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Tom Stoppard: Humanizing Chaos

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FLORIDA INTERNATIONAL UNIVERSITY

Miami, Florida

TOM STOPPARD: HUMANIZING CHAOS

A thesis submitted in partial fulfillment of the
requirements for the degree of

MASTER OF ARTS

in

ENGLISH

by

Elaine C. Pritzker

2011

To: Dean Kenneth Furton
College of Arts and Sciences

This thesis, written by Elaine C. Pritzker, and entitled Tom Stoppard: Humanizing Chaos, having been approved in respect to style and intellectual content, is referred to you for judgment.

We have read this thesis and recommend that it be approved.

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The thesis of Elaine C. Pritzker is approved.

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Florida International University, 2011

DEDICATION

I would like to dedicate this thesis to my parents – for instilling in me the importance of intellectual curiosity, and the powerful beauty of the written word. I would also like to dedicate this thesis to Josh. Thank you for being my constant, patient audience and sounding board throughout this process.

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I would like to thank my committee for guiding me through this process, and assisting me in creating order out of disorder. Dr. James Sutton's class was the impetus for my thinking and without his encouragement I could not have made it to this point. Dr. Asher Milbauer was a constant source of information and kept me bureaucratically in line. Dr. Richard Schwartz was an excellent outside reader, pushing me towards specificity, clarity and accuracy. Finally I would like to thank my major professor, Dr. Michael Gillespie. From the beginning, his confidence in my abilities and his guidance gave me the courage to attempt this project.

ABSTRACT OF THE THESIS

TOM STOPPARD: HUMANINZING CHAOS

by

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Florida International University, 2011

Miami, Florida

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The purpose of this study was to critically evaluate Tom Stoppard's application of chaos theory and quantum science in ROSENCRANTZ AND GUILDENSTERN ARE DEAD, HAPGOOD and ARCADIA; and determine the extent to which Stoppard argues for the importance of human action and choice.

Through critical analysis this study examined how Stoppard applies the quantum aspects of: (1) indeterminacy to human epistemology in ROSENCRANTZ AND GUILDENSTERN ARE DEAD; (2) complementarity to human identity in HAPGOOD; and (3) recursive symmetry to human history in ARCADIA. It also examined how Stoppard excavates the complexities of human action, choice and identity through the lens of chaos theory and quantum science.

These findings demonstrated that Tom Stoppard is not merely juxtaposing quantum science and human interactions for the sake of drama; rather, by excavating the complexities of human action, choice and identity through the lens of chaos theory and quantum science, Stoppard demonstrates the fundamental connection between individuals and the post-Newtonian universe.

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INTRODUCTION

I accept chaos. I'm not sure whether it accepts me.

Bob Dylan¹

In October 1989, Tom Stoppard gave a lecture at the California Institute for Technology entitled 'Playing with Science.' During this lecture, Stoppard argued that although his knowledge² of science was general, he grasped it well enough to apply it as a metaphor (Nadel 457). It is in this spirit that the current thesis is proposed: Through his application of chaos theory, Tom Stoppard argues for the importance of human choice and action in the universe, and thereby foregrounds human will as a fundamental part of the chaotic universe and not merely subject to its whim. Stoppard intuitively connects a connection between the characteristics of human identity and modern science. Uncertainty, unpredictability, indeterminacy, complementarity and the ultimate fate of the universe are of the utmost importance not only for chaoticists in a cosmic sense, but also for individuals in their daily lives. The proverbial flap of a butterfly's wing has as much impact as a person's decision to take a cab and the ramifications of each are just as unpredictable. Although both are seemingly inconsequential occurrences, chaos theory and experience tell us that both have incalculable and unpredictable potential

¹ (Anderson 98)

² In *Tom Stoppard: A Life*, Nadel explains, "the principle source of Stoppard's understanding of chaos theory was James Gleick's *Chaos*... Gleick provides a clear exposition of chaos not only in terms of scientific advances but in terms of the individuals who understood, often tangentially or accidentally how a science of chaos might exist" (Nadel 431).

ramifications. While the clock-work universe took the responsibility of action from the individual, chaos theory emphasizes the potential effect (and therefore inherent responsibility) of human action.

It is the anxiety over the realization that there is no longer a predetermined course that Stoppard dramatizes in *Rosencrantz and Guildenstern are Dead*.³ He does not do so in order to suggest that their (or our) existence is meaningless or out of their control as previous critics have argued.⁴ In *Rosencrantz and Guildenstern* Stoppard emphasizes the importance of action, and the ultimate responsibility of the individual for his or her action, even in a world that cannot be predicted. Foolishly relying on a predetermined system leads to apathy and indolence, paralyzing any inclination towards autonomous action. In *Rosencrantz and Guildenstern*, Ros and Guil's inaction leads to their own quiet fate.

In *Hapgood* and *Arcadia*, Stoppard takes a more direct approach by infusing the very structures of his plays with chaos theory and quantum science. *Hapgood* exhibits qualities of complementarity and questions the nature of identity. *Arcadia's* plot structure depends on recursive symmetry, strange attractors and human action for its movement and development. In both plays Stoppard foregrounds relationships and sex, exploring the many ways in which our actions are informed by them. Stoppard is not merely juxtaposing quantum science and human interactions for the sake of drama; rather by

³ Because this thesis argues that the characters in Stoppard's play are distinct from their Shakespearian predecessors, I will refer to the characters from the former as Ros and Guil and from the latter, as Rosencrantz and Guildenstern. In the interest of brevity, I will refer to the play by the shortened title: *Rosencrantz and Guildenstern*.

⁴ Like Paul Delaney, Douglas Colby and June Schlueter.

excavating the complexities of human action, choice and identity through the lens of chaos theory and quantum science, Stoppard demonstrates the fundamental connection between individuals and the post-Newtonian world.

A Brief History of Quantum Science and Chaos Theory

According to classical physics (developed primarily from Sir Isaac Newton's theories)⁵ the world functioned as a machine, deterministically propelled by cause and effect. In *Chaos Theory and James Joyce's Everyman*, Peter Mackey describes the "nature-the-machine" model as a clock or an engine.⁶ Composed of parts governed by laws, Nature becomes "wheels within wheels" (Stoppard, *Rosencrantz and Guildenstern* 60).⁷ With this concept engrained in Western civilization, the notion that if it were possible for humans to somehow discover the underlying causes, to "pick the lock of Nature", it would also be possible to chart all future events.⁸ Mackey exposes the inevitable problem with this view of the world:

⁵John Gribbin describes the power of these theories: "[l]argely on the strength of Newton's justified reputation as the greatest scientific genius, in the 18th century, his ideas about light, as well as his laws of motion and theory of gravity were widely regarded as gospel" (Gribbin 41). Gribbin further claims that Newton "established the first scientific paradigm, or model, of reality. This showed that the Universe obeys precise rules, or laws, and that events as different as the motion of the planets around the Sun and the bending of a light beam can be explained by the application of these rules" (Gribbin 46).

⁶ Gribbin depicts it as: "[t]he image handed down to us by the giants of 17th century science... 'clockwork Universe,' obeying inexorable laws" (Gribbin 46).

⁷ In the interest of space, further citations from this source will be identified by the abbreviation: *RG*.

⁸ An example of this is the famous boast by Pierre Simon de Laplace, one of the leading mathematicians of the 18th century. He famously boasted that "given the initial conditions and intelligence large enough to perform the calculations, he could predict the

It inspires us – if intuitively – to trust that we can break the code of nature... No matter how daunting the challenge, our knowledge, our epistemology, can accurately define the metaphysical nature – the real qualities – of the world itself. From this concept arises universal determinism, which says *everything* is predetermined... The determinism, however, leaves us in a depressing condition if we want to believe in our own freedom (Mackey 3).

As Mackey posits, prediction is possible in the determined Newtonian world, therefore free will and autonomous human choice and action become subject to the same predictable system. This idea of determinism becomes so engendered in Western civilization that even once scientific findings began to indicate that the binary of cause and effect that constituted the mechanical world was insufficient, members of the scientific community, Einstein included, were deeply skeptical.⁹

With the proposal of the second law of thermodynamics in 1853, William Thompson shook the Newtonian world with the realization that in the universe the level of disorder is constantly rising and the amount of potential energy is steadily diminishing. Before the second law of thermodynamics the clock work Newtonian universe ticked

state of the universe at any future moment” (Hayles 7). As Ian Stewart explains, “[w]hat we must realize, when considering statements such as Laplace’s is the atmosphere of excitement that prevailed in the science of the time, as phenomenon after, phenomenon – mechanics, heat, waves, sound, light magnetism, electricity – was brought under control by the self same technique. It worked. The paradigm of classical determinism was born: if the equations prescribe the evolution of the system uniquely, without any random external input, then its behavior is uniquely specified for all time” (Stewart 14).

⁹ As Gribbin states, Einstein’s two theories of relativity are considered part of classical physics. This explains why “Einstein spent ten years of his life fighting a friendly running battle in correspondence with Bohr, trying to show up the failings and absurdity of the Copenhagen Interpretation” (Gribbin 19).

merrily on, never running down. The inevitability of disorder in isolated systems¹⁰ and the continuous dissipation of energy in the universe¹¹ are two facets of the second law that the nineteenth century world was most startled by. In *Great Ideas in Physics*, Alan Lightman explains the trepidation many felt toward the second law,

Historically, the notion of a stable and unchanging universe has always been appealing, and the second law upset many people, including scientists when it was discovered in the mid-nineteenth century. The second law says that some processes in nature are one-way arrows, never going backward, never returning the world to its initial condition. The machines are running down. The universe, on average, is dissipating itself (*Great Ideas* 61).

The ultimate fate of the universe became known as “heat death,” and the prospect terrified the nineteenth century that had been raised with the stable, eternal Newtonian world. The second law exposed a flaw in the Newtonian clockwork model forcing the world to reexamine some of its most basic assumptions about nature.

Quantum theory sent shock waves through the Newtonian world, shattering the clock work model and destabilizing notions of certainty and perception. In the early twentieth century the world was ushered into an era of uncertainty and indeterminacy both socially, politically, economically and scientifically. At the end of the nineteenth

¹⁰ Alan Lightman explains, “There are many equivalent statements of the second law of thermodynamics: Isolated systems inevitably become less organized; the *usable* energy in an isolated system is constantly decreasing...” (*Great Ideas* 63).

¹¹ Lightman describes this phenomenon: “Heat can be converted to work only for so long, and then the process must come to a halt. Since heat is continuously flowing from hot bodies to cold bodies everywhere in the universe, as expressed by the second law of thermodynamics, the universe is gradually losing its ability to do work. The total store of usable energy is constantly diminishing” (*Great Ideas* 91).

century Max Planck, a leading German physicist, argued that light was not merely a wave (as previously believed) but made up of “quanta” or discrete packets of energy. Through his work with black body radiation, he realized that because quanta can be absorbed and released, they can also change form. Albert Einstein would extend Planck’s discovery in 1905 with his own theory that light does not always behave like a wave – sometimes light behaves as a particle. This wave-particle duality forms the basis of quantum theory and is still one of the greatest enigmas of the quantum world. It was in response to the wave-particle duality that Niels Bohr developed his principle of complementarity. The principle of complementarity states that it is possible for matter to simultaneously exist in opposite states (light, for example, consists of both particles and waves). It also states that the observer, through the act of observation, ultimately effects which state will present itself. The mysteries presented by the wave-particle duality launched an inquiry that would change the face of classical physics forever.

The dual nature of light, along with the emphasis on the impact of the observer, led physicists at the beginning of the twentieth century to attempt to describe this seemingly paradoxical discovery; their work formed the basis of quantum theory. In the 1920s Werner Heisenberg, an assistant to Niels Bohr in Copenhagen, developed a mathematical theory to account for the wave-particle duality. Around the same time Erwin Schrödinger also developed a theory to describe the wave-particle phenomena. Both theories made identical predictions, and together they formed the theoretical basis of quantum mechanics. Heisenberg’s Uncertainty Principle (also known as Indeterminacy) emphasized not only the role of the observer in an experiment, but also the limits on our knowledge and powers of prediction. Rich explains: “Either the wave

amplitudes can be known or the probability of the electron's position can be assessed, but neither the position and velocity nor the amplitude can be known at the same time" (Rich 26). It is impossible to simultaneously measure the position and momentum of a quantum object. This creates an immediate problem because in order to predict the future trajectory of an object both the position and momentum are needed. Because of our inability to measure both of these things, our knowledge of future trajectories will always be uncertain. Uncertainty or indeterminacy becomes a common fixture in the quantum world. The role of the observer allows for a certain amount of prediction; however the act of observing places limits on how much the observer can know – the observer will always be faced with uncertainty.

The phenomenon of the wave-particle duality of light and the role of the observer is most often explained with the example of the double-slit experiment. In a double-slit experiment, light is shown through a screen that has two slits. In one experiment, the observer uses a photon detector to determine which hole the photons traveled through. In the second experiment, the observer removes the photon detector. Our intuition tells us that the results should be the same, whether being observed or not light should pass through the screen the same way every time, but the results suggest otherwise. Alan Lightman describes the role of the observer in a double-slit experiment:

When we don't check the slit each photon goes through, each photon behaves as if it went through both slits at the same time, as a spread-out wave would do.

When we do check, each photon goes through *either* one slit *or* the other and behaves as a particle. Light behaves sometimes as a wave and sometimes as a particle. Astoundingly, and against all common sense, the behavior that occurs in

a given experiment depends on what the experimenter chooses to measure.

Evidently the observer, and the knowledge sought by the observer, play some kind of fundamental role in the properties of the thing observed. The observer is somehow part of the system (*Great Ideas* 200).

The double-slit experiment highlights the two main consequences of wave-particle duality: that observation determines the reality (properties) of matter and that indeterminism is inherent in science. Scientists have an essential inability to precisely predict the future events of a system in part due to the nature of their role as an observer and their inability to disentangle from the object they are observing.

Although Einstein contributed to quantum theory, he resisted the implications of Bohr's and especially Heisenberg's theories. Einstein was not alone in his skepticism, many physicists at the time (and even today) struggled with the implications of quantum theory and our inability to definitively articulate or even know the basic phenomena of the world. Alan Lightman explains, "Many contemporary physicists have essentially given up trying to describe the fundamental elements of nature by anything based on common sense. Richard Feynman has remarked that he can picture invisible angles but not light waves" (Alan Lightman, *A Sense of the Mysterious* 34). It was in fact the indeterminacy inherent in quantum theory that Einstein persistently objected to. He believed that everything should be deterministic and calculable; if it was not then that was an indication that something was missing in the prediction, nothing else. Einstein famously wrote back and forth with fellow physicists (such as Bohr and Born) debating the strengths and weaknesses of the new theory they had helped to create. In a letter to Born, Einstein summed up his feelings towards the quantum question: "The idea that an

electron exposed to a ray by its own free decision chooses the moment and direction in which it wants to eject is intolerable to me. If that is so, I'd rather be a cobbler or a clerk in a gambling casino than a physicist" (*Mysterious* 60). Until his death, Einstein refused to accept the uncertain quantum world and instead worked tirelessly on his own "unified field theory" – a theory which sought to unify the general theory of relativity and electromagnetism. With this theory Einstein hoped to expose the errors of quantum theory and to return the world to its Newtonian days when nature was predictable. Einstein believed in the determinist world and refused to accept that some things cannot be known.

Quantum physics revealed the indeterminacy inherent in the clockwork model and destroyed the pre-quantum notion of a passive observer. From this place of uncertain and indeterminate knowledge, physicists today still try to understand the most basic enigmas of quantum theory. In the twentieth century, uncertainty is not unique to physics however. With the social, political and moral upheavals of the twentieth century, uncertainty has crept into almost every facet of our world. Increasingly, scholars have employed cross-disciplinary tactics to examine issues in their own field. Within the past twenty years, a particular relationship has arisen between quantum theory and literature (most often post-modernism). Quantum theory's emphasis on the power of the observer, the complementarity of identity, the indeterminacy of knowledge, and our ultimate uncertainty in the face of the future has been appealing to a number of literary scholars. In his book *A Sense of the Mysterious*, physicist and novelist Alan Lightman argues for the fundamental connection between art and science:

The ambiguities and complexities of the human mind are what give fiction and perhaps all art its power...Science is powerful, but it has limitations. Just as the world needs both certainty and uncertainty, the world needs questions with answers and questions without answers” (Lightman, *A Sense of the Mysterious* 9, 14).

Lightman notes the common use of metaphors and analogies in both disciplines as a means of negotiating and articulating uncertainty. Katherine Hayles also explores the relationship between science and literature, in her book *Complex Dynamics in Literature and Science* she focuses specifically on the relationship between literature and chaos theory.

Although chaos has traditionally been viewed in science and literature as merely ‘noise’ devoid of order or information, chaos theory (also known as the science of chaos) is based on the discovery that highly chaotic systems are actually rich in information and often exhibit some sort of underlying, though unpredictable, order. Hayles explains, “One of the new science’s remarkable discoveries is that complex patterns emerge when they are mapped into time-series diagrams” (Hayles 8). Chaotic or complex systems depend on strange attractors and recursive symmetry to make sense of the information. Any point in a system that attracts that system to it is an attractor; strange attractor occurs in a nonlinear system. Using Stephen Smale’s baker’s transformation metaphor Hayles explains,

Imagine that the complex layering of dough in a croissant were infinitely thin. Points which started out very close to one another, as the folding and stretching continue, diverge unpredictably. Yet they continue to evolve within a confined

region. This conveys the flavor (so to speak) of how a strange attractor behaves when mapped into phase space. Its strangeness is now apparent, for it combines pattern with unpredictability, confinement with orbits that never repeat themselves (Hayles 9).

