison won the Longitude prize in the end, Maskelyne's almanac was much cheaper and therefore used more often in the following century. (Gould, 1923)

Maskelyne also gained fame for his attempt to determine the average density of the Earth by way of the Schiehallion experiment. This experiment is named after the Schiehallion Mountain on which it was performed, which was chosen because of its nearly regular conical shape. This method involved the determination of the difference in latitudes on two sides of the mountain using a plumb line, and comparing that observed value with the true latitude difference determined beforehand. Maskelyne used the plumb line to align his zenith sector and take over 150 observations on each side of the mountain in order to determine a highly accurate observed latitude. (Poynting & Thomson, 1894) This difference in latitude is related to the relative densities and volumes of the Earth and the mountain, which allowed Maskelyne to estimate the density of Earth at $4.5\frac{g}{cm^3}$, differing from the true value by only about 20%. (NASA, 2010)

4.3 Scientific Concepts

4.3.1 The Transit of Venus

The Transit of Venus is a recurring astronomical phenomenon wherein Venus crosses between the Sun and the Earth in its orbit. This event occurs in a nearly regular pattern that separates transits by small eight year gaps, separated alternatively by much longer gaps of 121.5 and 105.5 years, for a total cycle of 243 years (Dick, 2004). Since the Earth completes one orbit every year, it returns to very nearly the same position every 365.25636 days. In 243 years, or 88757.3 days, Earth will be in the same position as it is now. The reason for the regularity of the Transits of Venus is that in roughly the same amount of time, despite the much shorter orbital period of Venus (224.701 days), Venus will also return to the same position as it is now. This is because the time it takes for Venus to orbit the Sun 395 times corresponds to a period of 88756.9 days, differing from 243 Earth years by less than half a day. (Westfall, 2003)

During the Transit of Venus, an observer on the Earth sees the planet as a dark obscuration, like a small black dot tracing a chord across the Sun. The progression of Venus across the Sun usually takes several hours, and as such it is easily observable and the time of transit is measurable. The first scientific observations were made in the Transit of 1639; however, it was not until the Transit of 1761 that the event was met with a high level of scientific attention. Scientists were sent to all parts of the globe to observe this phenomenon in the hopes of obtaining measurements from many different latitudes in one

of the first international scientific collaborations. These measurements, when armed with the idea of parallax, would lead to an accurate approximation of the Earth-Sun distance, shedding light on the size of the entire solar system. Charles Mason and Jeremiah Dixon are renowned for their superior observations made at the Cape of Good Hope in South Africa. (Pannekoek, 1961)

4.3.2 Parallax

For the 1761 observations of the transit of Venus, it was necessary for Mason and Dixon, and likewise all other astronomers taking data for the event, to determine their exact latitude and longitude. The reason behind this follows from the same scientific concept that required so many astronomers, in one of the greatest international scientific collaborations of the time, to view the event simultaneously from different geographical locations: parallax. Parallax is the idea that an object, when viewed from two different locations, appears to change in position relative to a common background. Parallax can be easily demonstrated by placing a finger in front of your face and looking at the finger with one eye at a time. When the position of the finger is taken against a common background using the left eye only, it appears further to the right than when viewed with the right eye. This effect is more noticeable if the object being observed is closer to the observer than to the background.

Armed with this concept of parallax, the observers of the transit of Venus in 1761 were able to estimate the size of the solar system. At the time, the observations of Johannes Kepler were already well known. This includes his third law, which states that the cube of

each planets orbital radius, when divided by the square of the period of their orbit, is a constant. Since these periods can be observed fairly easily, the radii of planetary orbits are all known in terms of this constant. If two astronomers on Earth were to view the transit of Venus simultaneously from widely separated latitudes, each would see Venus tracing a different path across the sun because of parallax, as shown in Figure 4.6 below.

