SHAKESPEARE AND THE BRAVE NEW WORLD OF EARLY MODERN SCIENCE

by

ASHLEY REBECCA BENNING

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ABSTRACT

This thesis examines how Shakespeare's characters come to create knowledge through the use of early modern scientific modes of thought. Chapter one looks at scientific cataloging as a means of objectifying living things in botanicals, herbals, and anatomies and how this mode of defining the world is illustrated in several of Shakespeare's plays, such as *Julius Caesar*, *Macbeth*, *The Tempest*, and *Titus Andronicus.* Chapter two explores the art of prediction by reading signs in nature, such as astronomy, astrology, and prognostication, and focuses on *Macbeth* and *Julius Caesar*. Chapter three looks at knowledge creation through the scientific method, specifically hypothesizing, experimenting, and analyzing results. This method is especially evident in *Hamlet*. The conclusion uses *The Tempest* as an example which encompasses all these types of knowledge creation. This thesis ends with the assertion that though knowledge about the world is created through these various methods, the characters who are most successful are those who are able to discover truth about the human spirit.

DEDICATION

This work is dedicated to my great-grandmother Mary Hawkins, who taught me to work hard and treasure education.

I also dedicate this work to Dr. Susanne Collier-Lakeman, whose passion for Shakespeare was one of the inspirations for my pursuit of this degree.

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Contents

INTRODUCTION

Shakespeare's first recorded use of the word "science" was in *The Taming of the Shrew* in 1593, when Petruchio thrust Hortensio into Signor Gremio's house to be a tutor for Bianca. Petruchio claimed Hortensio would "instruct her fully in those sciences,/ Whereof I know she is not ignorant" (2.1.57-58)[1]. The sciences Petruchio is referring to are specifically mathematics and music, but early modern science also included alchemy, astronomy, astrology, and natural philosophy. Though written over a thousand years before Shakespeare's birth, the sciences of his day were still heavily influenced—and restricted—by Aristotle's definition of *scientia*, and it wouldn't be until shortly after Shakespeare's death that the world of science would experience a radical alteration in methodology and purpose.

Aristotle taught that matter and form were co-principles. By defining the four causes, as laid out in *Physics* II.iii, man might come to know a thing, these causes being:

> In one sense, then, (1) that out of which a thing comes to be and which persists, is called 'cause', e.g. the bronze of the statue, the silver of the bowl, and the genera of which the bronze and the silver are species.
>
> In another sense (2) the form or the archetype, i.e. the statement of the essence, and its genera, are called 'causes' (e.g. of the octave the relation of 2:1, and generally number), and the parts in the definition.
>
> Again (3) the primary source of the change or coming to rest; e.g. the man who gave advice is a cause, the father is cause of the child, and generally what makes of what is made and what causes change of what is changed.
>
> Again (4) in the sense of end or 'that for the sake of which' a thing is done, e.g. health is the cause of walking about. ('Why is he walking about?'

[1] Unless otherwise noted, all Shakespeare references come from *The Oxford Shakespeare: Complete Works*, ed. Stanley Wells and Gary Taylor (Oxford: Clarendon Press, 2005).

> we say. ‘To be healthy’, and, having said that, we think we have assigned the cause.) The same is true also of all the intermediate steps which are brought about through the action of something else as means towards the end, e.g. reduction of flesh, purging, drugs, or surgical instruments are means towards health. All these things are ‘for the sake of’ the end, though they differ from one another in that some are activities, others instruments.[2]

The consequence of such a mode of thought is a pigeon-holing effect. Every object or creation, according to Aristotle’s causes, must have a form, function, creator, and origin—all of which are tied together. To separate, for example, a man’s body from his thoughts or consciousness would thereby prove impossible.