Not only were these strange attractors creating order in seemingly disordered systems, but once scientists began looking for them they seemed to be everywhere. From the weather to measles epidemics to cotton prices to dripping faucets – investigators discovered that systems previously perceived to be hopelessly disordered exhibited strange attractors which in turn, indicated the underlying order of the system. Hayles notes, “The pervasiveness of strange attractors was both exhilarating and puzzling – exhilarating because it suggested that the idea had a wide scope; puzzling because it implied that systems which seemed completely different from one another nevertheless had something in common” (Hayles 10). But strange attractors only dealt with specific points in a system and did not seem to indicate *how* these patterns were emerging. While strange attractors are concerned with certain points in a system, recursive symmetry focuses on the general form of a system and the way it is repeated across different length scales. Hayles illustrates the significance of recursive symmetry:

The importance of recursive symmetry to complex systems derives from the kind of perspective required to see the predictability that lies hidden within their unpredictable evolutions. Mitchell Feigenbaum was the first to realize that, although iterating a nonlinear function yielded unpredictable results, the rate at which the recursions occurred quickly approached the limit that proved the universal constant. This constant expresses an orderliness amidst the

unpredictability by showing that large-scale features relate to small-scale ones in a predictable way (Hayles 10).

Recursive symmetry is crucial to understanding the extreme sensitivity of complex dynamic systems to small fluctuations.

Chaos theory does not abolish order, on the contrary, chaos theory affirms the necessity of order in our universe while realizing that disorder is also necessary and between the two the universe generates itself. As Katherine Hayles argues in her book *Strange Attractors*, “At the center of chaos theory is the discovery that hidden within the unpredictability of chaotic systems are deep structures of order. ‘Chaos,’ in this usage, denotes not true randomness but the orderly disorder characteristic of the system” (Hayles 1). Chaos theory defies Western assumptions of chaos as merely order’s opposite. Hayles argues that a pivotal moment in the science of chaos “occurred when complex systems were conceptualized as systems rich in information rather than poor in order” (Hayles 6). Chaos theory repeatedly demonstrated a more accurate depiction and understanding of the world because it took into account the unpredictable as it unfolded along with the predictable. As Hayles argues, “[p]art of the change that the science of chaos has brought about is the recognition that nonlinear systems are all around us, in every puff of wind and swirl of water” (Hayles 17). Stoppard too seems to intuit this and in an endeavor to express the implications of chaos theory for human beings, he dramatizes the inherent similarities between individuals and chaotic systems and in doing so demonstrates the power of human action and choice.

Conclusion

As the science of chaos continues to more accurately explain and describe our universe, the more it becomes a part of our lives. Widely considered a pop-odddity among fringe sciences, chaos has gained steam and validity. So much so that chaos has become a part of our everyday life. Pop culture is smattered with books, movies and television shows that overtly or covertly use/depend on chaos theory or quantum science. Even on an abstract level there is a greater acceptance of chaos and its implications. Academics in the Humanities have since discovered the benefits of adopting the principles of chaos theory for greater interpretive clarity. Though not always rigorously applied, literary scholars have achieved impressive critical arguments (of both past and present texts) by the metaphorical application of chaos theory. Though some remain skeptical of this new relationship between the sciences and the humanities, many see it as natural as the systems chaos theory describes. In fact, the very process of writing is infused with aspects of chaos and the importance of embracing this chaos is becoming increasingly relevant. American universities' pedagogical practices for writing are increasingly geared towards a process based writing practice that embraces the inherent chaos in the process. In his book *Engaging Ideas*, John Bean rejects the outdated 'traditional' view of writing as "formulaic" (the student plugs in facts plus a thesis and yields a paper); rather Bean argues that writing is a process infused with uncertainty and chaos, and rarely develops in an ordered and structured manner. Citing the French word for 'rough draft' *brouillon* (which literally means 'to place in disorder, to scramble', is etymologically related to words for cauldron and vortex) Bean argues: "This metaphor suggests a writing process

that begins as a journey into disorder, a making of chaos out of which one eventually forges an essay” (Bean 16). Order arises out of disorder.

As chaos becomes more and more prevalent in our lives, it is important to understand our own role in a universe driven by chaos. Stoppard puts forward his opinion in *Rosencrantz and Guildenstern, Hapgood* and *Arcadia*. Stoppard argues for the importance of human action and choice, and the complexities of the individual lives that influence them. Although the complexities of every individual are compounded in a chaotic universe they are at least given the hope of influence. Though the results of their actions are unpredictable, they have the freedom to make choices and take action. This freedom is what saves us from being helpless victims of a chaotic universe. We are autonomous agents that create as much chaos as order. As Stoppard demonstrates, the most unpredictable entity in the universe is the individual.

CHAPTER I: SURVEY OF CRITICISM

I am satisfied with the mystery of life's eternity and with the awareness of – and glimpse into the marvelous construction of the existing world together with the steadfast determination to comprehend a portion, be it ever so tiny, of the reason that manifests itself in nature. This is the basis of cosmic religiosity, and it appears to me that the most important function of art and science is to awaken this feeling among the receptive and keep it alive.

Albert Einstein

Rosencrantz and Guildenstern are Dead

When *Rosencrantz and Guildenstern are Dead* was first performed, the National Theatre was taking a gamble not only on a young unknown playwright, but also on an inexperienced cast and director. No one could have anticipated that this rag-tag play would be hailed as “the most important event in the British professional theatre of the last nine years” (Fleming 47). The initial critical response highlighted and emphasized the play’s absurdist or postmodern aspects, which in light of the period in which it was written, seems appropriate. Stoppard however, has flatly denied consciously infusing the play with the existential angst that marks many postmodern texts. He says that his “chief interest and objective was to exploit a situation which seemed to me to have enormous dramatic and comic potential – of these two guys who in Shakespeare’s context don’t really know what they are doing” (qtd. in Fleming 48). Stoppard does allow for an existentialist or absurdist reading while stipulating that, “[i]t has the right combination of specificity and vague generality which was interesting at that time. That’s why, when the play appeared, it got subjected to so many different kinds of interpretation, all of them plausible, but none of them calculated” (qtd. in Fleming 49). This “generosity” of Stoppard to open his text to any number of critical interpretations has only fueled the

debate around the maddening questions of just what exactly *Rosencrantz and Guildenstern* is positing about mortality, fate, and the very nature of truth and identity.

It would be remiss to put forth an interpretation of the nature of Ros and Guil's identity without acknowledging the long, deterministic history of critical responses to this very subject. Many critics point first to the three plays to which *Rosencrantz and Guildenstern* owes a conceptual debt. The first is Shakespeare's *Hamlet* to which *Rosencrantz and Guildenstern* owes not only its plot structure but, as some argue, its sense of the meta-fictional. Like Pirandello's *Six Characters in Search of an Author*, *Rosencrantz and Guildenstern* deals with the relativity of truth and the multiplicity of human personality within the structure of the play-within-the-play. Alongside Beckett's *Waiting for Godot*, *Rosencrantz and Guildenstern* seems to draw many parallels not only between the comic business that takes place in both, but also chance seemingly direct parallels between the characters (Estragon and Rosencrantz; Vladimir and Guildenstern). Critics have also argued however that despite these connections to established literary canon, *Rosencrantz and Guildenstern* lacks a certain aspect which fails to make it literary and confines it to the theatrical. Felicia Londré goes so far as to argue that *Rosencrantz and Guildenstern* simply does not hold up as literature and should be appreciated as it was intended, on the stage.

Critics unable to reconcile themselves with the literary inconsistencies in *Rosencrantz and Guildenstern* point to the intellectual aspect of the play as being both its virtue and its vice. Normand Berlin makes the argument that *Rosencrantz and Guildenstern* only functions on the intellectual level, making it a critical exercise for Stoppard and the audience, but in the same stroke undermining the tragedy. Richard

Allen Cave on the other hand does not find the “parody” destructive (in the sense that it is “elevated to the status of high comedy”), but he does fault the lack of imagination that Ros and Guil must possess as an “ethical failing” of the play. David Cowart asserts that this idea of illusion that Stoppard toys with throughout *Rosencrantz and Guildenstern*, is not merely his method but his subject. However for Cowart the relationship that develops between *Hamlet* and *Rosencrantz and Guildenstern* becomes “inimical to tragedy” and as Berlin argued, ultimately eradicates tragedy as it was “classically conceived.”

The relationship between *Hamlet* and *Rosencrantz and Guildenstern* has focused much of criticism on the meta-fictional aspects of the play, particularly the way in which Ros and Guil function as characters. On the basis of the meta-fictional nature of the text many critics have drawn metaphysical conclusions. Douglas Colby makes two bold arguments in regards to the play’s metaphysical implications. He argues first that because they are characters they have no will power and are therefore spiritually dead. His second argument is that the meta-fictional nature of the play suggests that the audiences are not only characters in a larger cosmic drama but are also spiritually dead. June Schlueter does not argue for the spiritual death of the characters and the audience, but she does agree that Ros and Guil are characters and therefore are only obligated to perform. Indeed Schlueter later argues in “Postmortem” that Stoppard creates the “illusion of freedom” but ultimately Ros and Guil are bound to the “tyrannical power of the script.”

The seemingly mystical way in which Ros and Guil are propelled through *Rosencrantz and Guildenstern* has sparked a great debate around the idea and function of “design” in the play. In a world with wheels within wheels, Ros and Guil are caught with no apparent agency in or understanding of the world through which they are moving.

Through the metaphor of a game, Jenkins argues that the world only appears absurd when viewed through the limited perspective of Ros and Guil, but when viewed through the elevated structure of *Hamlet*, the design becomes clear. The fact that Ros and Guil never get to see the larger design behind their lives does not indicate to Paul Delaney that their struggle was meaningless. Instead it demonstrates to him that their constant search for coherence implies a firm belief that there is some greater design to comprehend (as the audience already knows because of *Hamlet*). John Fleming refutes Delaney's strict application of "design at work." Fleming finds this line of criticism reductive in that the play's message becomes human life helplessly dragged toward the unknowable inevitability which has been preordained. He argues instead that Ros and Guil's very human struggle for comprehension redeems them from their "characterlessness" and that it conveys the play's true message: that every human life matters, no matter how small.

In "The Game of Coin Tossing" Douglas Colby centers in on the opening scene of *Rosencrantz and Guildenstern* (and the idea it conveys of there being two sides to every coin) as emblematic of the four themes he sees running through the play: all of which emphasize Ros and Guil's purported lack of autonomy and identity. With the first theme (there are two sides to every story), Colby argues that not only is *Rosencrantz and Guildenstern* the "reverse side" of *Hamlet* but that it is in fact complementary "the missing half that completes the Elizabethan tale" (Colby 30). Although he defines the second theme as "Ros and Guil are essentially two sides of the same person," Colby hastens to point out that they are similar yet distinct (like the two sides of the coin Guil is "heads" or "the brains" and Ros is "tails" or "the ass"). While the third theme (Fate) leaves room for Ros and Guil's deaths to be tragic, Colby concludes that because they are

characters swept up in a predestined plot over which they have no control, they have no will power and are therefore spiritually dead. Colby argues that the fourth theme (the complementary sides of Ros and Guil) suggests that this double identity extends to the audience and that they too are not only characters in some larger cosmic drama but *ipso facto*, they are spiritually dead.

However, Colby fails to acknowledge that Stoppard goes to great pains to draw out two distinct characters. He does this right from the start by pointedly assigning Ros and Guil character traits. Stoppard *uses* the coin tossing to create a distinction between the two characters from the very start. Although both characters presumably have been experiencing the same “phenomenon” of a coin repeatedly landing on heads, their reactions are disparate. Ros’s response is complacent: “The run of “heads” is impossible, yet Ros betrays no surprise at all – *he feels none*. However, he is *nice* enough to feel a little *embarrassed* at taking so much money off his friend. Let that be his character note” (my emphasis; *RG* 11). Ros genuinely sees nothing wrong with this – he tacitly assumes that there is some *reason* this is happening.

Critics who argue for Ros and Guil’s capacity for choice have most often pointed to the moment when Guil decides to reseal Hamlet’s death sentence, thereby sealing their own fates. Felicia Londré highlights Ros and Guil’s existential decision at the end of the play to follow through with their mission (to deliver Hamlet to England even though they know that he will die) as the most important nuance Stoppard added. Although Londré does not feel that this makes them tragic heroes (for her their deaths are meaningless because they fail to acquire self-knowledge), she does point out that without the anxiety

of the experience over that choice, they could not be the subjects of their own play – there would be no drama.

The fact that Ros and Guil never truly understand their circumstance does not indicate to Paul Delaney that everything that has transpired was meaningless. What is important is that “they make continuous attempts to master the situation and comprehend it with the assumption there is something to comprehend” (Delaney, *Theatre of Chaos* 34). Delaney methodically refutes the criticism that has relegated Tom Stoppard’s *Rosencrantz and Guildenstern* to the ranks of merely the existential or absurd. Referencing a number of critics (mainly Gruder and Brassell), Delaney argues that, even in the midst of their seemingly incomprehensible circumstance, Ros and Guil maintain the belief that there is some greater design (whether they are capable of perceiving it or not) and that they are “in an isolation amid a cosmic void” (*Chaos* 21). Delaney posits that Stoppard is not attempting to pass a moral judgment on Ros and Guil, rather he is trying to “dramatise their bewilderment before forces which they do not understand” (*Chaos* 30). For Delaney it is through their attempts (actions) to understand that Ros and Guil become the dramatic characters previous critics have denied them to be.

Chaos Theory and Literary Criticism

It becomes evident by even a relatively small sampling of critics that the mechanical view of the world is still deeply imbedded in most of the critical approaches to the play. Although Fleming’s argument that Ros and Guil are mindless pawns helpless to an omniscient pre-destiny is reductive, it is undeniable that without this notion of a “greater design” the play would ultimately read as absurdist. What becomes imperative in

resisting the timeless seduction of determinism is to remember that chaos theory does not eradicate determinism; in fact it is crucial to Chaos theory.

Chaos theory merely affirms that although a system may have determinate initial causes – nothing is immune to chance or choice. The play balances the determinism of *Hamlet*, which gives their search meaning, and the indeterminate events of *Rosencrantz and Guildenstern*, which gives Ros and Guil the dramatic tension necessary to be full characters. Without Guil’s constant faith that there *is* something to comprehend and that they are somehow missing it, the two become helpless fools battered about by the literary minds of Shakespeare and Stoppard. The prospect of a design gives them the prospect of purpose, the prospect to *do* something. It is important to keep in mind however that *Rosencrantz and Guildenstern* is a design, one which is constantly referencing itself. It is this tension over their true identity and subsequently the choice they are presented with at the end of the play that is necessary for their ability to be subjects of their own drama. It is this existential turmoil which makes them the dramatic characters that they never could have been in *Hamlet*.

Chaos theory offers the reader an avenue of escape from the soul-crushing determinism that dominates the play’s criticism. Thomas Jackson Rice argues that chaos theory, “springs from the discovery that chaos is *ordered*, that a vast array of complex and purportedly random phenomena, studied in sufficient detail, reveal deeply embedded patterns, designs that exist independently of the individual’s act of observation” (qtd. in Rice 84). Although chaos theory has been studied and applied to literature from a number of different vantage points, for this particular discussion Rice’s critique of philosopher Karl Popper’s stance on Chaos theory and its implications about the individual and free

will be central and sufficient. Popper reasons that the only way for human freedom to be possible “in a universe that blends determinism and chance” is an assimilation of consciousness and objective knowledge. Popper explains, “Our universe is partly causal, partly probabilistic, and partly open: it is emergent” (qtd. in Rice 86). The limit on human epistemology places the individual in a perilous balancing act between “phenomena that are deterministic in retrospect and unpredictable in prospect” (Rice 86). Therefore, Popper argues human reason is unlimited in regard to criticism but limited in its powers of prediction. In any given moment an individual is limited in his or her ability to predict what will happen but has an unlimited ability to critically engage his or her environment. Popper’s argument demonstrates that both the lack of limitation and limitation are essential for human rationality to exist.¹² It is this facet of Chaos theory that this thesis sees as being the root of Stoppard’s argument for the autonomy of the individual, and uses to argue for the agency of Ros and Guil in Stoppard’s play.

Although Chaos theory may not satisfactorily answer all of the questions raised by *Rosencrantz and Guildenstern*, it is inarguably an early attempt at dramatizing a philosophy that Stoppard would expand in his later plays. Many critics have argued, in fact, that Stoppard comes into his own with Chaos theory in *Arcadia* (1993). In this vein John Bull posits:

Where Stoppard had played with philosophy in earlier plays, here [*Arcadia*] its deployment is central to his establishment of what is, in effect, a political credo:

¹² Popper contends that “human reason is unlimited with regard to criticism yet limited with regard to its powers of prediction; and shows that both the lack of limitation and the limitation are, in their respective places, necessary for human rationality to exist at all” (qtd. in Rice 86).

that the individual is more or at least capable of being more, than just a construction of the political state; that all ideologies will crumble in the face of individual will; but that the result is not an ungovernable chaos, rather a set of unpredictable patterns (Bull 150).

Though directed at *Arcadia*, this “credo” can just as easily be applied to the problems presented by *Rosencrantz and Guildenstern* that this thesis attempts to address. Ros and Guil are certainly more than their “construction of the political state” – in this case *Hamlet*.