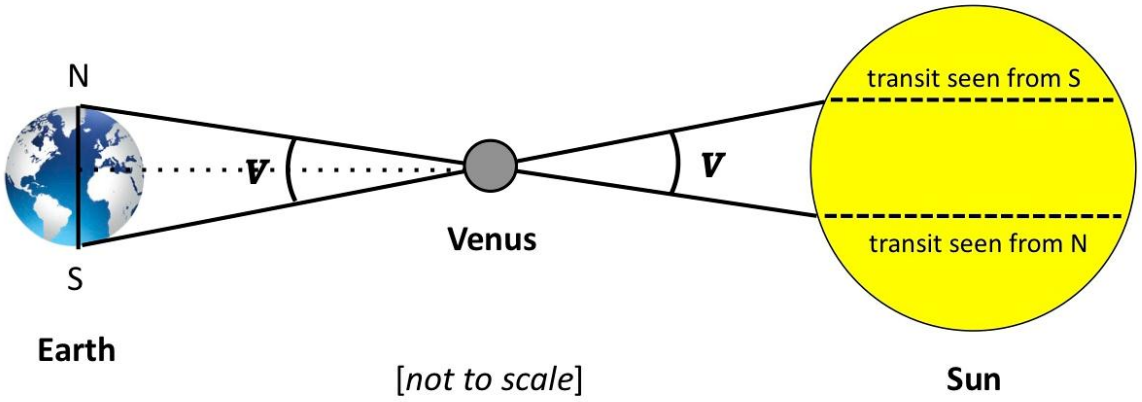

Figure 4.6: Transit of Venus

The two observers see Venus trace a different path across the sun, the difference of which yields the parallax angle which is determinable by observation, here denoted as V. Because of the symmetry of the system, the angle V is the same on both sides of Venus. (Nelson, 2011)

The astronomers were able to measure the difference in angle between these two paths, above denoted as V, and as such they can create a triangle between Venus and each observer's location. Alongside their observations of the Transit of Venus, each observer also took many measurements of their own location. As such, the distance between any two astronomers' points of observation, above denoted as N and S, can be determined. Because the distance between Earth and Venus is much greater than the distance between any two points on Earth (by over 3000 times when the observers are as far apart as possible), the

angle V is extremely small. As such, small angle approximations may be used which greatly simplify the trigonometry involved, such that only the angle V and the distance between the two observers is needed to determine the distance between the Earth and Venus. Since Venus was known to be about .723AU from observation and application of Kepler's Third Law, where 1 AU is the Earth-Sun distance, then the distance between the Earth and Venus could be used to easily determine the distance between the Earth and the Sun. This value allowed astronomers to make approximations to the size of the solar system as a whole.

5 Conclusions

In *Mason and Dixon*, Thomas Pynchon manages to weave events and characters into the lives of the two famous astronomers which transform the historical novel into a bold statement on the scientific practices and technology of the 18th century and today. Pynchon build off of historical facts of that time period to create fantastical situations that display the imaginative and creative opportunities that existed in the unexplored and untainted lands of America. Pynchon's belief was that America held a great level of possibility with the discovery of ungoverned land, and he saw it as a place of the truly subjunctive. However, Mason and Dixon, acting in compliance with orders from the British government, set out and created a right line through the center of America. This line served to divide the people of this land and create an unnatural border that gave the rulers of Maryland and Pennsylvania a more discrete control over their people.

This marked the beginning of what Pynchon believes to be the loss of his hope for a land of freedom and possibility. The Mason-Dixon Line formed a scar through nature, causing damage to the individual by allowing those in power to gather more power over the subjects. Pynchon disagrees with this heightened level of governmental control, and instead hopes for the freedom and possibility expressed by Vaucanson's Duck and Symmes's Hole.

Pynchon is not entirely without hope, however, and expresses in the ending of the book an opportunity for the future. As Mason is dying, he and his family move to America.

And though Mason was a true man of the Age of Reason, and although he took part in the creation of the line that serves to separate northern and southern America, his children hold a hope. To end the book, two of his sons speak of a fascination with the Indians, both their natural and magical ways. Thus, Pynchon believes that, although science and technology have been pursuing the wrong path in the past, there is a chance that the future of science can restore the imagination and inventiveness that used to exist in its practice.

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