Over the thousand years between Aristotle’s *Metaphysics* and the seventeenth century, European thinkers adapted Aristotle’s assertions to fit a religious mindset: all matter takes its form because God wills it so, and he is the instigator of all creation and movement. To question the accepted makeup of the world would be to question God. Thus, for centuries, philosophers reverse-engineered the world around them while maintaining the premises put forward by Aristotle and the Bible.

This is not to say that radical thinkers did not question their environment. However, Aristotelian philosophers would have shunned experimentation as we use it today, arguing that placing objects in unnatural conditions would taint the results. They were more interested in experiential evidence, or what all mankind experienced to be true. The *Cambridge History of Science* cites the “universal behaviors” that “The sun always rises in the east; acorns always (barring accidents) grow into oak trees” as examples of truths gained by experience.[3] If one did not experience something, one relied on the experience of others to gain

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[2] St. Thomas Aquinas, *Commentary on Aristotle’s Physics*, trans Richard Blackwell, Richard J. Spath, and Edmund Thirlkel (Notre Dame, Indiana: St. Augustine’s Dumb Ox Books, 1999), 93.

[3] Roy Porter, Katharine Park, and Lorraine Daston, *The Cambridge History of Science: Volume 3, Early Modern Science* (Cambridge: Cambridge University Press, 2013), 109.

understanding. This could often be accomplished in the university setting, which basically became a warehouse of stored experiences which students could assimilate into their own understanding as if the experience had been their own.

As a result, the working definition of the universe in early modern England was a conglomeration of old ideas and religious dogma, a scholasticism brought about by centuries of relative conservation in the scientific arena (especially when compared with the exponential changes in mankind's understanding of the universe in just the eighteenth century, for example). This definition was not without truth, or devoid of ingenuity, but one's understanding of the universe and how it operated was usually the result of a cultural heritage of beliefs formed by a combination of academic study far removed from the average man, and his religious experience and local superstition. This thesis will look at many of the ways Shakespeare's characters interpret the universe both following this traditional model and emerging models, and how they seek to interact with or manipulate these models to their purpose.

There were those who sought to engineer experience, to force nature to act in certain ways. The reception of such methods was mixed, as were the practitioners. It is thought by some, as in Keith Thomas's influential *Religion and the Decline of Magic,* that the origins of many occult practices, like alchemy, originated within the Church. He writes, "Alchemy was associated with asceticism and contempt for the world. It was no accident that, despite various prohibitions, many medieval alchemists had been monks, and that the monasteries retained a reputation for occult learning of this kind in the century after the Reformation."[4] George Ripley, whose extensive and colorful alchemical scrolls were copied numerous times throughout the sixteenth century (by Simon Forman, among others), was a fourteenth-century Augustinian canon. His *The Compound of Alchymy* claims to present "the right & perfectest

[4] Keith Thomas, *Religion and the Decline of Magic* (London: Penguin Books, 1991), 321.

meanes to make the Philosophers Stone,"[5] the most fundamental aim of all alchemists. His work, conducted while in the service of the Church (and on his seven-year university leave blessed by the Church) was used—and plagiarized—for over a century following his death.[6]

This figure of the alchemist gaining his power from extensive study and knowledge of nature came to be connected with biblical Adam, whose Book of Nature (complete understanding of the natural world) was lost to him with the Fall. Mankind was, therefore, capable of understanding the world, but had to re-learn everything that Adam once knew. Once that understanding was acquired, man would theoretically be able to manipulate and create as Adam was once able to do.[7]

This relatively simple concept has a deeper significance, though, grounded in the belief that it is *possible* to know what God knows. In early modern philosopher Francis Bacon's *New Organon*, he explains that the Fall of Adam had a twofold effect. "For by his fall man lost both his state of innocence and his command over created things. However, both of these losses can to some extent be made good even in this life, the former by religion and faith, the latter by the arts and sciences."[8] In spite of the close connections between alchemy and Christianity, the form was also associated with counterfeiting and the occult, and was outlawed by the 1404 Act Against Multipliers. The ban remained in place until 1689.[9]

Alchemy was not the only practice which sought to control the natural world. Thomas offers a detailed analysis of the tug-of-war between religion and magic during the

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[5] George Ripley, *The Compound of Alchymy* (Thomas Orwin: London, 1591), *EEBO* http://gateway.proquest.com/openurl?ctx_ver=Z39.88-2003&res_id=xri:eebo&rft_id=xri:eebo:citation:99851205.