In *Rosencrantz and Guildenstern*, Stoppard drops two characters into a complex system in which *Hamlet* represents a determinate reality from which an indeterminate reality (along with Ros and Guil) emerges along its margins. Because *Rosencrantz and Guildenstern* is indeterminate it is not necessarily bound to its urtext. As Chaos theory affirms, even in a system that is initially deterministic, small differences can create vastly divergent outcomes, thus predicting the future is nearly impossible. Though Chaos theory and *Rosencrantz and Guildenstern* may seem hopelessly disparate subjects, there has been a substantial amount of scholarly work dedicated to exposing the similarities between this mathematical field and literary studies. As Peter Mackey posits in *Chaos Theory and James Joyce’s Everyman*, “[i]n postmodernism, quantum indeterminacy, or any other kind, finds epistemological, semiological, ontological and finally, metaphysical expression” (Mackey 12). Although Chaos theory becomes an inadequate method of analysis when fully applied to *Rosencrantz and Guildenstern*, this denigrates neither the elements of Chaos theory that are present nor the impacts that these elements have. Critics point to one of Stoppard’s later plays, most often *Arcadia*, when discussing the

relationship between his work and Chaos theory. However, it is arguable that *Rosencrantz and Guildenstern* served as a drawing board for Stoppard to develop his philosophy of Chaos theory and to experiment with the application of it in theater. This is not intended to detract from the validity of the play or the characters. Quite the contrary, John Bull posits that in *Arcadia*, “Stoppard’s use of “chaos theory” allows him to argue for the supremacy of the individual in a way that would have gladdened the hearts of Rosencrantz and Guildenstern” (Bull 147). Stoppard first endeavors to make this argument (as previously stated by Bull) in *Rosencrantz and Guildenstern* and because of that, Ros and Guil should be viewed as autonomous characters that maintain their “supremacy of the individual” despite their imposing and deterministic environment.

Hapgood

When *Hapgood* was first published in 1988 it quickly gained the reputation of being Stoppard’s most “scientific” play to date. Audiences were baffled by the intricacies of Stoppard’s complex quantum laden plot. Although the play failed to gain much critical or popular success, critics still point to it as Stoppard’s technical drawing board for his highly acclaimed scientific masterpiece, *Arcadia*. However, the application of science in theater is not the only conceptual debt *Arcadia* owes *Hapgood*. As Paul Edwards argues in “Science in *Hapgood* and *Arcadia*,” “Science should, through the sideways slant of its analogies, illuminate the human world, and perhaps show it in a more intense and emotional light than could be achieved through more direct treatment” (Edwards 172). In *Hapgood*, Tom Stoppard explores how science (quantum science in particular) illuminates the human world. He explores the mystery that lies at the heart of quantum mechanics by dramatizing the complexity and contingency of human identity. He reveals

identity to be fluid and to some extent determined by the context in which a person is viewed.

Like light, identity exhibits characteristics of indeterminacy and complementarity and is contingent on the observer. Stoppard makes a clear juxtaposition between the mystery of light and the mystery of identity, both of which require a ‘both/and’ perspective to appreciate. Stoppard argues for a ‘both/and’ perspective in a world in which the ‘either/or’ paradigm is antithetical not only to the reality of the universe but also to the reality of human identity - both of which can be said to have infinite and contradictory possible manifestations that only become fixed when someone observes it from a specific point of view.

Through the quantum metaphor of complementarity, Stoppard brings the abstract concepts of the new sciences down to the most basic and relatable level: the complexity and duality of every individual identity. In his article *Particle Physics and Particular Persons*, Paul Delaney posits: “That impossible reality – that light consists of waves if the experimenter looks for one phenomenon but of particles if he looks at it in a different way – becomes in *Hapgood* a metaphor both for the mysteries of the world of espionage and the even greater intricacies of the human personality” (Delaney 132). Delaney highlights the connection Stoppard makes between the complementarity and indeterminacy in particles and personalities. Through quantum mechanics, Stoppard argues not only for a shift from an ‘either/or’ to a ‘both/and’ mindset, but for a reverence for the mystery of identity and the universe.

Critics of *Hapgood* have often argued that Stoppard is timid in his application of quantum theories and fails to use it to its full postmodern potential. In “Tom Stoppard

and Postmodern Science,” Daniel Jernigan contends that “instead of embracing the radical anti-epistemology of quantum mechanics that would link his work to the thought of such figures as Nietzsche and Derrida... Stoppard can be seen to be offering a thoroughly classical interpretation of quantum mechanics” (Jernigan 10). According to Jernigan, Stoppard’s interpretation of quantum mechanics is more in line with Einstein and Bohm. Stoppard “imagines that a classical scenario that normalizes nonclassical behavior still persists. Stoppard thus avoids using quantum mechanics to its full postmodern potential and even appears to side with Einstein in his desire for a more explicable quantum world” (Jernigan 11). But Stoppard is not trying to make physics classical again, rather, he attempts through dramatization to demonstrate how principles of quantum mechanics (like doubling, complementarity and indeterminacy) are inherent not just in the universe but in the individual as well.

Stoppard carefully constructs a plot which will not only allow him to explore the intricacies of quantum science and identity, but will self-reflexively reinforce these concepts. Katherine Kelly argues in *Tom Stoppard and the Craft of Comedy*, that Stoppard’s construction of *Hapgood* illustrates both “how a scientific paper and a work of art differ and how they overlap” (Kelly 155). Continuing with the metaphor of play as experiment, Kelly posits that the first act contains a failed experiment that leads to a hypothesis. The failed experiment is, of course, the mime in the first scene of the play in which Hapgood, Wates, Ridley and Merryweather attempt to discover whether Kerner has been leaking unauthorized information to the KGB. Through the botched mission, Hapgood, Wates and Blair realize that the person who has been slipping information to the Russians is Ridley.

The failed experiment leads to the second act which, as Kelly describes it, carries out the experiment developed by Blair and Hapgood to catch Ridley in the act. Stoppard explains, “In a normal spy thriller you contrive to delude the reader until all is revealed in the denouement; this is the exact opposite of a scientific paper in which the denouement – the discovery – is announced at the beginning. *Hapgood* to some extent follows this latter procedure. It is not a whodunit because we are told who has done it near the beginning of the first act, so the story becomes *how* he did it” (qtd. in Fleming 180). Jenkins describes the effect being that “with logical precision, Stoppard leads us through each layer of his theme to its human centre, and the rest of Act One deploys the uncertainties of espionage, quantum physics, and individual personality until they interlock at the conclusion of the Act in the play’s crucial equation” (Jenkins 187). This first act also sets up a number of motifs which Stoppard will continue to use throughout the play such as twinning and the indeterminacy of identity. Edwards argues: “twinning and doubling are at the heart of the analogy this play makes with quantum physics, by making the “uncertainty principle” concrete on a human scale” (Edwards 173). As Edwards’s argument suggests, Stoppard demonstrates how uncertainty is a fundamental part of human reality and identity.

In *Hapgood*, Stoppard rejects the reductive ‘either/or’ worldview and embraces a ‘both/and’ mindset in which the wonderful mysteries and complexities of quantum science are one and the same with those of human identity. Kerner gets at the heart of Stoppard’s message when discussing Einstein’s reluctance to accept the implications of Heisenberg’s Uncertainty principle:

Quantum mechanics made everything finally random, things can go this way or that way, the mathematics deny certainty, they reveal only probability and chance,

and Einstein couldn't believe in a God who threw dice. He should have come to me, I would have told him, 'Listen, Albert, He threw *you* – look around, He never stops' (Stoppard, *Hapgood* 49).

Through Kerner (as Delaney notes) Stoppard implies “that the wholly unpredictable uniqueness of the particular individual constitutes evidence of the divine” (Delaney 129). Stoppard argues not only for the autonomy of the individual but for the humble amazement of the mystery that is identity. He will go on to perfect not only his treatment of science but also his argument for the individual in his most successful play, *Arcadia*.

Arcadia

When *Arcadia* was first published and performed in 1993, it was praised not only for its masterful use of chaos theory in both the structure and the content of the play, but also for the depth of its feeling. Having been labeled as a cold and unfeeling writer since the publication of *Rosencrantz and Guildenstern*, Stoppard finally dispelled such criticisms with *Arcadia*. Previously deemed an absurdist, Stoppard began to be described by critics like Paul Edwards as “a deeply Romantic writer in that the emotional heart of his plays has to lie in what cannot be articulated directly” (Edwards 172). As an author consistently accused of being “too cerebral” Stoppard had finally touched the hearts of both critics and audiences. Although Edwards opens his article “Science in *Hapgood* and *Arcadia*” with disparaging remarks towards *Hapgood*'s critical reception, he seems to tacitly agree with what he presents as Stoppard's view: that *Hapgood*'s “technical successes were to be the foundation for the critical success of *Arcadia*” (Edwards 171). What Stoppard achieves in *Arcadia* is not merely sentimentally powerful or scientifically adroit; it is a melding of both modern science and universal humanism which

demonstrates that we are not merely affected by the chaotic inclinations of nature; rather we are a fundamental part of it.

Critics who have engaged *Arcadia*'s use of chaos theory have focused specifically on three aspects: that chaos is not randomness or chance; the importance of fractals in a chaotic system; and the unavoidable sensitive dependence on initial conditions. In his article "Comedy, Chaos, and Casuistry," Ronald H. McKinney describes chaos theory as "concerned with examining the unstable behavior of non-linear, dynamic systems, those 'in which extreme sensitivity to initial conditions create effects that are disproportionate to their causes'" (McKinney 395). In *Arcadia* initial conditions (which may seem trivial at first) have an unpredictable yet significant impact on later characters.

William Demastes argues that Thomasina's "Geometry of Irregular Forms," (now known as fractal geometry) is "yet another significant path of entry into chaotic, a butterfly-effect engagement of the study of morphology" (*Chaos* 92). Thomasina observes "[m]ountains are not pyramids and trees are not cones" and it is the endeavor of her new geometry to better represent nature. "Armed thus, God could only make a cabinet" she exclaims. Rather than just accepting this, as Septimus does, Thomasina declares "What a faint-heart! We must work outward from the middle of the maze." (Stoppard, *Arcadia* 37).

Using Stephen Kellert's example of a jagged coastline, Demastes demonstrates that although nature "does not create straight edges but rather fractals" what is important is "the surprising self-similarity that nature utilizes throughout these scaled levels, self-similarity betraying duplication because of small though rising adjustments at each stage" (*Chaos* 92-93). He argues, "[t]iny initial deviations result in natural diversity, but this

does not concede randomness because this morphological butterfly effect produces self-similarity even as it produces diversity” (*Chaos* 93). Meaning that even in nature what may seem random at first glance actually consists of deeply complex patterns. Chaos is not arbitrary; it is constructed by an intricate order. Demastes argues that Valentine’s description of Thomasina’s leaf algorithm, “provides something of a sense of the rising order out of chaos, an order that will in fact be reproduced in larger scale in Noakes’s picturesque style, a landscape initially created by Noakes but then permitted to rise on its own, a wild (but not random), verdant Arcadia” (*Chaos* 98).

Demastes emphasizes that the actual math involved in fractals is fairly simple. What is daunting however is the sheer number of computations necessary in order to reveal the “ordered, self-similar, scaled patterns actually produced in nature” (*Chaos* 93). As such, “[c]omplexity arises from simplicity, as order arises from disorder” (*Chaos* 93). Demastes contends that the nineteenth-century section of the play is evidently “suggesting that a Thomasina *could* have existed in 1809 because the necessary information was available and because the social inclination toward ‘irregularity,’ as attested by the picturesque style, was also culturally available though not pervasive” (*Chaos* 96). He also points out that Thomasina is not only intellectually and mathematically adroit but she is also “very much a part of her age in much the same way Galileo, Newton, and Einstein were part of theirs” (*Chaos* 97). Demastes finds this observation contradictory to the common conception of science as uninfluenced by culture. Rather, Demastes contends that “the history of science continually verifies the claim that culture influences science and science influences culture” (*Chaos* 97). This thesis attempts to make a similar argument.

In spite of her brilliance, Thomasina does not possess the technology to bring her theories to fruition. Demastes maintains that because Thomasina lacks the technology “Stoppard introduces the late twentieth-century counterparts to the nineteenth-century cast, including Valentine, the student of nonlinear mathematics, who provides regular commentary on the chaotic nature of nature” (*Chaos* 97). Valentine becomes Stoppard’s quantum mouthpiece.

Susanne Veas-Gulani makes a connection between Valentine’s statement about chaos theory getting closer to “the ordinary-sized stuff which is our lives” and Thomasina’s continuous attempts to find explanations for occurrences in her world. In her article “Hidden Order in the ‘Stoppard Set’: Chaos Theory in the Content and Structure of Tom Stoppard’s *Arcadia*” Veas-Gulani points to Thomasina’s rice pudding analogy as proof that Thomasina is “...thinking about the irreversibility of processes as well as the movement towards larger and larger disorder, which is formulated in the second law of thermodynamics” (Veas-Gulani 414). Chaos theory is presented in the play mainly through the work of Valentine and Thomasina. Stoppard uses Valentine as the mouthpiece through which the audience is given the tools to understand “the incredible event happening in the scenes of the past: the development of chaos theory by a young girl, Thomasina Coverly” (Veas-Gulani 414). Thomasina realizes “the discrepancy between the traditional geometrical forms and natural objects.” She spends the three year time lapse (from 1809 to 1812 that occurs between Act One and Two) trying to find equations that would lead to natural shapes:

Each week I plot your equations dot for dot, xs against ys in all manner of algebraical relation, and every week they draw themselves as commonplace

geometry, as if the world of forms were nothing but arcs and angles. God's truth, Septimus, if there is an equation for a curve like a bell, there must be an equation for one like a bluebell, and if a bluebell, why not a rose? Do we believe nature is written in numbers? (*Arcadia* 37).

Thomasina is appalled at the inconsistencies she sees between the magnificently complex world around her and "commonplace geometry," and is determined to find a better explanation.

Susanne Veas-Gulani identifies three "fractals" that constitute the structure of *Arcadia*. She argues that Sex, Literature and the Garden are the three major "fractals" holding the play together. She reasons, "[e]ach of them could be seen as a strange attractor around which the content evolves" (Veas-Gulani 416). Veas-Gulani maintains that in setting up the structure of *Arcadia*, Stoppard follows another principle of chaos theory as outlined by Gleick: simplicity. She argues "since the play circulates around similar themes and topics in all three time spheres, it is characterized by simplicity" (Veas-Gulani 419). Stoppard surrounds the central theme of chaos theory with topics such as sex, literature and the garden creating a unified structure.

Veas-Gulani identifies the Garden as the third strange attractor in the play. Always under construction the garden becomes the "...symbol of the change from one period to another, namely from the Enlightenment to Romanticism" (Veas-Gulani 417). The garden becomes the perfect juxtaposition of the two opposing ideologies in the play: the rational order of the Enlightenment and the sentimentality of the Romantics. Veas-Gulani attributes Stoppard's use of the garden as one of the structural principles of the play to Gleick's *Chaos: Making a New Science*.

In his article “Tom Stoppard and ‘Postmodern Science’” Daniel Jernigan examines Tom Stoppard’s employment of chaos theory and quantum mechanics in an effort to fairly assess whether or not his work can be considered postmodern. Jernigan focuses specifically on *Hapgood* and *Arcadia* reasoning that although these two plays are not as “theatrically experimental as Stoppard’s earlier work, they nonetheless engage the concerns of the postmodern era in their adoption of theoretical science” (Jernigan 3). Jernigan’s connection between postmodernism and quantum mechanics is based on the explanation given by Jean-François Lyotard in *The Postmodern Condition: A Report on Knowledge*. He argues, “Lyotard recognizes both quantum mechanics and especially chaos theory as the postmodern theories par excellence, given their radical incredulity over the possibility of achieving a grand metanarrative description of the universe” (Jernigan 4).

Jernigan emphasizes that what distinguishes both quantum mechanics and postmodernism from their ideological predecessors is their rejection of and incredulity towards a universal scientific or “meta” narrative of reality. He argues that Stoppard is not a postmodernist because he does not use quantum mechanics to its postmodern effect.¹³ But by assuming that Stoppard is merely “normalizing” chaos theory, Jernigan misses one of the most important and intriguing facets of the play. Although a more ambiguous ending may have adhered more closely to the postmodern paradigm, it would have failed to deliver the play’s true message: that we are not helplessly caught in an

¹³ Jernigan dismissively comments that “Stoppard’s investigation into these theories seeks to normalize them according to a classical interpretation rather than to revel in their anti-epistemological implications” (Jernigan 4).

unpredictable universe over which we have no control, rather that we are a part of an exceedingly complex and dynamic system in which (although not always predictable) order eventually emerges.

CHAPTER II: THE PARALYSIS OF THE NEWTONIAN MIND

Deep in the human consciousness is a pervasive need for a logical universe that makes sense. But the real universe is always one step beyond logic.

Frank Herbert

In *Rosencrantz and Guildenstern* Stoppard explores the problem: how do we act in a world that is no longer predictable? The implications of Heisenberg and Bohr's discoveries were staggering to these men and women of science. Suddenly the universe was no longer knowable. Gone was the clock and all of its neat and orderly parts. There was no lock to pick – the universe was a writhing mass of possibility and the best these scientists could hope for was an educated guess. This revelation not only shook their logic, it shook their faith.

Ros and Guil are doomed not because of their predetermined fate in *Hamlet* (as previous critics have suggested) but because of Guil's refusal to accept the responsibility of action in a world which is fraught with uncertainty. For Stoppard, the Newtonian worldview robs the individual of their freedom of choice and action, incapacitating them through fear of uncertainty. To say that Ros and Guil do not have lives outside of *Hamlet* becomes problematic once the two are compared side by side. Although Ros and Guil's "lives" are bounded by Stoppard's play (as any characters of fiction are) their experiences are not limited by Shakespeare's. In determining how (and if) Stoppard's characters diverge, it is imperative to understand the characters first presented by Shakespeare. Rosencrantz and Guildenstern are introduced in the beginning of Act 2 Scene 2 of

Hamlet. The first 40 lines of dialogue between the King, the Queen, Rosencrantz and Guildenstern are nearly replicated in Stoppard's *Rosencrantz and Guildenstern are Dead*. The differences between the two sets of dialogue emerge within the margins (within the parentheses of the stage direction.)

The scene as presented by Shakespeare is a seemingly simple one: the King and the Queen welcome two courtiers, childhood friends of their son, whom they have summoned to assist them in understanding what is plaguing Prince Hamlet. And yet beneath this presumably straightforward scene is a roiling mass of complexities and ambiguities. What are the King and Queen's real motivations? Why have Rosencrantz and Guildenstern agreed to spy on their friend? Is there anything even really wrong with Hamlet? These are the very things on which Ros and Guil ponder while in the margins of Stoppard's play. Although parts of Ros and Guil's reality are determined by *Hamlet*, Ros and Guil are not. Their characters and experiences remain distinct, even as they seemingly melt into one another.

In *Hamlet* Rosencrantz and Guildenstern make their next appearance towards the end of Act 2 Scene 2. This scene, in which the two courtiers try to glean Hamlet's afflictions, is discussed rather than presented in Stoppard's play. Though Stoppard's audience catches the first few exchanges and the last few, the bulk of the discussion is left to be recapitulated by Ros and Guil. In *Hamlet* this scene is the first if not longest instance of sustained dialogue between Rosencrantz and Guildenstern and any of the other characters. The two remain on stage for three hundred and ten lines during which Hamlet confronts the two courtiers, Polonius introduces the Player, and Hamlet arranges the dumb show, *The Murder of Gonzago*. Although Ros and Guil are not present for all of

this during Stoppard's play (Hamlet goes off-stage with Polonius to meet the Player and then returns with the Player) a close look at this scene reveals that although they inevitably speak the same lines when they encounter *Hamlet*, Ros and Guil are hardly Rosencrantz and Guildenstern.

In Shakespeare's play, Hamlet greets Rosencrantz and Guildenstern not only in a friendly manner, but in almost jovial relief: "My [excellent] good friends! How dost thou Guildenstern? Ah, Rosencrantz! Good lads, how do you both?" (Hamlet II.ii.221-223). Rosencrantz and Guildenstern reply mildly but Hamlet persists jocularly, almost giddy by the presence of his friends:

Rosencrantz: As the indifferent children of the earth.

Guildenstern: Happy, in that we are not [over-]happy, on Fortune's [cap] we are
not the very button.

Hamlet: Nor the soles of her shoes?

Rosencrantz: Neither, my lord.

Hamlet: Than you live about her waist, or in the middle of her favors?

Guildenstern: Faith, in her privates we.

Hamlet: In secret parts of Fortune? O, most true, she is a strumpet. What news?

(Hamlet II.ii.224-233).

Rosencrantz and Guildenstern are vague in their answers; it is only Hamlet's goading which finally elicits the saucy response from Guildenstern (one that in Stoppard's play would be more likely to come out of Ros's mouth than Guil's) – which demonstrates the fact that these men are actually good friends who know each other fairly well. Presumably it is this familiarity which causes Hamlet to check his enthusiasm in

greeting his friends and to doubt Rosencrantz's evasive answer. When Hamlet first suspects that Rosencrantz and Guildenstern are there on the behest of the King and Queen is unclear; what is clear however is that Hamlet is put on guard during their brief conversation. When Hamlet calls Rosencrantz on his fib and asks the pointed question: "But your news is not true. Let me question you in particular. What have you, my good friends deserv'd at the hands of Fortune that she sends you to prison hither?" (Hamlet II.ii.235-238). Whether or not Hamlet was suspicious of Rosencrantz and Guildenstern's motives before their arrival, their behavior (coupled with his pre-existing paranoia) is enough to convince Hamlet that their presence is not merely a happy coincidence. Over the course of the next forty-seven lines Hamlet reposes the same question four times. Each time Rosencrantz and Guildenstern evade the question. He questions them casually, "[b]ut in the beaten way of friendship, what make you at Elsinore"; politely, "[w]ere you not sent for? Is it your own inclining? Is it a free visitation?"; directly, "[y]ou were sent for, and there is a kind of confession in your looks... I know the good King and Queen have sent for you"; and finally, exasperated, Hamlet pleads,

"[b]ut let me conjure you, by the rights of our fellowship, by the consonancy of our youth, by the obligation of our ever-preserv'd love, and by what more dear a better proposer can charge you withal, be even and direct with me, whether you were sent for or no!" (Hamlet II.ii.264-280).

Rosencrantz and Guildenstern have been stalling up to this point and even after Hamlet has appealed to their friendship – the two hesitate. Rosencrantz tries to subtly consult Guildenstern, "[w]hat say you" but he fails in evading Hamlet's attention: "[n]ay then I have an eye of you! – If you love me, hold not off" (Hamlet II. ii. 284-286). It is

Guildenstern who finally admits, “[m]y lord, we were sent for” (Hamlet II.ii.287).

Hamlet does not press them to explicitly divulge their orders and Rosencrantz quickly diverts Hamlet’s attention to the tragedians. When read next to the opening scene of *Rosencrantz and Guildenstern*, it is difficult to believe that critics have persisted in conflating the flat, insidious pair of Shakespeare’s play with the perplexed, yet persistent duo presented by Stoppard.

Like many of the great Western classical thinkers, Guil searches for some intuitive order in the world around him, and yet like many modern thinkers, Guil seems to be vaguely aware that if his world is determined he can have no influence in it. Guil struggles with the very problems Mackey presents as the products of universal determinism.¹⁴ Guil searches for the structure of the world he finds himself in but the more he searches the more he forfeits his freedom to act. When the Player arrives Guil pushes him to explain why he has come. What Guil really wants to know is *how* the Player knows to come. The failure of the coins to act according to the laws of probability has robbed Guil of certainty in his own actions. In asking the Player whether it was fate or chance that brought them there, Guil is really asking what forcers are responsible for his circumstance. However, when the Player asserts that they have no control, “Oh yes. We have no control. Tonight we play to the court. Or the night after. Or the tavern. Or not” (RG 25). Guil reacts by desperately asserting his autonomy from any deterministic system: “I have influence!” (RG 26).

Rather than embracing the chaos (as Ros arguably does) Guil resists the reality of what is happening by applying scientific methods of logic and reasoning to the

¹⁴ See Mackey quote on p. 5.

phenomenon at hand, thereby distancing himself emotionally from the situation. Guil constantly tries to make sense of the world around him through scientific methods. At the beginning of the play the run of heads in the coin toss offends Guil's logical and rational sensibilities. Guil's application and ultimate rejection of possible theories mirror the frustrations experienced by scientists like Einstein who struggled to resolve the apparent randomness of quantum science with the classically determined universe to which they had grown accustomed. Guil shares this struggle to accept the fact that his world is no longer predictable. Guil posits, "A weaker man might be moved to re-examine his faith, if in nothing else at least in the law of probability" (*RG* 12). With each failed explanation it becomes harder for Guil to suppress his rising panic or understand the implications of what is going on around him.

Ros accepts things as they come, a willing participant in the chaotic world in which he finds himself; while Guil struggles to predict what will come next and what their move should be rather than reacting to situations as they occur. While Guil is tempted to reexamine his faith in the basic functioning of the universe, Ros does not seem concerned with the lack of determinism or probability. The straight run of heads amuses Ros, perhaps because he is winning, but also because he sees nothing alarming in the pattern:

Guil: No questions? Not even a pause?

Ros: You spun them yourself.

Guil: Not a flicker of doubt?

Ros: (aggrieved, aggressive) Well, I won – didn't I? (*RG* 17).

Guil expects there to be a predictable pattern of heads and tails because that is what the laws of probability tell him to expect.

Guil's tendency to over think and analyze rather than experience and react to the situation at hand prevents him from making the right decision on the ship and seals the fates for the characters of both plays. Stoppard seems to be juxtaposing the two ideologies which struggled over chaos theory. Guil is representative of the residual classical interpretation of the world, while Ros (and the Player) represent the emergent quantum view which embraces chaos and the indeterminate aspects of the universe. Through the actions of both characters Stoppard seems to argue against the classical interpretation of the universe as inimical to the supremacy to the individual and the freedom to choose.

While Guil struggles to understand the nature of the reality he finds himself in, the Player does not seem to be burdened by the same existential dilemmas. In an indeterminate world the best one can hope for is an educated guess of future events but Guil does not like to be unprepared. When the Player describes the different performances Ros and Guil can take part in Guil is scandalized by the vulgarity of the performances. Guil is so appalled that he reacts with physical violence by "smashing the Player across the face" (RG 26). Guil is offended not only by the obscene nature of what the Player presents but by the surprise. Based on his classical view of the world it is not how Guil expects the players to behave:

(shaking with rage and fright): It could have been – it didn't have to be *obscene...*

It could have been – a bird out of season, dropping bright-feathered on my

shoulder... It could have been a tongueless dwarf standing by the road to point the

way... I was *prepared*. But it's this, is it? No enigma, no dignity, nothing *classical*¹⁵, portentous, only this – a comic pornographer and a rabble of prostitutes... (RG 27).

What really seems to disturb Guil however is the assuredness with which the Player travels through the world.

Ros, on the other hand, does not seem alarmed by the players' appearance. Rather than looking for the pattern, Ros reacts to the changes in his environment. Instead of creating an intellectual distance between himself and his reality, Ros is able to truly be in the moment and react rather than struggling to predict. Comically, Ros's reaction to the Player's proposition is the antithesis of Guil's. Rather than being shocked and disgusted, Ros is titillated and intrigued.

The dual nature of the Player as a character of both *Hamlet* and *Rosencrantz and Guildenstern* allows him to hold a world view more in line with chaos than any classical interpretation. If *Rosencrantz and Guildenstern* exists in the margins of *Hamlet* then the Player represents the point at which the two become blurred. While Ros and Guil are excluded for the most part from the *Hamlet* frame story, the Player moves easily between the two in a self-assured way that infuriates Guil.

Guil: Well... aren't you going to change into your costume?

Player: I never change out of it, sir.

Guil: Always in character.

Player: That's it.

Pause

¹⁵ My emphasis.

Guil: Aren't you going to – come on?

Player: I am on.

Guil: But if you are on, you can't come on. Can you?

Player: I start on (*RG* 34).

When the Player asserts that they have no control he is acknowledging the limitation of human epistemology to have a total fixed world view which allows him to predict the trajectory of his future. He embraces the many roles we all play and the fact that at any given moment we are all characters adapting to different scenes. Though the Player has been criticized as the most absurd character in the play, he is not extending a nihilistic view of a meaningless and random universe. He instead embraces whatever role the situation calls for and embraces the chance and randomness of his world with the conviction that order will inevitably arise out of disorder. This is an idea which Stoppard later explores in *Hapgood*.

Guil decides that he has no choice because of his fear of participation in an unpredictable and chaotic world: “At least we are presented with alternatives... but not choice” (*RG* 39). Guil refuses to accept that they have an option to choose. According to his pre-determined worldview the decision has been made and should be part of a predictable pattern of actions that he can logically deduce. However, as chaos theory affirms, the world is not always logical or predictable and though a pattern may later become apparent, it is impossible for human beings as a part of this spontaneous pattern to understand the pattern as it evolves. Once the pair encounters the *Hamlet* characters, Guil is willing to relinquish any responsibility for action:

There's a logic at work – it's all done for you, don't worry. Enjoy it. Relax. To be taken in hand and led, like a child again, even without innocence, a child – it's like being given a prize, an extra slice of childhood when you least expect it, as a prize for being good, or compensation for never having had one... (RG 40).

Guil is more than happy to relinquish his control to a predetermined reality. When events are predetermined one is relieved of the burden of choice like a child who relies on the decisions of his or her parents. The problem with this mode of thinking (Stoppard seems to suggest) is that because of chaos theory we now know that the world is not predetermined and we are part of a chaotic universe which requires us to act in order to effect change. As much as individuals are affected by chaos, as a part of the chaotic universe they have the potential for unpredictability and choice.

In a role-reversal from the previous scene, Ros has been prompted to action by their circumstance and Guil (now complacent at the slightest hint of a pre-determined path) is indifferent to any action outside of that: "Words, words. They're all we have to go on" (RG 41). Ultimately it is this complacency and indifference which inhibits the pair from any autonomous movement. Ros struggles to understand their present situation so that he may act. While Ros labors to parse their vague exchange with Hamlet, Guil merely repeats what has been said. Ros tries to get Guil to go with him after Hamlet but Guil reasons "Why? They've got us placed now – if we start moving around, we'll all be chasing each other all night" (RG 41). As Ros observes, Guil's refusal to act makes the two characters spectators.¹⁶ Guil no longer wants to struggle to understand, he is content to wait and see what happens next: "Wheels have been set in motion, and they have their

¹⁶ "I feel like a spectator – an appalling business" (RG 41).

own pace, to which we are... condemned. Each move is dictated by the previous one – that is the meaning of order. If we start being arbitrary it'll just be a shambles: at least, let us hope so" (RG 60). Guil is unwilling to act because he is afraid to act. He does not know the initial conditions and he cannot predict what will come next. Rather than struggling to understand, Guil concedes to a higher determinism to propel his course. Unfortunately for Guil, his world is fraught with uncertainty and it is impossible to predict how action (and even inaction) will affect his circumstances.

Ros and Guil are not the only characters in *Rosencrantz and Guildenstern* who cannot predict the chain of events that make up their world. Stoppard emphasizes the separate sphere of *Rosencrantz and Guildenstern* through the interactions between Ros, Guil and the Player. While all three are part of *Hamlet*, their roles in *Rosencrantz and Guildenstern* are separate. Though the Player seems to have some notion of *Hamlet's* trajectory, he is just as subject to uncertainty in *Rosencrantz and Guildenstern* as Ros and Guil:

It was not until the murderer's long soliloquy that we were able to look around; frozen as we were in profile, our eyes searched you out, first confidently, then hesitantly, then desperately as each patch of turf, each log, every exposed corner in every direction proved uninhabited (RG 64).

The Player's vulnerability is demonstrated by the surprise, hurt and confusion he feels as a result of Ros and Guil's disappearance earlier in the play. Robbed of observers, the players are trapped between their roles as characters in the dumb show and characters of *Rosencrantz and Guildenstern*. Like a photon in an indeterminate state, the players depend on their observers to define their role and their identities.

The Player makes Stoppard's strongest argument for a quantum world view that embraces uncertainty rather than enforcing a Newtonian order which is incongruent to the natural state of things. The Player challenges Guil's view of uncertainty and chaos as a glitch in the orderly predetermined system of nature:

Player: Uncertainty is in the normal state. You're nobody special.

Guil: But for God's sake what are we supposed to do?!

Player: Relax. Respond. That's what people do. You can't go through life questioning your situation at every turn.

Guil: But we don't know what's going on, or what to do with ourselves. We don't know how to *act*.

Player: Act natural. You know why you're here at least.

Guil: We only know what we're told, and that's little enough. And for all we know it isn't even true.

Player: For all anyone knows, nothing is. Everything has to be taken on trust; truth is only that which is taken to be true. It's the currency of living. There may be nothing behind it, but it doesn't make any difference so long as it is honoured (*RG 66-67*).

In this exchange the classical is pitted against the quantum. Guil has refused to act because he does not have all of the facts but the Player asserts that it is impossible to ever have all of the facts. This is in part because, as Heisenberg's Uncertainty Principle proved, the world is not predictable. Uncertainty and order coincide to complete the disorderly order of our universe. It also refutes any acquisition of absolute knowledge or truth. As the Uncertainty Principle reified, the best that can be hoped for is an educated

conjecture and gone are the days of the clock-work universe which only needs to be taken apart. The Player at the same time emphasizes the importance of action. All one can do is react and trust that some of one's assumptions are true; but there is never anyway to know for sure. As long as this is honored the uncertainty does not matter. Guil's pragmatic and classical temperament creates a mental block which prevents him from opening his mind to uncertainty and all its possibilities.

When Ros shouts for Hamlet, Hamlet appears demonstrating that Ros and Guil are capable of effecting change if they choose to do so (RG 90). However, Ros is only able to convince Guil to act when Hamlet tells them to go on to the ship headed for England:

Ros: He *said* we can go. Cross my heart.

Guil: I like to know where I am. Even if I don't know where I am, I like to know *that*. If we go there's no knowing.

Ros: No knowing what?

Guil: If we'll ever come back.

Ros: We don't want to come back.

Guil: That may very well be true, but do we want to go?

Ros: We'll be free (RG 95).

Ros intuits that the only way to effect change is through action. As the Player explained, they must react and trust some assumptions to be true if they want to move through their uncertain world. Though Guil does act he does so begrudgingly and only on Ros and Hamlet's behest. His action is not indicative of any acceptance of uncertainty; rather, he clings to the next determined environment he encounters (the boat) and so stubbornly

refuses to engage in his reality by acting that he seals the fate of all of the characters in both plays.

Although Guil finally accepts that he has some freedom to act, he limits his freedom to that which keeps him comfortably within the bounds of his determinate course. Guil relaxes considerably once on the boat headed to bring Prince Hamlet to England. He takes comfort in the contained nature of the boat: “Yes, I’m very fond of boats myself I like the way they’re – contained. You don’t have to worry about which way to go, or whether to go at all – the question doesn’t arise, because you’re on a boat, aren’t you” (*RG* 100). Guil enjoys the limited freedom the boat affords him because he doesn’t have to worry about straying outside of the pre-determined course that he believes exists:

Free to move, speak, extemporize, and yet. We have not been cut loose. Our truancy is defined by one fixed star, and our drift represents merely a slight change of angle to it: we may seize the moments, toss it around while the moments pass, a short dash here, an exploration there, but we are brought round full circle to face again the single immutable fact – that we, Rosencrantz and Guildenstern, bearing a letter from one king to another are taking Hamlet to England (*RG* 101).

While Ros struggles to understand the chaos around him and act on his best assumptions, Guil easily embraces what his classical sentiments understand: an ordered and predictable path.