[6] Margaret Healy, *Shakespeare, Alchemy and the Creative Imagination: The Sonnets and* A Lover's Complaint (Cambridge: Cambridge University Press, 2011), 21.

[7] Deborah Harkness speaks at length about John Dee practicing "Adam's Alchemy" to heal the Book of Nature, which had been ill since Adam's Fall. For more, see Deborah Harkness, *John Dee's Conversations with Angels* (Cambridge: Cambridge University Press, 1999).

[8] Francis Bacon, *The Instauratio Magna Part II: Novum Organum and Associated Texts*, ed. Graham Rees and Maria Wakely, *The Oxford Francis Bacon* (Oxford: Oxford University Press, 2012), http://dx.doi.org/10.1093/oseo/instance.00007242.

[9] Charles Nicholl, *The Chemical Theatre* (New York: Akadine Press, 1997), 13.

Renaissance. The portion of Thomas's work with which I am most concerned is the overarching theme evidenced in the emergence of "cunning folk" and the like, which is that there was a generally held belief that by saying the right words, mixing the right ingredients, or performing an act at the right time one could alter one's circumstances, future, or surroundings.[10]

Two major shifts occurred in the sixteenth century which would play into the transformation of ideas about man's place in the world, particularly the Englishman's place in the world: the English Reformation, and the greater exploration of the Americas by the British and other Europeans. Thomas devotes several chapters to scrutinizing the eradicating of "magical" elements in the breaking away from Rome, specifically noting that this radical change in the fundamental belief system of the masses paved the way for the emergence and wider spread of magic. Couple this with the exploration of the New World, where countless new varieties of flora, fauna, and humans were discovered, and it is easy to see how the early modern man would have been on a quest to understand and define his environment.

As with any great paradigm shift, veins of new thinking emerged before the general public accepted the new world view. Though the majority of what we today call the Scientific Revolution occurred in the later seventeenth century, men like Bacon were questioning Aristotle and previously-held "immutable" truths a century prior.[11] All of the new modes of thinking explicated below will be referred to again in later chapters. Thus it is important to lay out the definitions I will be using for them, as well as the perceived influences they may have had on the early modern world.

One subtle but powerful shift in thinking was humanism, or the perception of mankind as different from or set aside from the rest of the world—though not necessarily

[10] See chapter 8 "Cunning Men and Popular Magic" in Thomas, *Religion and the Decline of Magic*
[11] Francis Bacon, *Novum Organum*

infallible. John S. Mebane's concise definition of humanism aptly describes one consequence of this new world view: "the historical perspective which enabled the humanist to see a text of Aristotle or Cicero not as a timeless authority, but as a human creation composed under the limitations of a given culture."[12] By drawing a shadow of fallibility over Aristotle's teachings (or others like him) it becomes possible to question those teachings.

Skepticism was another emerging mode of thought. Benjamin Bertram succinctly describes the mentality this way: "skepticism ultimately undermines the belief that the truth can ever be uncovered: without the means of 'seeing' the truth, we are trapped in our subjective sense-perception."[13] It was more than a wavering of belief in the classical tradition; it became a general acceptance that since humans are flawed any principle put forward by mankind must also be flawed.

Skepticism touched not only philosophy but also religion. The Reformation was, at its core, a statement that religion could be altered to fit the needs of the powerful (though, ostensibly, to bring the Church back to proper teachings). If tenets could be discarded or added seemingly at will, many wondered if they had ever been true to begin with. Atheism—or an early modern equivalent which was less extreme than today's model—encompassed everything from witchcraft to "popishness." Thomas notes that stripes of skepticism date to much earlier than the Reformation, perhaps paving the way for such a movement in the sixteenth century. He claims, "Many medieval clergy and laity had been beset by overwhelming temptations to blasphemy and atheism, and a wide range of popular skepticism was uncovered by the fifteenth-century church courts."[14] While not always a capital offense, speaking out against the Church or otherwise proclaiming atheistic views did lead to many

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[12] John S. Mebane, *Renaissance Magic and the Return of the Golden Age: The Occult Tradition and Marlowe, Jonson, and Shakespeare* (Lincoln: University of Nebraska Press, 1989), 8-9.

[13] Benjamin Bertram, *The Time is Out of Joint: Skepticism in Shakespeare's England* (Newark: University of Delaware, 2004), 158.

[14] Thomas, *Religion and the Decline of Magic*, 199.

death sentences or other severe consequences in the fifteenth and sixteenth centuries. It was not uncommon for parishioners to seek proof of God's existence. There are court records of men and women performing heinous deeds in an effort to force God—or the Devil—to reveal Himself, or to at least confirm the existence of heaven or hell.[15]

But in the quest for truth, and in the vacuum created by the changes and omissions in the reformed Church, many turned to sources outside the Church for supernatural aid. A practitioner of the supernatural arts could be found within reach of most any town in Britain, though they did not usually advertise their talents.[16] Known variously as cunning folk, wise people, white witches, wizards, or by regional terms, these men and women were purported to be able to summon the forces of nature to do their bidding, whether that be healing someone, cursing someone, helping crops to grow (or die), or foretelling future events.

Thomas has gone into great detail about the types of services these practitioners could perform, and the perceived effectiveness of these actions, and to be sure the examination of magic in the medieval era is interesting and somewhat romantic, but what is most relevant to this study is that this is yet another way that man attempted to understand and control his environment. And it is important to note that wise people did not have a monopoly on the supernatural; royalty were also believed to be able to perform miracles, as in the case of the King's Evil. A common ailment, scrofula brought many subjects to the king in the hopes that his touch would cure them. For centuries, the king would hold annual ceremonies in which he would touch the afflicted and they would be healed, the belief being that his divine calling as monarch also gave him the authority to wield Godlike power. So many were "healed" (the

[15] Jan Frans Van Dijkhuizen's *Devil Theatre: Demonic Possession and Exorcism in English Renaissance Drama, 1558-1642* (Cambridge: Boydell & Brewer, 2007) contains some excellent examples, especially as relating to seeming evidence of the existence of the devil via demonic possession and exorcisms, and draws parallels between these instances and scenes in Renaissance drama.

[16] Thomas, *Religion and the Decline of Magic*, 291.

ailment in actuality would often disappear on its own) that this superstition continued for centuries, even during the Civil War when Charles I was in exile.[17]

The healing of the King's Evil is just one example of how health and supernatural power were connected, but there are many others. The era leading up to Shakespeare's lifetime is one of blurred lines between the religious, medical, and magical. Physical ailments could be tied to evil spirits in the body or an imbalance of the humors, the act of a local wise person, or a poor alignment of the stars.

Yvonne Petry uses the writings of French surgeon Pierre Pigray to examine the intersection of the supernatural and early modern medicine. She writes that early modern physicians "were keenly aware that there was often no manifest connection between the cause of a disease and its symptoms. In general, early modern physicians favoured a natural explanation when one was available, but allowed for the possibility of demonic involvement, particularly when a patient's symptoms surpassed natural limits."[18] The inability to see the microorganisms causing disease coupled with the biblical support that illness could come from evil sources shaped early modern medicine and compelled physicians to accept that they would not always understand how an affliction came to be. Threads of Aristotelian views on the body also come into play, with the idea that the mind and body are the same. Petry writes,

> [T]he Galenic understanding of the body was essentially holistic, assuming a close relationship between a patient's mental and physical states … One's thoughts and passions were considered susceptible to forces from beyond the natural world. When faced with a patient thought to be afflicted with a demon, a doctor could try to argue that it was just a result of melancholic humours, but

[17] Thomas, *Religion and the Decline of Magic*, 290.