This inability to open his mind to uncertainty cripples Guil to the point that he loses all human empathy and seals his own fate when he chooses not to act and reseals

the letter. Both characters are challenged in the climactic scene in which they read the contents of the King's letter and realize that their mission is to escort young Hamlet to his death. Ros reacts emotionally, "We're his *friends*" (RG 110). Guil, resistant as always to action, argues that they have no way of knowing this and that they have only been told they are friends of Hamlet. Echoing the Player, Ros argues that what they are told is all they have to depend on. Guil attempts to reason his way out of action:

... Well, he is a man, he is mortal, death comes to us all, etcetera, and consequently he would have died anyway, sooner or later. Or to look at it from the social point of view – he's just one man among many, the loss would be well within reason and convenience... Or look at it another way – we are little men, we don't know the ins and outs of the matter, there are wheels within wheels, etcetera – it would be presumptuous of us to interfere with the designs of fate or even of kings. All in all, I think we'd be well advised to leave well alone. Tie up the letter – there – neatly – like that. – They won't notice the broken seal (RG 110).

Guil would rather sacrifice the life of his presumed friend than step outside of his newfound determined course. Ros is unmoved by Guil's cold, selfishly pragmatic rationalization. Ros is not willing to risk his friend's life. He tries to persuade through emotion, "He's done nothing to us" but to no avail. Ultimately Guil's fear of action keeps him from reacting sympathetically to Hamlet's danger. Though Ros ultimately does not oppose Guil's decision, he does not endorse it: "It's awful" (RG 111). Guil realizes his mistake too late. Only at the very end does Guil realize the folly of refusing to act: "There must have been a moment, at the beginning, where we could have said – no. But

somehow we missed it” (RG 125). Guil’s fear of uncertainty paralyzes him to the point that he allows himself to be propelled to his own death.

Guil is so desperate to ignore any indication that they have made a wrong choice because acknowledging that mistake would mean they would have to abandon the predetermined course laid before them and return to the realm of the indeterminate. Guil becomes increasingly panicked as he consistently fails to satisfactorily apply logic to their situation. The fact that he cannot successfully trace effects back to their causes is maddening to the ever pragmatic Guil. He is so desperate to understand the order of the system he’s in that Guil readily clings to the first opportunity for deterministic movement. Aboard the ship, Guil is finally at peace because he is no longer an autonomous agent in an indeterminate reality. He is confined within the ship and therefore is bound to the ship’s trajectory. But this false sense of security is what lulls Guil into making his last decision – a decision that seals the fate of both plays.

Chaos theory opens the door for change, but Guil’s desperate adherence to the Newtonian paradigm prevents him from seeing any way out. Only because in Guil’s mind the universe consists of “wheels within wheels” is he bound to the deterministic tug of the system. He cannot see that determinism is no longer the operating ideology; his world is dynamic and fraught with uncertainty – much like our own. It is Guil’s failure to perceive uncertainty as possibility – freedom to choose – that damns him, not Shakespeare. Stoppard dramatizes the folly in allowing uncertainty to paralyze you to the point of inaction.

From the beginning of *Rosencrantz and Guildenstern* the audience is faced with the crux of the paradox of complementarity: entities can exist in opposite states

simultaneously. The audience is told that Ros and Guil are dead and yet there they are tossing coins. Audience members who are familiar with *Hamlet* will know that indeed “Rosencrantz and Guildenstern are dead” (Hamlet V.ii.353). And yet... there they are watching the dumb show, struggling to understand what is right in front of them. For the audience, Ros and Guil are simultaneously alive and dead; simultaneously characters in Shakespeare’s play and Stoppard’s. Although they may be doomed by *Hamlet* and by the title, their anxieties are real, their choices are real and their struggle to understand the indeterminate world they occupy is real. Rosencrantz and Guildenstern may be dead but Ros and Guil remain caught in a system in which their opportunities to create new exists are clouded by their staunch dedication to the classical mechanical theory of the world and their underestimation of the potential impact of the trivial. For Ros and Guil what is determinate are their roles in *Hamlet*. What takes place in the margins of *Hamlet* however becomes the indeterminate realm of *Rosencrantz and Guildenstern*. In this indeterminate realm even the most trivial decisions can have an incalculable impact. What Ros and Guil do not realize is that they did have a chance to change the course of their destiny, only it was such a fleeting and seemingly inconsequential moment; they allowed it to pass them by.

The world does not work in the neat orderly manner Newton laid out, but we still must act within it as a part of it. Nature may be imbued with chaos and uncertainty but so are human beings. People do not fall neatly into ‘either/or’ categories rather they are a mass of contradictions, inconsistencies and complexities. The prediction of human behavior is as difficult as predicting whether light will present itself as particle or wave. The same complexities that quantum science seeks to explain in Nature also present

themselves in individuals. Our actions have incalculable potential and there is no predicting the ramifications of even the most trivial act. Stoppard suggests that rather than lamenting the loss of order (as Guil and Einstein do) we should rejoice in throwing off the oppressive shackles of the clock work universe. By recognizing the complexities inherent in ourselves, we can identify with the perspective presented by chaos theory, rather than fearing uncertainty. Without uncertainty there would be no opportunity for change or creation. As autonomous agents in this dynamic system we have the power to affect change through our choice of actions within that system.

CHAPTER III: LIGHT, IDENTITY, AND THE INESCAPABLE REALITY OF
UNCERTAINTY

Physics is not important, love is.

Richard Feynman¹⁷

Although *Hapgood* was not a critical success it effectively furthered Stoppard's argument for the complexity of human personality. While in *Rosencrantz and Guildenstern* Stoppard allowed select paradigms of quantum science to inform his play, in *Hapgood* he infuses the very structure of the play with Heisenberg's Uncertainty principle. By juxtaposing the indeterminacy and complementarity of light particles with the subtleties and complexities of identity, Stoppard creates a parallel between the two emphasizing their dependence on an observer and their fluid nature. The parallel demonstrates the reality of chaotic aspects in our own nature, thereby establishing human beings as fundamental agents in the universe who are just as unpredictable as their universe. Stoppard argues for a 'both/and' perspective in a world in which the 'either/or' paradigm is antithetical not only to the reality of the universe but also to the reality of human identity - both of which can be said to have infinite and contradictory possible manifestations that only become fixed when someone observes it from a specific point of view.

¹⁷ In a letter to Marcus Chown's mother written at the behest of her son to convey the importance of physics. Richard Feynman is considered the "greatest theoretical physicist of his generation" (Gribbin 91).

The Double Slit Experiment demonstrates the ultimate ‘either/or’ question of quantum science: Is light either a wave or a particle? The answer of course is that light consists of *both waves and particles*. As discussed in the introduction, the double-slit experiment reveals the indeterminate nature of light as both particle and wave. The problem was there was no way to predict which it would present: particle or wave? Any attempt to observe the photons passing through the slit only served to produce what the observer was looking for: particles or waves. The deeper scientists probed, the more unsatisfactory the ‘either/or’ paradigm became; nature simply did not function in this manner. Experiment after experiment proved not only was the clock work model obsolete, but so was the ‘either/or’ logic on which it depended. Quantum theory, however, provided an alternative: the possibility that entities in the universe could *both* be one thing *and* another. Like light being *both particle and wave*, quantum theory challenged the world to open its mind to the realization that in nature things are rarely ‘either/or’. Increasingly the ‘both/and’ world view began to better reflect the realities of the world.

Stoppard constructs a plot, which not only allows him to explore the intricacies of quantum science and identity, but self-reflexively reinforces these concepts. The play begins with a failed experiment which leads the characters to develop a hypothesis (Ridley is the double agent). The hypothesis is tested in the second act of the play with another experiment (the trap for Ridley). The scientific structure works on two levels. First, the movement of characters in the experiment is reminiscent of the movement of particles in a double slit experiment. The men’s bath house in which the first scene is set has four doors by which characters can come and go. The scene opens with a whirlwind

of entrances and exits by a number of characters. The bathhouse which is described as circumnavigable makes it particularly difficult to determine which doors characters are going into or coming out of. The introduction of twins increases the difficulty to the point that it is nearly impossible to predict the movements of characters or even determine who they are. Like in the double slit experiment it is impossible to tell which door (hole) the character (photon) will go through. With the introduction of twins it becomes impossible to tell which twin we are seeing.

Each experiment reveals the complexity of identity and the importance of the observer. The experiments (like the double slit experiment) the indeterminacy and complementarity of identity. In the first scene, both the Russian twins and the Ridley twins cause chaos because the agents do not know which twin to follow. In the final experiment, Hapgood pretends to be her own twin Celia while Ridley continues to pretend not to be the spy he really is. There is the added complication in the inter-scene of the second act when Ridley suddenly makes a ‘quantum leap’ and becomes his twin.¹⁸

Through juxtaposition Stoppard explores the indeterminacy and complementarity of identity, and through the lens of quantum science constructs a plot which inherently demonstrates the wisdom of accepting a ‘both/and’ quantum world view and the folly of sticking to the ‘either/or’ Newtonian perspective. For most of the second scene the audience is faced with the mysterious complementarity of identity. Throughout the entire second experiment the audience must question what it is seeing: Hapgood or Celia? Ridley or Ridley’s twin? It was in response to the wave-particle duality that Niels Bohr

¹⁸ This mirrors the quantum phenomenon of an electron’s ability to change quantum states. Momentarily in a superposition of states, an electron “jumps” to a different energy level.

coined the term “complementarity.” Bohr considered “an entity such as an electron as neither a wave nor a particle but something different” (Gribbin 16). Rather than forcing the ‘either/or’ Bohr settles for a more realistic concept of light has *both* particle *and* wave depending on the observer.

Within this structure, Stoppard uses twins to convey the indeterminacy of identity by highlighting the fundamental unreliability of appearances. The twin motif is introduced almost immediately in the first act. As Hapgood and her team lie in wait for their Russian ‘sleeper’ turned ‘joe’ Kerner to meet his contact Georgi, they are unpleasantly surprised by the appearance of twin Russian agents.¹⁹ Merryweather, a member of Hapgood’s team assigned with the job of tailing the Russian contact, unwittingly follows one twin in and the other twin out; completely unaware that he is tailing two different people. These are not the last set of twins to appear in the play. When Ridley is discovered to be the double agent, Kerner and Hapgood correctly conclude (on the basis of the bridges of Königsberg) that Ridley has been passing information to the Russians with the help of his twin. In order to catch Ridley and his twin in the act, Hapgood must pretend to be her own twin, Celia Newton. Katherine Kelly argues that like the dual nature of light, “twins insidiously undermine all notions of fixity – fixed time, fixed space, personal identity, and reliable perception” (Kelly 151). In the world of espionage, twins make particularly adept agents because they defy surveillance. However, twins are not the only representations of doubles in the play. Almost every

¹⁹ John Fleming provides the following definitions: “[a] ‘sleeper’ is an agent who is sent in years in advance and establishes himself or herself as an ordinary citizen preparing for the moment when he or she will be activated and required to pass on vital pieces of information. A ‘joe’ is an agent who has been turned to work for the other side” (Fleming 177).

character in *Hapgood* is a double in some way. The play suggests that this notion of “twinning” (that two possibilities can exist simultaneously) is a fundamental part of human nature.

By presenting characters that carry multiple identities (depending on the context in which they are viewed) Stoppard makes a strong case for the complementarity of identity. Complementarity is demonstrated in *Hapgood* by the numerous and varied monikers given to the characters. Kerner is one of Hapgood’s ‘joes’ but he is also Josef, her former lover whom she still affectionately refers to sometimes as Joe. He is the father of her son, who is also named Joe. Not only does Hapgood have many ‘Joes/joes’ (some of which are Joes on multiple levels) in her life, but she also goes by a number of different names. To the agents and ‘joes’ that she runs she is Hapgood or her code name ‘Mother’.²⁰ At work Hapgood is ‘Mother’, at home she is Mum. At times Hapgood also goes by ‘Mrs. Hapgood’ (the title of course being a courtesy as she is unmarried). Hapgood’s handles become more personal, depending on the level of intimacy with other characters. To Blair, who is both her boss and (it is suggested) her occasional lover, she is alternately Hapgood and Elizabeth. Kerner on the other hand refers to her affectionately by the Russian translation of her name: Yelizaveta or Lilichka and in the diminutive, Lilya. Once she assumes the role of her own twin sister, Celia Newton, Hapgood refers to herself (herself being Hapgood not Celia) as ‘Betty’ and is dubbed ‘Auntie’ by Ridley. Fleming argues that, “the lack of a single, fixed name alludes to the changing, divided nature of her individual identity and the motif of ambiguous nomenclature runs

²⁰ Blair explains to Wates: “[t]here is a son but she was called Mother when she joined the Defence Liaison Committee – the tea would arrive and the Minister would say, ‘Who’s going to be mother?’” (*Hapgood* 27).

throughout the play, reinforcing the theme that everyone has multiple identities” (Fleming 184). The reality of multiple identities is one which Kerner readily embraces, Blair rejects, and Hapgood hopelessly tries to juggle.

Like Einstein and Bohr, Stoppard pits the classical ‘either/or’ Blair against quantum ‘both/and’ Kerner to highlight the inevitable fallibilities in ‘either/or’ thinking and to emphasize the two extremes Hapgood is caught between. The concept of multiple identities is first voiced by Kerner in the second scene of the first act as he obliquely answers Blair’s query as to where his loyalties lie: East or West. Kerner prefaces his answer with a description of the double slit experiment and the dual nature of light. When Blair fails to grasp the significance of this Kerner answers more directly:

Somehow light is particle and wave. The experimenter makes the choice. You get what you interrogate for. And you want to know if I’m a wave or a particle. I meet my Russian friend Georgi, and we exchange material. When the experiment is over, you have a result: because I have given Georgi enough information to keep him credible as a KGB control who is running me as a sleeper – *which is what he thinks he is.* (Hapgood 12).

Kerner’s easy acceptance of the duality of both light and identity is not only because of the fact that he is a physicist but also that as an individual, Kerner must balance a number of roles and identities.²¹ Because of his own bifurcated identity, Kerner has ceased to

²¹ In *Theatre of Chaos: Beyond Absurdism, into Orderly Disorder*, William Demastes charts Kerner’s many roles: “[h]e is both physicist and secret agent, by birth German and Russian (having been born in the German city of Königsberg (which was annexed as Russian after World War II and renamed Kaliningrad), by current affiliation both Russian and British (working for both governments), by inclination an artist though by training a

operate within the restrictive Newtonian ‘either/or’ mindset and has adopted the ‘both/and’ quantum world view. If Kerner is the character in the play who most embraces the implications of wave-particle duality, Blair is the most resistant. In *Hapgood*, Blair represents the staunchly Newtonian mindset, still mired in binaries and hopelessly trapped in an ‘either/or’ world.

Because Blair fails to grasp the fluidity of identity, he imposes strict ‘either/or’ boundaries on his and Hapgood’s relationship. By denying the inherent complexity of life and identity, Blair ruins their relationship and dramatizes the folly of ‘either/or’ thinking. Blair is woefully out of step with the new sciences as Stoppard makes clear in the third scene of the first act: “[a]nti-particles. Do you know what they are? They were never mentioned by Democritus who was the pro-particle chap when I was at school” (*Hapgood* 18). Blair goes on to admit, “I gave a chap a job with us once because he said he’d read physics and I thought he meant the book by Aristotle” (*Arcadia* 18). Both of these ancient philosophers were determinists who rejected chance and chaos and strove for a more ordered understanding of the world. With this ideological background it is not surprising that Blair fails to grasp Kerner’s meaning.²² Blair’s mindset is militantly ‘either/or’: either with us or against us; either Russian or British; either technical or personal he maintains distinct boundaries. The only area in Blair’s life which becomes blurred is his relationship with Hapgood.

scientist, fluent in both Russian and English, lover and employee of Hapgood (the father of her son)” (*Chaos* 44).

²² Demastes argues: “the thing that quantum mechanics challenges – the notion of an objective, rationalist grounding of reality – is the thing the chief British officer, Blair, needs so desperately to understand in order to recover stolen, nationally sensitive property. It is, however, the thing Blair refuses to grasp” (*Chaos* 44).

The tenuous relationship that exists between Hapgood and Blair is clearly divided into two definite spheres: personal or technical. The boundaries of their relationship are established in the second scene of the first act:

Blair: Don't pack it in yet, I need you.

Hapgood: I suppose that's technical, is it?

Blair: I suppose so.

Hapgood: Just making sure. I was calling you at the pool this morning. Where were you?

Blair: I was there.

Hapgood: I needed *you*.

Blair: No, no, that was only personal. But you're going to need me now (*Hapgood* 24).

Hapgood's sarcastic quip "I suppose that's technical, is it?" suggests that this is not the first time the two have had a conversation on this issue. The scene also establishes Blair's priorities. Blair will always choose the technical over the personal. In his mind they both need each other technically, but she is not allowed to need him personally if it conflicts with the technical. The ultimate demonstration of Blair's true loyalty occurs at the end of the play. After agreeing with Hapgood that it would be too dangerous to include her son in the trap for Ridley, Blair goes against her wishes and without her knowledge brings Joe to the pool.²³ For Blair what matters is not the safety of a little boy, but the safety of

²³ Fleming makes the assertion that "Blair surrenders his personal relationship with Hapgood and risks her son's safety because for him individual people are sometimes pawns that must be sacrificed to win the "larger" game of international espionage" (Fleming 187).

the 'Service' and all its secrets. When faced with either the life of a child or getting the upper hand on the KGB, Blair chooses the latter.

Blair's decision is antithetical to the decision Kerner has made before the play starts: to give the Russians his anti-particle research in exchange for his son's safety. In the first scene of the second act, Kerner confesses that over a year ago the Russians found out about his and Hapgood's son Joe and threatened his life if Kerner did not hand over his research. Although this story is supposed to be part of the ruse meant to lure Ridley into revealing his twin, both Hapgood and Blair realize that Kerner has 'made up the truth' (*Hapgood* 88). When Blair confronts him later Kerner coolly replies,

Yes – no, either – or... You have been too long in the spy business, you think everybody has no secret or one big secret, they are what they seem or they are the opposite. You look at me and think: *Which is he?* Plus or minus? If only you could figure it out like looking into me to find my root. And then you still wouldn't know. We're all doubles. Even you (*Hapgood* 72).