[18] Yvonne Petry, "'Many Things Surpass our Knowledge': An Early Modern Surgeon on Magic, Witchcraft, and Demonic Possession," *Social History of Medicine* 25, no. 1 (2011): 48.

> also had to admit the possibility that a demon could stir up and interfere with the humours.[19]

It was not taken for granted by all physicians, however, that the Galenic idea of the humors was fact. Galen's work dates from the beginning of the common era, more than a thousand years before Shakespeare, and was rooted in Aristotle's philosophy of the mind/body relationship and book knowledge. With the early modern pushback against Aristotle came some resistance to Galen's teachings. Paracelsus in the fifteenth century put forward a then radical theory that instead of the body being made up of humors it was instead made of the same building blocks as the universe. Lauren Kassell, in her biography of Simon Forman, explains that

> instead of the elements of earth, air, fire, and water [that Galen claimed made up the humors], he [Paracelsus] described all things as made from salt, sulphur, and mercury and he outlined analogies between each of these substances and, for instance, body, soul, and spirit and that liver, heart, and brain. Disease was not the result of an imbalance of humours but was caused by damage to or impediment of the spirit (*archeus*) when a malevolent influence penetrated a part of the body.[20]

To the modern observer these two ideas are not so different: both are founded in the assertion that the body is made of distinct building blocks, and these can be attacked or disturbed by outside forces, resulting in disease or pain. The difference to note here, and which will become important in the later discussion of Shakespeare's plays, is the relationship drawn between ailments of the body and ailments of the spirit or mind. Neither Paracelsus nor Galen denied the traditional Aristotelian view that the two were in any way separate. The

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[19] Ibid., 49.

[20] Lauren Kassell, *Medicine and Magic in Elizabethan London: Simon Forman: Astrologer, Alchemist, and Physician* (Oxford: Oxford University Press, 2005), 7.

microscope would not arrive on the scene until the late sixteenth century, and only much later would it be refined enough to examine germs, but physicians of the early modern age were not that far off in their understanding that something unseen was causing illness. They just didn't understand that the object was unseen because it was so very small, and not because it came from a supernatural realm.

Paracelsian methodology relied on experiential learning, a departure from the book-learning foundation of Galenistic approaches to medicine. Further, Paracelsian medicine was chemical, instructing the use of the elements mentioned earlier (salt, sulphur, mercury, and the like) in treatment of conditions, whereas followers of Galen relied on herbal remedies, blood letting, and, occasionally, amulets or other effects meant to bring the humors back into balance.

Paracelsus also encouraged experimentation and observation, casting away the published and largely unchallenged remedies issued by Galen. Experimentation, not regularly practiced in medicine prior to Paracelsus, took root in other branches of the sciences as well, alchemy being the most notable and earliest example. Tied to skepticism and the emerging doubt about pre-conceived notions of the universe and its operations, experimentation began to emerge as an acceptable avenue for gaining understanding in the early modern era.

Francis Bacon and René Descartes are two of the early modern names often associated with the scientific method, but experimentation was becoming a more widespread method even a century before their time. Mebane writes, "Those who contributed to science and technology in the sixteenth century were often eclectic thinkers, willing to experiment with virtually anything to see if it worked: Hermetic/Cabalistic magic, alchemy and Paracelsianism, the technology developed by mechanical artisans in response to economic needs, ancient scientific texts rediscovered by the humanists, Aristotelianism…"[21] As early as

[21] Mebane, *Renaissance Magic*, 37.

the thirteenth century, Roger Bacon was writing about the importance of experimentation as a component of finding truth—in contradiction to the Aristotelian view that reading of others' experiences would suffice. In *On Experimental Science,* he writes, "There are two ways of acquiring knowledge, one through reason, the other by experiment. Argument reaches a conclusion and compels us to admit it, but it neither makes us certain nor so annihilates doubt that the mind rests calm in the intuition of truth, unless it finds this certitude by way of experience."[22] However, Roger Bacon's work shows the heavy influence of religion on his philosophy as he asserts that while experimentation is more valuable than second-hand experience, divine inspiration is by far the best way of coming to the knowledge of things.

New concepts and inventions required new words and terms, new modes of rhetoric, and new meanings for old ideas. Language became a battleground for these new ideas, with some believing artistic language best conveyed truth and others believing such rhetoric obscured truth. Rhetoric, which I will here use to mean the combination of word choice and syntax, transformed into a method of layering humanistic or skeptical paradigms into writing—both narrative and informative. There is some debate today about to what extent the philosophy of plain speaking was adopted by early modern philosophers, but it cannot be denied that the topic was discussed during that era and strong convictions were held on each side of the argument.[23] At play in these arguments are the same questions brought to the front in skeptical attitudes: were the classical philosophers correct in their assertions of the purpose of language, or is there another way to approach language? More specifically, does figurative or metaphorical language bring the reader closer to or farther from the truth?

Philip Sidney's *In Defence of Poesy,* published posthumously in 1595, is a lengthy treatise on the purposes and merits of poetic language. He claimed that poetry was creation,

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[22] Roger Bacon, *On Experimental Science*, in *The Library of Original Sources*, ed. Oliver J. Thatcher, vol. 5: *The Early Medieval World* (Milwaukee: University Research Extension Co., 1901), 369.

[23] See Kenneth J.E. Graham, *The Performance of Conviction: Plainness and Rhetoric in the Early English Renaissance* (New York: Cornell University Press: 1994).

and was therefore of more value than other sciences that merely copied reality. Elizabeth Spiller writes,

> What most Renaissance thinkers identify as the "sciences" of man become indistinguishable from traditional definitions of the mimetic arts. That is, the astronomer who can 'set down' in what must necessarily always be an imperfect copy of the order of the stars thus becomes another version, in his field, of the bad artist who does not create true art but only "counterfeits" it by attempting to reproduce mere physical beauty in his works.[24]

Sidney wasn't alone in his assertion that poetry was creation, though what was being created is open for interpretation. For example, Stuart Clark points out that language of exorcism and demonology became so dependent on structure—namely the use of antithesis and opposites—that it became unclear if the language was describing, caused by, or creating the supernatural activity. He claims that "demonism became so dependent on particular linguistic strategies … that it came to be seen as the product, rather than the subject-matter, of its own language."[25]

Bacon pushed back against the idea that language had any power other than to inform, and argued that the only thing poetics could create was confusion. As Ryan Stark points out in *Rhetoric, Science, and Magic in Seventeenth-Century England*, "To be rhetorically plain in the experimental sense was to be epistemologically sound, religiously levelheaded (i.e. non-superstitious), and ontologically enlightened, and—moreover—to have all of those other qualities that signaled an unruffled refinement that mystics and sorcerers could never achieve."[26] An example of this sentiment can be found in Bacon's 1605 *The Advancement of*

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[24] Elizabeth Spiller, *Science, Reading, and Renaissance Literature: The Art of Making Knowledge* (Cambridge: Cambridge University Press, 2004), 38.

[25] Stuart Clark, *Thinking with Demons: The Idea of Witchcraft in Early Modern Europe* (Oxford: Clarendon Press, 1997), 10.

[26] Ryan Stark, *Rhetoric, Science, and Magic in Seventeenth-Century England* (Washington, DC: Catholic University of America Press, 2009), 9.