Although Blair sees him as a traitor for giving confidential information to the Russians, Kerner does not see himself as a traitor. He does not view himself as *either* a Russian sleeper *or* a British joe, rather he understands that he is *both* a spy *and* a father. In Kerner's mind the East and the West are both relatively corrupt and what deserves his protection and loyalty are not either of these but his eleven year old son.²⁴

Blair refuses to recognize the fluidity of identity. When Blair finally tires of Kerner's quantum metaphors he explodes "You're this or you're that, and you know

²⁴ Delaney argues this scene demonstrates that "Kerner seems to think not so much in terms of ideology as in terms of the responsibility he bears as an individual in dealing with other individuals" (Delaney 139).

which. Physics is a detail I can't afford, I've got one of my people working the inside lane on false papers and if she's been set up I'll feed you to the crocodiles – is that *real* enough for you?" (*Hapgood* 73). Kerner's response foreshadows Blair's decision at the end of the play: "One of your *people*? Oh, Paul. *You* would betray her before I would. My mamushka" (*Hapgood* 73).²⁵ When they are in the technical realm Blair expects to deal with Hapgood. When they are in the personal realm Paul expects Elizabeth. Blair does not tolerate either world interfering with the other. He doesn't grasp that Hapgood and Elizabeth are two sides of the same person and sometimes the technical becomes personal. When Hapgood calls out to Blair at the end of the first act, she is not calling as an employee reporting to her boss, she is calling as an upset lover and she receives no answer. Although Hapgood has already experienced her personal world interfere with her technical world, Blair is unwilling to cave on his boundaries. When she radios, Blair expects to hear Hapgood reporting in but it is Elizabeth calling out. He ignores her call, choosing the technical over the personal for the first but not last time in the play. Blair refuses to accept the uncertainty of reality. However, the world is not static and neither are the individuals that populate it. By denying the complementarity of identity Blair not only fails to see the answer to his case but also drives Hapgood away.

²⁵ Delaney posits: "although Blair may perceive Kerner's statement as evidence of continuing loyalty to the West, Kerner is actually saying that he places a higher premium on not betraying a particular person - much as he would protect his own mother – than on giving away scientific secrets" (Delaney 138). Delaney uses this as a basis to ultimately pit the two against each other: "[a]s opposed to Kerner's poignant concern for persons, the urbane organization man Blair is the prim exemplar in the play of the elevation of corporate interests above any interest in individuals... Blair sees persons ultimately in terms of their instrumental worth, as tools, chess pieces, to be used" (Delaney 140).

The play juxtaposes the ideologically opposed Blair and Kerner, setting the stage for the crux of the play: Hapgood's decision about her own identity – between her role as 'Mother' and Mum. Hapgood's conversion from an 'either/or' to a 'both/and' perspective begins with the birth of her son – an experience which teaches her the inevitable superposition of states in life. Hapgood is not only calculatingly brilliant, she is an excellent manager and spy and the first and only woman in the Service. However, since the birth of her son Hapgood feels increasingly torn between her professional or technical world (her job) and her personal one (her son and the men she loves). She slowly allows her personal world to encroach upon her technical. When Blair admonishes Hapgood for sending Joe a postcard while on a covert operation, she hotly responds:

No, you're right, I break the rules, and if Matron is KGB it's going to be all over Dzerzhinsky Square – Hapgood was in Vienna. Well, I keep *missing* things, last time I missed him in *Robin Hood* even if he was only a tree, and if I can't send him a rotten postcard you can take Vienna and stick it up your – (*Hapgood 22*).

Hapgood cannot suppress the guilt she feels for putting her son in boarding school but realizes that her job is incompatible with the demands of a full-time parent:

He'd have to put himself to bed four times a week even when I'm working out of Half Moon Street – I already run the only intelligence network in the Western world which exhibits seasonal fluctuations, and it's only a matter of time before somebody works out it's the school holidays. Anyway, there's the male society thing, they're supposed to need that when they haven't got a father (*Hapgood 23*).

Hapgood's guilt is not merely because she feels that she is an absent mother, but also because she feels she has robbed her son of his father, all in the name of business.

Hapgood's relationship with Kerner is a constant tug of war between her personal and professional sensibilities. On one hand, Joseph Kerner is the Russian sleeper she turned: her 'star joe'. She is ferociously proud of this: "*Kerner is my joe! I turned him*" (*Hapgood* 43). On the other, he is her Joe – lover and father to their son. As Ridley explains to Celia (who is actually Hapgood):

She got pregnant screwing the Russians, Auntie. Then it was a choice between losing a daddy and losing a prize double, a turned mole who would have been blown overnight if he was known to be the father, and we aren't in the daddy business, we're in the mole business (*Hapgood* 81).

Once Kerner is blown and there are no professional limitations to their relationship, Hapgood clumsily tries to reinitiate the personal relationship that she has rejected all along: "I won't need you any more, I mean I'll need you again – oh, *sugar!* – you *know* what I mean – do you want to marry me? I think I'd like to be married" (*Hapgood* 50). Hapgood struggles to recover what she has lost (her family) in the name of business.

However, just as Hapgood is realizing the depth of her feeling, Kerner is more convinced than ever that their relationship was never more than business for her. He reproachfully reminds her:

If I loved you it was so long ago I had to tell you in Russian and you kept the tape running. It was not a safe house for love. The spy was falling in love with the case-officer, you could hear it on the playback. One day you switched off the hidden microphone and got pregnant (*Hapgood* 50).

He responds incredulously to her protestations of love: "You interrogated me. Weeks, months, every day. I was your thought, your objective... If love was like that it would not

even be healthy” (*Hapgood* 50). His constant and cynical denial brings forth the true force of Hapgood’s love: “(*Flares*) That’s a damned lie! You unspeakable *cad!*” (*Hapgood* 50). The normally prim Hapgood, the unflappable spy mistress is finally pushed to profanity. However, the tenderness between the two is truly felt after Kerner reveals his plans to return home:

Hapgood: You mustn’t say that to me, Joseph. Please don’t say it.

(Kerner comforts her.)

Kerner: Milaya moya, rodnaya moya²⁶... it’s all right. I am your Joe.

(She suffers his embrace, then softens into it.) (Hapgood 51).

Despite what has transpired between them there is a gentleness to their exchanges that suggests their relationship was more than Kerner claims it was and more than Hapgood believed it to be.

Until the final scene of the play, Hapgood has consistently chosen the technical over the personal. Once she assumes her role as her own twin Celia Newton, Hapgood is allowed to step outside of herself and not only take an objective look but fully become her antithesis. Ridley (for whom the ruse is intended) describes Celia as “a pot-head... she won’t stop talking, she bites her nails, she looks like shit” (*Hapgood* 66). As her own sister, Hapgood allows herself surprisingly honest self-reflection: “having the kid was good for her, she always thought the delinquents had the bastards and the scholarship girls had the wedding. It shook up her view of the world” (*Hapgood* 77). As the conversation revolves around Joe, Ridley becomes increasingly bitter, “she should have given him a daddy instead of getting her buzz out of running joes to please an old bastard

²⁶ My darling, my darling...

who doesn't want her and never will... Blair's been running *her* for years!" (*Hapgood* 81). In a line that cuts right to the heart of the matter Ridley sardonically remarks: "Betty bought the whole lie and put it first, she *is* the lie" (*Hapgood* 82). Hapgood has dedicated her life and sacrificed her family for her work, but once her technical world begins to threaten her personal one, Hapgood draws the line.

Blair's betrayal ultimately allows Hapgood to make the ideological break necessary to leave her technical world and fully assume her role in her personal one.²⁷

Not only does Blair betray her trust by bringing her son into a potentially dangerous situation against her express wishes, but he does so knowing full well what her reaction will be:

Hapgood: I'll never forgive you for that, never ever.

Blair: I know that. I knew that. (*Hapgood* 86).

Despite the fact that Blair knew his actions would be detrimental to his personal relationship with Hapgood, he refused to allow it to affect his technical decisions. What he did not anticipate was that once Hapgood's technical world endangered the very center of her personal one, she would choose being Mum over "Mother".²⁸ Trying to bring her back to 'reality' Blair poses the ultimate 'either/or' question:

Blair: It's them or us, isn't it?

²⁷ Fleming observes, "for ten years Hapgood chose the values of the technical over the values of the personal, but now, after killing Ridley and seeing Blair, the man she most wanted, place her son's life in jeopardy, she disavows her profession" (Fleming 189).

²⁸ Kelly reasons: "the process of confirming Ridley's double (and double cross) also confirmed Blair's Newtonian rigidity and Hapgood's post-Newtonian flexibility" (Kelly 157).

Hapgood: Who? Us and the KGB? The opposition! We're just keeping each other in business, we should send each other Christmas cards – oh, f-f-fuck it, Paul!

(*Hapgood* 87).

The two Hapgoods collapse as the mother reacts to Blair's careless use of her child and 'Mother' realizes that the game she thought she was playing isn't real at all.

In summary, through quantum physics Stoppard argues for the complexity and unpredictability of individual personality and in doing so he emphasizes the importance of human choice and action. Kerner in particular argues for the uniqueness of human personality. The fact that complex and diverse personalities (like Einstein's) occur is proof to him that God exists. For Kerner the very existence of such complex and fluid personalities proves there is some meaning in the chaos. In *Arcadia*, Bernard makes a similar argument when he angrily tells Valentine "you cannot put Byron in a laptop" (*Arcadia* 60). Invention depends on chaos and unpredictability, and is ultimately shaded by the complexities of the creator's personality. Hannah also argues that this element of unpredictability is necessary for genius. Valentine dismisses the fact that Thomasina and Septimus could have discovered what their scribbling indicates "[b]ecause there's an order things can't happen in. You can't open a door till there's a house." Hannah meaningfully responds, "I thought that's what genius was" (*Arcadia* 79). Although Thomasina's brilliant equation depends on the computer in order to be fully realized, it is still imbued by the complexities of her personality. Though the equation is logically brilliant she gives it the witty (but silly) name: the "rabbit equation" because it "eats its own progeny". The complexities of human personalities and the actions they choose

imbue the world with both chaos and order demonstrating the fundamental importance of human action in the universe.

CHAPTER IV: ORDER OUT OF DISORDER INTO DISORDER: THE
REGENERATIVE WALTZ

*Nature has played a joke on the mathematicians. The nineteenth century mathematicians
may have been lacking in imagination, but Nature was not.*

F.J. Dyson, 'Characterizing Irregularity'²⁹

Arcadia shares many characteristics with the previous plays discussed here. All three contain mysteries which require detective style inquiry: in *Rosencrantz and Guildenstern* the hapless duo try to determine why they are where they are and how they should act; in *Hapgood* the titular character must determine how Ridley has been slipping information to the Russians and whether or not Kerner has also become a double agent; and in *Arcadia* Bernard seeks to discover what occurred when Byron was at Sidley Park and Hannah searches for the Sidley Hermit. Superimposed on this modern timeline is the timeline in question: 1809 - Thomasina Coverly has just begun to explore the mysteries of her new mathematics.³⁰ Stoppard uses both lines of inquiry (of the ability to accurately reconstruct the past, and the move from Newtonian science to fractal geometry) to display the fundamental connection between human action and the chaotic inclination of the universe. By establishing a plot structure that employs recursive symmetry Stoppard

²⁹ (Nadel 433)

³⁰ Thomasina's mathematics seeks to describe the irregular forms of the universe, like an apple leaf or a jagged coastline. Though she is limited by her lack of technology, Valentine later proves that her early attempts were correct. Through fractal geometry, Thomasina seeks to give order to the irregular patterns that appear in nature.

creates a predetermined world which unfolds along with the undetermined actions of the characters. Characters become agents of chaos and order in a world that becomes harder and harder to predict with the more human interaction. Through strange attractors and recursive symmetry Stoppard foregrounds the fundamental importance of human action and choice in a universe which blends order and disorder and is constantly regenerating itself. Stoppard structures his plot as a recursive system, constantly emphasizing the power of sex, love and human action in a world that blends the determined and the undetermined. What Stoppard achieves in *Arcadia* is not merely sentimentally powerful or scientifically adroit – it is a melding of both modern science and universal humanism which demonstrates that we are not merely affected by the chaotic inclinations of nature; rather we are a fundamental part of it.

The structure of the play superimposes two timelines on the same scene. Although the characters change as time shifts, the physical reality of the room does not. By using recurrent images (or strange attractors) like the apple, the garden and the letters, Stoppard demonstrates the level of determinism that is inevitable in the universe. Chaos occurs when human actions (especially those driven by sex or love) disrupt the natural order. Human desire becomes the external input in the complex system which no one can predict with certainty.³¹ In *Arcadia* the characters become unpredictable autonomous agents in the universe whose actions (no matter how trivial) have incalculable effects on the universe. However, no matter how much chaos is created by human action, order is

³¹ Hayles differentiates that “[w]hereas Newtonian mechanics envisions the universe through inertial reference frames that extend infinitely far in space and time, chaotic concentrates on complex irregular forms and conceptualizes them (in fractal geometry) through fractional dimensions that defeat tidy predictions and exact symmetries” (Hayles 7).

inevitable. Thomasina finally gets a hint of justification for her intuition at the end of the play in an article Septimus gives to her: “Well! Just as I said! Newton’s machine which would knock our atoms from cradle to grave by the laws of motion is incomplete! Determinism leaves the road at every corner, as I knew all along, and the cause is very likely hidden in this gentleman’s observation” (*Arcadia* 83-84). Through his work Stoppard has argued the humans are not mindless subjects battered around by the universe rather they are a fundamental agents of chaos and order in the universe. Through their free will to choose and act, human beings unleash energy into the universe which gets mixed in with incalculable results. All one can do in such a universe is strive to find truth where it is possible and to take responsibility for the potential chaos of one’s actions.

Stoppard incorporates the conflict between Classicism and Romanticism, mirroring the conflict between the ordered Newtonian physics and the disordered chaos theory. The Romantic period signaled the end of the logical, ordered Classicism. The narrow parameters on art, society and literature were removed and the response was an effusion of beauty with an emphasis on “natural” and an avoidance of the artificial.³² The garden is the physical manifestation of this conflict between Classicism and Romanticism. Lady Coverly’s orderly garden is usurped by Mr. Noakes’s Romantic landscape design. The garden comes to embody the principles of chaos theory: though it

³² In “Keats and Romantic Science,” Alan Richardson explains: “With the mechanistic scientific paradigm associated with Newton giving way to a biological emphasis typified by Darwin, science and medicine took on a “Romantic” character, featuring a naturalistic ethos, an attention to “organic form,” and developmental and ecological models that show more than superficial resemblance to analogous impulses in the arts” (Richardson 231).

is seemingly disordered, Mr. Noakes careful planning ensures that within the perceived disorder of a garden, there is an underlying order.³³ Through the common pursuit of intellectual curiosity Stoppard bridges the gap between these two disparate periods.

Because *Arcadia*'s plot structure represents a system which displays recursive symmetry there are a number of symmetries and asymmetries which occur throughout the play. In each scene the general form (the set) is repeated. The stage directions specify the uniformity of the set despite time period:

The action of the play shuttles back and forth between the early nineteenth century and the present day, always in this same room. Both periods must share the state of the room, without the additions and subtractions which would normally be expected (*Arcadia* 15).

Although the objects remain in the fixed location of the room, the actions of the characters are unpredictable and as a result the movement of the objects becomes unpredictable. Septimus's pet tortoise Plautus is almost indistinguishable from Valentine's Lightning. Fermat's theorem (which Thomasina declares merely a joke to drive everyone mad) is reflected at the end of the play by Thomasina's own theorem (which Septimus predicts will drive him mad). However, not all symmetries are sustained across the two periods. The uncertainty of human behavior causes asymmetries which cannot be predicted. Septimus and Thomasina share their first kiss in the hermitage; Bernard and Chlöe are caught having sex in the hermitage by Chlöe's mother who is

³³ Richardson argues: "The chemistry of the Romantic era – virtually a "new science" ... implied a constantly changing physical environment, a world of process and transformation in contrast to the fixed and mechanical universe of Newtonian physics" (238).

looking for the theoldite (left by Hannah). Trivial acts bear incalculable effects in a chaotic system. The more erratic the variable, the harder to predict its movements. Not surprisingly, the fickle nature of sexual desire comes to have the biggest impact of all.

The apple, acting as a strange attractor, holds a dual meaning in the play; it is not only a symbol of science and scientific progress (it is what inspires Thomasina and what drives Hannah and Valentine to test her mad scribbling) but also becomes a symbol for love and sexual desire. The apple, whose leaf becomes a central image in the play, is introduced at the end of the first scene and is a point to which the play recurrently turns. The apple, a timeless symbol of temptation from the Garden of Eden and the central image in the apocryphal story of Newton's discovery of gravity, is first given to Hannah by a besotted Gus in the second scene. His gesture seems to confirm what Clöe has been telling Hannah: Gus is in love with her. Disturbed by this display of affection, Hannah places the apple on the desk. Septimus picks up the apple in the third scene and (after cutting off the leaves and stems) proceeds to eat the apple, sharing occasionally with Plautus. Moments later Thomasina picks up the discarded apple leaf and vows to deduce its equation. Hannah will later pick up the same leaf as she timidly pushes Valentine, "So you couldn't make a picture of this leaf by iterating a whatsit?" (*Arcadia* 47). Although Valentine denies such a possibility at first, by pushing Thomasina's equation through a computer a few million times, he discovers that she was in fact on the right track and dubs the apple leaf algorithm: the Coverly set.

It is because of her general unease towards love and sexual desire that Hannah originally abandons the apple on the desk. Indeed, in *Arcadia* the chaos sexual attraction inspires is what drives the action of the play. Valentine refers to sex as "[t]he attraction

that Newton left out” (*Arcadia* 74). As the characters act and make choices based on sexual desire, new relationships are created and destroyed. The order and disorder created by sexual desire unfolds together, creating the fabric of the human experience. The effects of actions driven by sexual desire are unpredictable and their effects reverberate from one time period to the next.