Learning: "Words are but the images of matter; and except they have life of reason and invention, to fall in love with them is all one as to fall in love with a picture."[27] Montaigne also rejected poetic language, siding with classical philosophers: "Socrates and Plato had been right to describe rhetoric as 'the art of deceiving and flattering,' and its greatest utility was as a means of duping the people with the 'sweet sound of harmony' rather than the 'force of reason.'"[28]

This preoccupation with proof, truth, and reality—even in rhetoric—is easy to understand in light of the changes in "truth" the early modern man experienced. For example, the sixteenth-century man would have experienced the discovery of the heliocentric model of the solar system through the works of Copernicus and Kepler, turning on its head the very "proof" he had hitherto accepted that the Earth was the center of the universe. It is little wonder that skepticism found such a stronghold in the minds of the early modern citizen.

As Harkness states, "To be in London during the second half of the sixteenth century was to be in a state of heady confusion when it came to natural knowledge and questions of science."[29] When Shakespeare settled in London in 1592, the city was a bustling metropolis of 200,000.[30] Not too far away from the Globe Theatre was Lime Street, a community of naturalists who shared specimens, conducted experiments, and published guides about the natural world. Harkness creates a portrait of these naturalists in *The Jewel House: Elizabethan London and the Scientific Revolution*, wherein she claims that these men (for few women were involved), mostly immigrants, fed off each other's ideas and created a scientific microcosm within the hectic and gritty city. The Royal Society wouldn't be founded for several decades, but in this small community the spirit that would drive the Royal Society

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[27] Ibid., 12.

[28] Juliet Cummins and David Burchell, *Science, Literature, and Rhetoric in Early Modern England* (Burlington: Ashgate, 2007), 76.

[29] Deborah Harkness, *The Jewel House: Elizabethan London and the Scientific Revolution* (New Haven: Yale University Press, 2007), 10.

[30] Ibid., 1.

thrived. About the innovative thinkers in London, both within Lime Street and beyond, Harkness writes,

> Though they lacked a single building like the Globe Theater to draw the eye of a passing stranger, at street level they made up a recognizable and important feature of London life. These naturalists, medical practitioners, mathematicians, teachers, inventors, and alchemists not only actively studied the natural world; they were also interested in how that study could benefit human lives. During the age of Elizabeth, London nurtured the development of an empirical culture—the culture of the Scientific Revolution. While members of the royal court occupied themselves with threats foreign and domestic, and the universities of Oxford and Cambridge still debated the authority of ancient texts, the residents of London were busy constructing ingenious mechanical devices, testing new medicines, and studying the secrets of nature.[31]

Though the Lime Street naturalists did not publish anything of lasting significance, their work contributed to one of the defining naturalist and botanical publications of the time, John Gerard's *The Herball or Generall historie of plantes* (1597), which Harkness claims was plagiarized from a Lime Street resident.[32] More important than the publications, though, is the mindset of the community, which reflects the embracing of personal experience and experimentation as a method for gaining knowledge.

London was home to several hospitals (Bethlem, St. Bartholemew); barber-surgeons and physicians, many times unlicensed, were plying their trade in London homes; chemists and apothecaries were dispensing their remedies with liberality—for those who could pay.

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[31] Ibid., 2.
[32] Ibid., 17.

Simon Forman, an astrologer-physician practicing in London during Shakespeare's time, kept extensive records of his patients and remedies. His notes are among the most detailed and complete records of early modern physicians in England available today, and include cases of pregnancy, mental illness, and the generic "disease."[33] Forman would consult the astrological signs at the time of the patient's query, usually draw up an astrological image or figure, compare symptoms with those likely to emerge at the time in relation to the alignment of various celestial bodies, and then diagnose and prescribe a remedy.[34]

While early modern medical practice is not the focus of this thesis, what is germane to this study is the marriage of occult philosophy with science as Forman practiced it on his patients.[35] His unique blend of alchemy (he pursued the philosopher's stone at one point), astrology, philosophy, and medicine as presented in his casebooks and other written records is indicative of the fluid philosophies of the workings of the universe during Shakespeare's life. Forman's diaries also reveal that he attended some performances of Shakespeare's works.