Sex is a constant source of disorder and conflict in the play, demonstrating the unpredictability and potential chaos it is capable of creating³⁴. Sex is introduced in the first line of the play with Thomasina’s question, “Septimus, what is carnal embrace?” (*Arcadia* 1). From that moment on, sex becomes one of the foreground issues in the play. The establishment and dissolution of relationships drives the plot creating order and chaos as sexual desire (the driving force) follows its own erratic course. The first scene opens with the revelation of Septimus and Mrs. Chater’s tryst³⁵ in the gazebo. The tryst results in chaos with Chater’s discovery and threats of violence. Much of the first scene consists of a confused conversation between Septimus, Chater, Mr. Noakes, Captain Brice and Lady Croom. Lady Croom, Captain Brice and Mr. Noakes having unwittingly walked in on Septimus and Chater’s confrontation begin discussing the garden. Septimus and Chater consumed by their own predicament assume the other three are referring to

³⁴ As Veas-Gulani argues “sex is in fact responsible for many different (unexpected) developments in the plot. It thus functions as a strange attractor to which the plot returns again and again, resembling a self-similar fractal structure” (Veas-Gulani 417).

³⁵ This affair sets up the conditions necessary to create the false history that Bernard “discovers”. It is because of his affair with Mrs. Chater that Septimus is challenged to a duel by Mr. Chater (in a note that Bernard later finds and assumes is Lord Byron’s) and is forced to mollify Mr. Chater with false praise and the promise of a glowing review of *Couch of Eros*. Sycophantically, Mr. Chater writes a warm inscription in Septimus’s copy of *Couch of Eros* (which Bernard later misinterprets).

Septimus's tryst. The results are comical but nonetheless alarming to Septimus and puzzling to Lady Croom. It is Thomasina who perceives the folly of both and restores order: "Septimus, they are not speaking of carnal embrace, are you Mama?" (*Arcadia* 10).

The first scene sparks Thomasina's sexual awakening which will continue throughout the play and in turn creates more chaos which continues to drive the plot. While constantly on the fringe, Thomasina is all the more observant giving voice to what others do not or choose not to see. "Mama is in love with Lord Byron" Thomasina offhandedly remarks (*Arcadia* 36). Although it is true that Lady Croom and Lord Byron are having an affair, Thomasina does not state it just for the sake of conversation. She does so (childishly) to needle Septimus, who is obviously affected by the news, "Septimus's pen stops moving, he raises his eyes to her at last" (*Arcadia* 36). Thomasina also reveals that Byron (in an attempt to impress Lady Croom) let slip that Septimus was the author of a searing review of 'The Maid of Turkey' in front of Charter. This final insult drives Charter (with Captain Brice's encouragement³⁶) to challenge Septimus to a duel. In the midst of this confusion Lady Croom ducks in to "borrow" Septimus's copy of 'The Couch of Eros' for her lover Byron.

Sex is a driving force, but it is not the defect of some omnipotent deity; rather, it is the culmination of human action and choice both of which can have incalculable affects on the universe. Septimus is saved from the duel when Lady Croom discovers

³⁶ It is Captain Brice who has brought the Chaters to Sidley Park and it is suggested that he has done so more for Mrs. Chater's talents than for Mr. Chater's. His encouragement for Charter to engage in a duel with Septimus is really driven from his own jealousy at having his mistress taken from him. Comically, Charter is the only one (except for perhaps Thomasina) who does not realize this.

Mrs. Chater leaving Lord Byron's room in the middle of the night. Lady Croom immediately dismisses the Chaters, Captain Brice (for bringing them there), and Lord Byron. She is furious with Septimus for having invited Byron. He mollifies his mistress by burning Byron's letter, and scene six ends with the suggested promise of a late night rendezvous between Septimus and Lady Croom. By the next scene however, there has been a three year time lapse and Lady Croom has moved on, and is entertaining her new lover Count Zelinsky in the next room. Septimus sulks as Thomasina (three years older than in the last scene) vainly tries to flirt with her tutor. It is her desire for Septimus that causes Thomasina to sneak down on the night before her birthday to steal a waltz and a kiss. In *Arcadia* relationships are ruled by sexual desire which is unpredictable and erratic. Lady Croom transfers blame, rationalizing: "[i]t is a defect of God's humor that he directs our hearts everywhere but to those who have a right to them" (Stoppard 71). However, as the play demonstrates, this classical deterministic view is naïve to the reality of the universe.

Thomasina asserts both the power of sex and the power of choice in her discussion of Cleopatra. In her disdainful evaluation, Thomasina emphasizes not only the sexual aspect of Cleopatra's choices but the historical impact of these choices:

Everything is turned to love with her. New love, absent love, lost love – I never knew a heroine that makes such noodles of our sex. It only needs a Roman general to drop anchor outside the window and away goes the empire like a christening mug into a pawn shop. If Queen Elizabeth had been a Ptolmey history would have been quite different – we would be admiring the pyramids of Rome and the great Sphinx of Verona (*Arcadia* 38).

Thomasina argues that history would have been better off if the lusty Cleopatra had been replaced by the “virgin” Queen. By juxtaposing two historically divergent sexual figures, Thomasina identifies sex as an uncontrollable and unpredictable historical agent apt to wreak chaos and destroy progress.

It is Chlöe who fully articulates the power of human action and sexual desire, and their potential impact in the universe. The conversation between Chlöe and Valentine about the possibility of a holistic prediction of future events reflects Thomasina and Septimus’s earlier conversation.³⁷ The difference is that Chlöe rejects hope of any definite knowledge of the universe reasoning that sex makes prediction impossible.

Chlöe: The future is all programmed like a computer – that’s a proper theory, isn’t it?

Valentine: The deterministic universe, yes.

Chlöe: Because everything including us is just a lot of atoms bouncing off each other like billiard balls.

Valentine: Yes. There was someone...³⁸

Chlöe: But it doesn’t work, does it?

Valentine: No. It turns out the maths is different

Chlöe: No, it’s all because of sex.

³⁷Thomasina: “If you could stop every atom in its position and direction, and if your mind could comprehend all the actions thus suspended, then if you were really, *really* good at algebra you could write the formula for all the future; and although nobody can be so clever as to do it, the formula must exist just as if one could.”

Septimus: “(Pause) Yes. (Pause.) Yes, as far as I know, you are the first person to have thought of this” (*Arcadia* 5-6).

³⁸ Valentine was most likely about to reference Pierre Simon de Laplace.

Valentine: Really?

Chlöe: That's what I think. The universe is deterministic all right, just like Newton said, I mean it's trying to be, but the only thing going wrong is people fancying people who aren't supposed to be in that part of the plan.

Valentine: Ah. The attraction that Newton left out. All the way back in the garden. Yes. (Pause) Yes, I think you're the first person to think of this (*Arcadia* 74).

Chlöe sees the universe in the same determined way Newton did, however Chlöe does not link human behavior to this same determined system. On the contrary, human behavior becomes an agent of chaos in a determined world. Once again "the unpredictable and predetermined unfold together to make everything the way it is" (*Arcadia* 47). Human behavior is unpredictable and erratic and becomes increasingly unpredictable when influenced by sexual desire. The importance of Chlöe's argument lies in the power and autonomy she gives to human action. People are not helplessly bound to a determined system which drags them mercilessly to their death; rather they are free agents capable of creating both order and disorder.

Even human affairs become recursive as the relationships of the modern period reflect those of their nineteenth century counterparts. Like Lord Byron and Lady Croom, Bernard and the current Lady Croom are engaged in a flirtatious, possibly intimate relationship. Valentine tells Hannah:

My mother's lent him her bicycle. Lending one's bicycle is a form of safe sex, possibly the safest there is. My mother is in a flutter about Bernard, and he's no

fool. He gave her a first edition Horace Walpole, and now she's lent him her bicycle (*Arcadia* 51).

Bernard's potential affair is jeopardized by his current affair with her daughter Chlöe. While Septimus seems to be conscientious of Thomasina's feelings, Bernard is oblivious, merely exhilarated by the game: "[n]o-I don't want her mother to know. This is my first experience of the landed aristocracy. I tell you, I'm boggle-eyed" (*Arcadia* 64). Like Lady Croom, Bernard refuses to take responsibility for his actions, "[s]educing her? Every time I turned round she was up a library ladder. In the end I gave in" (*Arcadia* 64). Bernard is eventually burned when Chlöe's mother catches her with Bernard in the hermitage. This is not however Bernard's most significant relationship in the play. The relationship between Bernard and Hannah, though never physically sexual, is significant because it pits the classical and romantic ideologies that shape the play against one another.

As the dominant form of communication in the play and a strange attractor, letters become a source of order and disorder as they both aid and sabotage the endeavors of those trying to reconstruct the past. The opening action of the first scene mirrors that of the third scene with Septimus, Thomasina and Jellaby on stage. The stage directions even comment, "We have seen this composition before: Thomasina at her place at the table; Septimus reading a letter which has just arrived; Jellaby waiting, having just delivered the letter" (*Arcadia* 35). The opening action of both of these scenes hangs on the contents of the letters. The letters of course are from the poet Ezra Chater, the first on the occasion of Septimus's adultery with Mrs. Chater and the second in outrage at the degrading review

of Chater penned by Septimus. Septimus places both of these letters in his copy of *The Couch of Eros* (Chater's latest book) along with a warning letter from Mrs. Chater (that her husband has sent for pistols). It is this copy of *The Couch of Eros* and its contents on which Bernard, after discovering on the sales slip it had been in Byron's library, bases his investigation of Byron's time at Sidley Park. On the basis of the letters, Bernard extrapolates that Byron had an affair with Mrs. Chater and then killed the small time poet Ezra Chater in a duel. Bernard believes this is the long searched for explanation as to why Byron sailed to Lisbon and stayed abroad for two years after 1809. On the basis of the passages underlined in *The Couch of Eros*, Bernard also infers that Byron was the slanderous author of the Chater review in the *Picadilly Recreation*; he disregards the inscription (written sycophantically to Septimus by Chater in hopes of a glowing review) as merely indicative of the fact that the book did not originally belong to Byron.

Although Bernard's conjecture is theoretically sound it cannot hope to accurately reconstruct the complex motives and actions of human beings. When Hannah suggests that Byron and Septimus may have been contemporaries at Trinity, Bernard is encouraged to dig deeper. Hannah's discovery of a letter from Lady Croom to her husband discussing her brother, Captain Brice's, marriage to Mrs. Chater in 1810 bolsters Bernard's theory. When Valentine reveals that Byron's name is in the game books for shooting a hare in 1809, Bernard takes this as confirmation of his theory and proceeds to publish. As Hannah and Valentine attempt to point out to Bernard, speculating about a person's actions can be dangerous with no evidence to back it up. Exasperated, Hannah exclaims "[I]ook, sorry – I only meant, Byron could have borrowed the book without asking" (*Arcadia* 56). Ultimately, the only letter that would have been helpful to Bernard

is burned by Septimus before anyone has a chance to read it. Septimus is eager to prove himself to his livid mistress because he is in love with her. His sexual attraction causes him to destroy (by fire) the only shred of evidence that would have cast light on Bernard's case. The accusatory letters from Mr. Charter and the cautionary letter from Mrs. Charter are what lead Bernard to make his false Byron hypothesis. Sex is so powerful that even separated by a hundred and eighty years Septimus's acts are still causing confusion and chaos.

Through the garden and the characters' relationships, Stoppard depicts the aesthetic and intellectual movement from classicism to romanticism³⁹ (from human imposed order to embracing disorder) which mirrors the same movement made by classical scientists with the discovery of quantum science. A recursive element in the play, the garden becomes the perfect juxtaposition of the two ideologies that shape the play: the rational order of the Enlightenment and the sentimentality of the Romantics. The garden is largely discussed in 1809 by Lady Croom, who fretfully watches as Mr. Noakes wreaks havoc on her perfectly ordered garden, and in 1989 by Hannah Jarvis, who is investigating the Sidley Park hermit – her “peg for the nervous breakdown of the Romantic Imagination” (*Arcadia* 25). Lady Croom woefully pours over Mr. Noakes garden books, lamenting the loss of order:

Here is the Park as it appears to us now, and here as it might be when Mr. Noakes has done with it. Where there is the familiar pastoral refinement of an

³⁹ In a statement that strongly echoes the ethos of *Hapgood*, Demastes describes Stoppard's personal view of romanticism as “between the classical and absurdist either/or, occupying a both/and landscape of interacting order and disorder eternally at play” (*Chaos* 103).

Englishman's garden, here is an eruption of gloomy forest and towering crag, of ruins where there was never a house, of water dashing against rocks where there was neither spring nor a stone I could not throw the length of a cricket pitch. My hyacinth dell is become a haunt for hobgoblins, my Chinese bridge...usurped by a fallen obelisk overgrown with briars... But Sidley Park is already a picture and a most amiable picture too. The slopes are green and gentle. The trees are companionably grouped at intervals that show them to advantage. The rill is a serpentine ribbon unwound from the lake peaceably contained by meadows on which the right amount of sheep are tastefully arranged – in short, it is nature as God intended (*Arcadia* 12).

Lady Croom detests the “eruption of gloomy forest” and the fact that her Chinese bridge has been “usurped by a fallen obelisk overgrown with briars”. However, Lady Croom’s lamentation juxtaposes (humorously) the folly in both styles. On the one hand, Lady Croom believes “nature as God intended” must be ordered by humans, carefully constructed with “the right amount of sheep... tastefully arranged”. On the other hand, the Romantic design represents ordered disorder (like chaos theory). Though parts of the design may seem silly (“ruins where there was never a house”) what is important is the emphasis on orderly chaos. It is for this reason Thomasina declares Mr. Noakes the “Emperor of Irregularity”. He masterfully combines the undetermined and the predetermined until the two come together to form the Romantic landscape.

Hannah, like Lady Croom, values the order of Classicism and after studying Mr. Noakes’s garden books has pegged the Sidley Hermit as the perfect symbol of “the whole

Romantic sham” (*Arcadia* 27). She disdainfully refers to Noakes’s design as “untamed nature in the style of Salvator Rosa. It’s the Gothic novel expressed in landscape.

Everything but vampires” (*Arcadia* 25). Echoing Lady Croom, Hannah wistfully describes Sidley Park before Mr. Noakes’s alterations as “smooth, undulating, serpentine – open water, clumps of trees, classical boathouse” (*Arcadia* 25). Like Lady Croom, Hannah values order and logic and disdains the chaotic “Romantic sham”. Her work “The Genius of the Place: Landscape and Literature 1750 to 1834” posits the hermit of Sidley Park as the symbol of:

[a] century of intellectual rigour turned in on itself. A mind in chaos suspected of genius. In a setting of cheap thrill and false emotion. The history of the garden says it all, beautifully. There’s an engraving of Sidley Park in 1730 that makes you want to weep. Paradise in the age of reason. By 1760 everything had gone... ploughed under by Capability Brown. The grass went from the doorstep to the horizon and the best box hedge in Derbyshire was dug up for the ha-ha so the fools could pretend they were living in God’s countryside. And then Richard Noakes came in to bring God up to date. By the time he’d finished it looked like this... The decline from thinking to feeling, you see. (*Arcadia* 27).

Hannah’s nostalgia for the Enlightenment is barely surpassed by her disdain for Romanticism. She flatly tells Bernard, “I don’t like sentimentality” (*Arcadia* 28). Hannah

rejects sentimentality for reason, thinking for feeling and logic for intuition.⁴⁰ Despite Hannah's adherence to logic, her theory isn't any more correct than Bernard's.

Stoppard emphasizes Hannah's role as the classically sensible "Newtonian" by introducing Bernard Nightingale, her ideological opposite, shortly after. Bernard "wears a suit and tie. His tendency is to dress flamboyantly, but he has damped it down for the occasion, slightly. A peacock-coloured display handkerchief boils over his breast pocket. He carries a capacious leather bag which serves as a briefcase" (*Arcadia* 16). By juxtaposing the two character descriptions, Stoppard is immediately pitting the thinker and the feeler against one another. One scene that demonstrates the disparity between the classical and romantic temperaments occurs during the fourth scene between Hannah and Bernard. Having presumably just discovered a superscription by Byron in *Couch of Eros*, Bernard is challenged by Hannah:

Hannah: Is it his handwriting?

Bernard: Oh, come *on*.

Hannah: Obviously not.

Bernard: Christ, what do you want?

Hannah: Proof

Bernard: Proof? *Proof?* You'd have to be there, you silly bitch! (*Arcadia* 49)

Bernard's Byron theory gains even greater steam when Hannah presents him with evidence confirming that Mrs. Chater remarried (insinuating that Mr. Chater had indeed

⁴⁰ William Demastes argues "Hannah uses her mind to try to prove that Sidley Park is paradigmatic of the 19th century 'decline from thinking to feeling, intimating a desire to use orderly thought to prove it superior to the chaos/picturesque/Romantic model, which she describes as the irregularity of sentiment" (*Chaos* 99).

been killed). Bernard pounces upon this shred of evidence and embraces it as definitive proof that his theory is true. Hannah however, true to the classical form, remains skeptical. “You haven’t established it was fought. You haven’t established it was Byron. For God’s sake, Bernard, you haven’t established Byron was even here!” (*Arcadia* 50). Although Bernard’s theory is wrong, his response to Hannah’s challenge encapsulates one of the central conflicts of the play: between rational thinking and intuitive feeling,

Bernard: I’ll tell you your problem. Not guts.

Hannah: Really?

Bernard: By which I mean a visceral belief in yourself. Gut instinct. The part of you which doesn’t reason. The certainty for which there is no back-reference. Because time is reversed. Tock, tick goes the universe and then recovers itself, but it was enough, you were in there and you bloody *know*.
(*Arcadia* 50)

Although Bernard may be as wrong about time being able to flow backwards as he is about Byron, his assertion about Hannah is accurate.

The relationship between Bernard and Hannah is not only an iteration of the earlier intellectual seekers (Septimus and Thomasina) it also juxtaposes classical and romantic ideologies.⁴¹ Hannah seeks to expose the Romantic sham and Bernard seeks to expose the dark motive for Byron’s (Bernard’s hero and the face of Romanticism) trip to Lisbon. The difference between the two is introduced in their character descriptions.

⁴¹ Zeifman references Stoppard who has said he wanted “to write about the contrast between the classical temperament (“those who have particular respect for logic, geometry and pattern”) and the romantic temperament (“those with a much more spontaneous, unstructured communion with nature”) (qtd. in Zeifman 186).

Pragmatic Hannah is introduced wearing “nothing frivolous. Her shoes are suitable for the garden” (*Arcadia* 15). If Hannah represents the classical mindset, Bernard positively champions Romanticism. Flamboyant, sensual and impulsive, Bernard constantly offends Hannah’s (and Valentine’s) sensibilities. He publishes impulsively, ignoring anything that might contradict his theory. He sensationalizes his story, titling it: ‘Even in Arcadia – Sex, Literature and Death at Sidley Park’. He passive -aggressively takes a swipe at Valentine (and his work with grouse populations) when he declares “but as we know now, the drama of life and death at Sidley Park was not about pigeons but about sex and literature” (*Arcadia* 56). Hannah is constantly exasperated by Bernard as he refuses to conform to her logical system and persistently insists on using his intuition.

In the end gut instinct and cold rationality both fail as Bernard and Hannah discover their theories are wrong. Bernard’s theory is undermined by the fact that Septimus burns the only letter (the one from Byron that Septimus burns for Lady Croom) that would have shed light on the truth. Hannah’s original theory about who was the hermit of Sidley Park is wrong and though she discovers (or intuits) that it was Septimus, she has no way of proving it. By way of a magazine article she discovers that the thousands of pages of cabalistic proofs found in the hermitage were not mad scribbling but a continuation of Thomasina’s mathematical intuitions. Hannah cannot prove this however because the contents of the hermitage were burned dismissed as the scribblings of a “mind in chaos.” Despite Bernard and Hannah’s faith in their intuition and logic (respectively) their efforts to accurately reconstruct the past are thwarted by sex and love and the actions they motivate.

Neither logic nor intuition stands a chance when faced with the unpredictabilities of human action and choice – especially when it comes to love and sex. Bernard’s intuition cannot recover the complex and unpredictable sexual motivations of character’s in the past. By focusing on one sexual liaison (Byron and Mrs. Chater) Bernard ignores the numerous other possible liaisons, which in the end significantly affect his theory. Hannah presumes the hermit is a fixture; placed there as a part of the ludicrous Romantic aesthetic, like the ruins and the obelisk. That love is a factor never dawns on Hannah. Septimus becomes the hermit and toils to extend Thomasina’s algorithm because he is tortured by her death. He is not mad as everyone (including Hannah at first) accuses him of being; he is heartbroken. The realization is humbling to Hannah as she discovers that even she is not immune to the transformative forces of chaos or love, and as the play progresses she slowly learns to rely less on her own intellect and more on her feelings. By the end of the play Hannah (who has repeatedly stated her opposition to romance, sentimentality and relationships in general⁴²) lets her guard down and allows Gus to take her in his arms and lead her in a waltz as the piano faintly plays from the next room.

The iterative and recursive nature of the plot and action reflects the self-organizing and regenerative qualities of chaotic systems and demonstrates how sensitive such systems are to unknown variables. In *Arcadia*, the characters become the unknown variables and it is through their actions that the plot is able to regenerate itself. Stoppard infuses his play with aspects of modern science in such a way that foregrounds the

⁴² “What the hell is it with you people? Chaps sometimes wanted to marry me, and I don’t know a worse bargain. Available sex against not being allowed to fart in bed” (*Arcadia* 63).

importance and significance of human action. Their actions have the ability to create chaos or to unearth order from the disorder around them. By demonstrating the potential power of human action, Stoppard makes his argument that humans are not merely affected by the chaotic inclinations of nature; rather they are a fundamental part of it.

The argument between Valentine and Bernard crystallizes the opposition between Classicism and Romanticism and brings the question of triviality into play. As the rational Hannah and Valentine try to make Bernard see the holes in his theory, Bernard and Valentine clash over the issue of triviality:

Bernard: (*Jeering*) Parameters! You can't stick Byron's head in your lap top!

Genius isn't like your average grouse.

Valentine: (*Casually*) Well, it's all trivial anyway.

Bernard: What is?

Valentine: Who wrote what when...

Bernard: Trivial?

Valentine: Personalities.

Bernard: I'm sorry – did you say trivial?

Valentine: It's a technical term.

Bernard: Not where I come from, it isn't (*Arcadia* 60).

Valentine defends his position arguing that it doesn't matter who got there first – what matters is the knowledge acquired. Bernard explodes: “But don't confuse progress with perfectibility. A great poet is always timely. A great philosopher is an urgent need. There's no rush for Isaac Newton. We were quite happy with Aristotle's cosmos. Personally, I preferred it” (*Arcadia* 61). Valentine values the cold rationality of science,

indifferent to the complexities of personality and sturdily factual in its testability. Bernard values the individuality of artistic expression, utterly absorbed in the complexity of personality, incapable of being computer generated.⁴³

It is Valentine, the modern day chaotician who is able to create order out of Thomasina's discovery. Generations later, what were considered mad scribblings are now part of a new science that is revolutionizing the accepted world view and the role of people in it. Through Valentine, Stoppard explains not only the complexities of chaos theory but the importance of Thomasina's discovery and why she was never able to get it to "square back to sense":

Hannah: What I don't understand is... why nobody did this feedback thing before – it's not like relativity, you don't have to be Einstein.

Valentine: You couldn't see to look before. The electronic calculator was what the telescope was for Galileo.

Hannah: Calculator?

Valentine: There wasn't enough time before. There weren't enough *pencils!* (*He flourishes Thomasina's lesson book.*) This took her I don't know how many days and she hasn't scratched the paintwork. Now she'd only have to press a button, the same button over and over. Iteration. A few minutes. And what I've done in a couple of months, with only a *pencil* the calculations would take me the rest of my life to do again – thousands of pages – tens of thousands! And so boring (*Arcadia* 51).

⁴³ Thomasina's "genius" on the other hand depends on the computer in order to reach full realization.

Thomasina is limited; there is not enough room or time to extend her “rabbit equation”. It is through her equation that Thomasina intuits that order can arise out of disorder.

Intellectual curiosity bridges the gap between the two time periods; despite differences in ideology and practice, the intellectual seekers in *Arcadia* all have the same goal: to create order out of their disordered universe. Hannah assumes a modern (and quantum) position that values the trivial and its potential. Hannah identifies the desire and the active search to discover truth to be the most significant facet of our experience. Hannah articulates the importance of the trivial, intellectual curiosity and the human experience:

It's *all* trivial – your grouse, my hermit, Bernard's Byron. Comparing what we're looking for misses the point. It's wanting to know that makes us matter.

Otherwise we're going out the way we came in... (*Arcadia* 76).

The most thrilling aspect of this universal search is that, as Uncertainty Principle suggests, we will never completely understand mysteries of our universe, but as long as intellectual seekers exist order will inevitably arise and the meaning will never be lost. As the plot demonstrates the trivial becomes increasingly important in a complex system. Although the relationships and situations are recursive, human actions (no matter how trivial) create asymmetries which defy prediction.

When Thomasina first articulates her intuition about entropy (“You cannot stir things apart”) it is Septimus who makes the connection between the implications of entropy, free will and the role of human action in the universe:

No more you can, time must needs run backward, and since it will not, we must stir our way onward mixing as we go, disorder out of disorder into disorder until

pink is complete, unchanging and unchangeable, and we are done with it forever.

This is known as free will or self-determinism (*Arcadia* 5).

Septimus intuits that the Newtonian paradigm is inimical to free will: “If everything from the furthest planet to the smallest atom of our brain acts according to Newton’s law of motion, what becomes of free will?” (*Arcadia* 5). Septimus sees the inherent incongruencies between Newtonian determinism and free will. The Newtonian paradigm does not work because it does not factor in the reality of free will. Quantum science on the other hand embraces unpredictability and therefore it embraces free will and all of the potential chaos it may wreak.

Valentine also expresses the incongruencies between reality and the Newtonian paradigm however he has 180 years of science to justify them:

When your Thomasina was doing maths it had been the same maths for a couple of thousand years. Classical. And for a century after Thomasina. Then maths left the real world behind, just like modern art, really. Nature was classical, maths was suddenly Picassos. But now nature is having the last laugh. The freaky stuff is turning out to be the mathematics of the natural world (*Arcadia* 45).

This “freaky stuff” which defied Newton consistently proved to be a more accurate representation of reality. But while the new science could describe the very big and the very small, the everyday remains inaccessible:

The ordinary-sized stuff which is our lives, the things people write poetry about – clouds – daffodils – waterfalls – and what happens in a cup of coffee when the cream goes in – these things are full of mystery, as mysterious to us as the heavens were to the Greeks (*Arcadia* 48).

The occurrences of the everyday, including human actions, remain as inexplicable and unpredictable as the cosmos were to the Greeks. As Thomasina intuits, chaos theory finally offers an explanation of the most mysteriously banal elements of everyday life. Septimus absent mindedly replies to Thomasina's insistence that traditional mathematics is ill-equipped to depict the realities of the world around them: "He [God] has a mastery of equations which lead into infinities where we cannot follow" (*Arcadia* 37). Thomasina refuses to accept that the world works in a way that is understandable to God but inaccessible to her, "What a faint-heart! We must work outward from the middle of the maze" (*Arcadia* 37). Thomasina is not satisfied to merely bow to the divine determinism of classical mathematics. She realizes that as part of the system the best she can do is try to understand it from the inside out.

As the timelines converge, the implications of Thomasina's 'rabbit equation' become clear.⁴⁴ Although the inevitable implications of the second law of thermodynamics still apply, Thomasina's discovery promises a possibility of renewal after destruction. Though the world may suffer heat death it will regenerate itself through its destruction:

Thomasina: No marks?! Did you not like my rabbit equation?

Septimus: I saw no resemblance to a rabbit.

Thomasina: It eats its own progeny.

(Septimus and Hannah turn the pages doubled by time.)

Hannah: Do you mean the world is saved after all?

⁴⁴ As Nadel argues, "[t]he grand mystery Stoppard is able to present in mundane terms is the fate of the universe, made marvelously clear at one point through the overlapping conversations of Septimus, Thomasina, Hannah and Valentine" (Nadel 442).

Valentine: No, it's still doomed. But if this is how it started, perhaps it's how the next one will come.

Hannah: From good English algebra?

Septimus: It will go to infinity or zero, or nonsense.

Thomasina: No, if you set apart the minus they square back to sense (*Arcadia* 77-78).

Through her 'rabbit equation' Thomasina intuits how order can arise out of disorder.

What has been lost will be recovered.

Septimus makes a similar observation about the inevitable recovery of knowledge earlier in the play while discussing the burning of the Library at Alexandria with Thomasina. Though Thomasina mourns the intellectual loss, Septimus reassures her that all will be restored:

We shed as we pick up, like travellers who must carry everything in their arms, and what we let fall will be picked up by those behind. The procession is very long and life is very short. We die on the march. But there is nothing outside the march so nothing can be lost to it. The missing plays of Sophocles will turn up piece by piece, or be written again in another language. Ancient cures for diseases will reveal themselves once more. Mathematical discoveries glimpsed and lost to view will have their time again (*Arcadia* 38).

Septimus' observation is made ever more poignant by Thomasina's death by fire at the end of the play. Although Thomasina tragically loses her life, her ideas and her work are not lost with it. Through Septimus's dedication to her vision, Valentine and Hannah are able to recover what has been lost: the brilliant mind of Thomasina Coverly.

In the final scene, the timelines converge once more; this superposition of timelines becomes even further complicated by the fact that the characters in the modern period have put on Regency dress for a party. For the first time not only is the set indistinguishable from one time period to the next but the characters become harder to place. It is possible to identify them with their period due to which characters interact with which and our previous experience however it is arguably harder to separate the two. The audience is faced with the future superimposed on the past. This superimposition is compounded by the fact that the characters in the past and in the present are all discussing Thomasina's discovery:

(Septimus and Valentine study the diagram doubled by time.)

Valentine: It's heat.

Hannah: Are you tight, Val?

Valentine: It's a diagram of heat exchange.

Septimus: So, we are all doomed!

Thomasina: (Cheerfully) Yes.

Valentine: Like a steam engine, you see – (Hannah fills Septimus's glass from the same decanter, and sips from it.) She didn't have the maths, not remotely.

She saw what things meant, way ahead, like seeing a picture (*Arcadia* 93).

Thomasina articulates her vision despite the fact that she doesn't have any mathematical expressions to affirm what she intuits about heat and ultimately the universe:

Hannah: What did she see?

Valentine: That you can't run the film backwards. Heat was the first thing which

didn't work that way. Not like Newton. A film of a pendulum, or a ball falling through the air – backwards, it looks the same.

Hannah: The ball would be going the wrong way.

Valentine: You'd have to know that. But with heat – friction – a ball breaking a window -

Hannah: Yes.

Valentine: It won't work backwards.

Hannah: Who thought it did?

Valentine: She saw why. You can put back the bits of glass but you can't collect up the heat of the smash. It's gone.

Septimus: So the Improved Newtonian Universe must cease and grow cold. Dear me (*Arcadia* 93).

What Thomasina realized was that in the universe (like in her porridge) “the heat goes into the mix” (*Arcadia* 94). Valentine articulates the cosmic significance: “(He gestures to indicate the air in the room, in the universe) And everything is mixing the same way, all the time, irreversibly” (*Arcadia* 94). Perhaps one of the most powerful moments in the play, the two timelines hang in a suspended superimposition of states as the characters in both realize the implications of Thomasina's discovery. This scene is imbued with a heightened level of urgency as the audience realizes they are seeing Thomasina on the eve of her seventeenth birthday and her death. The papers Septimus is poring over will in fact drive him to become the mad hermit after Thomasina's untimely demise. His subsequent scribbling will eventually lead Hannah and Valentine to re-discover

Thomasina's work. Although Thomasina's brilliance is lost with her in the fire, her thoughts live on through Septimus and are regenerated in the present.

It is Thomasina who gives hope to the audience and the characters in the face of her (and the universe's) impending doom:

Septimus: When we have found all the mysteries and lost all the meaning, we will
be alone on an empty shore.

Thomasina: Then we will dance (*Arcadia* 94).

Thomasina realizes that although death (of the self or universe) is inevitable so is regeneration. Death does not have to be the end. Even as the universe continues to slowly cool, it is out of this process that the next will come. Nothing is ever truly lost. What else is one to do but dance? The image of the two dancing couples, waltzing in unison across time remains an image of hope for the audience.⁴⁵ Although Thomasina will surely go to her death once the dance is done, her work and her love will not be lost. Septimus, out of love, toils to extend Thomasina's algorithm. It is his work which brings Hannah to Sidley Park, where she meets Gus who innocently falls in love. Through her work with Valentine and Bernard, Hannah discovers her Romantic side and letting go of her staunch un-sentimentality opens herself to Gus's love. Disorder regenerates into order; love that is lost in 1812 is restored in 1989. Though order inevitably becomes disorder, the quest for knowledge is not futile. Intellectual curiosity is the driving force of order in an otherwise chaotic world. These seekers of order and truth give meaning to an otherwise senseless universe. Like strange attractors their repeated attempts at finding order create

⁴⁵ Nadel posits that "the dance is the triumphant, visual celebration of Thomasina's early observation that things cannot be stirred apart, set against the inescapable backdrop of the dissipation of energy" (Nadel 433).

an overarching pattern that gives us meaning and purpose. There is always the hope of coming order, even in the face of crippling disorder.

CONCLUSION

Color my life with the chaos of trouble. Cause anything's better than posh isolation.

Belle and Sebastian⁴⁶

In *Rosencrantz and Guildenstern, Hapgood, and Arcadia*, Tom Stoppard is not merely juxtaposing quantum science and human interactions for the sake of drama; rather by excavating the complexities of human action, choice and identity through the lens of chaos theory and quantum science, Stoppard demonstrates the fundamental connection between individuals and the post-Newtonian world. Although Heisenberg's Uncertainty Principle dispels any hope of complete knowledge of our universe, chaos theory at least gives us the hope of influence. As Guil desperately proclaims: we have influence. Though we cannot know anything with complete certainty we do know that we have the opportunity to act. and with that action potentially change the world and the people around us. Stoppard puts the universe back in the hands of his characters who, like everyone, struggle with questions of certainty and prediction. By creating dramatic situations which parallel or are infused with the principles of quantum science, Stoppard demonstrates the power of their, and by association our, actions in the universe. Guil condemns himself, and Ros, when he chooses not to act after discovering Hamlet's death sentence. Blair, crippled by his 'either/or' mentality, forces Hapgood to act (by leaving) after he puts her son in harm's way. Sexual desire drives *Arcadia's* plot as the effects of characters' actions and choices reverberate across almost two centuries. As Stoppard

⁴⁶ (Belle and Sebastian xvii/xviii)

demonstrates, humans create just as much chaos through their actions as they are subject to by nature. Chaos theory demonstrates the importance of trivialities, including human actions and choice, suggesting that whether or not there is an omnipotent being keeping watch, human actions have very real and unpredictable consequences in our universe. Chaos theory throws off the shackles of scientific and spiritual determinism. Humans are not victims of the chaotic universe; rather they are a fundamental part of it. Their actions create a ripple effect which reverberates throughout the universe with incalculable and unpredictable effects.

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