While Forman was working in London, Queen Elizabeth was consulting with John Dee at court, a man who claimed to speak with angels and foretell future events through the use of seer stones. A learned mathematician, he turned to the occult arts as a natural branch of science and enjoyed the patronage of many English nobles aside from his attentions from Queen Elizabeth.[36] Many scholars believe Shakespeare's Prospero in *The Tempest* is modeled after Dee, who would have been present in Elizabeth's court when Shakespeare's plays were

[33] Forman's work influenced many others, including Richard Napier, who inherited his papers. Both Forman's and Napier's papers can be accessed through The Casebooks Project at University of Cambridge: http://www.magicandmedicine.hps.cam.ac.uk/.

[34] His casebooks leave some question about whether or not he approached the patients based solely on their vocalized symptoms, or if he forced their symptoms into categories based on the probability that those symptoms would be caused by the celestial bodies at that time or season.

[35] Kassell, *Medicine and Magic*.

[36] See Harkness, *John Dee's Conversations*.

performed there.[37] Prospero's reliance on book learning, his manipulation of the elements and ability to talk to beings of the unseen world, and his approach to the occult as a science are all reminiscent of Dee.

Parsing early modern science into easily defined components as one would today's sciences is not easily done. When pulling at the threads connecting anatomy, botany, alchemy, mechanical science, meteorology, and natural science it becomes clear that the overarching ideas behind these branches are even more exciting than their specific practices. As a result, the following chapters will look at distinct branches of science through a lens of the idea of knowledge creation. I will be exploring how practitioners of each branch were seeking truth about their world, and then how these different modes of knowledge creation were manifest in Shakespeare's works as characters navigated their own worlds.

Chapter one examines defining one's world through the process of documentation and cataloging, as evidenced with botany and anatomy. Early modern botanists and physicians both created reference texts for their subjects in their efforts to understand the workings of the plant world and the human body. Dissecting their subjects and meticulously marking the components that make up the whole resulted in the creation of numerous published herbals and anatomies, some of which offered not only descriptions but also remedies for ailments. Many of Shakespeare's characters call on the healing properties of plants to cure them, such as Ophelia in *Hamlet.* These sixteenth-century user manuals provided a sense of power over nature and the human body. But with this laser-like focus on cataloguing parts and dissecting also came a de-humanizing, or a loss of the "person." The body became something to be observed. This darker side of anatomy becomes clear in *Titus Andronicus*, where body parts

[37] For example, see Katherine Eggert, *Disknowledge: Literature, Alchemy, and the End of Humanism in Renaissance England* (Philadelphia: University of Pennsylvania Press, 2015).

and treatment of the body becomes especially significant, especially in understanding gender and power.

Chapter two takes a wider view, moving from chapter one's focus on the building blocks of the human body and the plant world to the broader ideas of supernature, astronomy, astrology, and meteorology. Instead of creating knowledge through thorough dissection and analysis, the early modern man (or woman) found knowledge by reading signs in the stars, weather, or actions of animals. Superstition, prognostication, and cultural memory informed the teleology of supernature, resulting in a language of omens and portents. Nature could both reflect the quality of human actions and warn against future dangers; simple occurrences like the hooting of an owl and larger occurrences of greater effect like an earthquake—and everything between—could carry a message. Shakespeare plays on his audience's knowledge of natural signifiers often, but of particular interest to this thesis are *Julius Caesar*, *King Lear*, and *Macbeth*, where nature both foreshadows future events and reflects the emotions of the main characters.

Chapter three looks at how knowledge is created through experimental and mechanical science, as illustrated in *Hamlet*. Shakespeare pulls in elements of all the aforementioned sciences in Hamlet's quest for truth. Hamlet notes the natural and supernatural signs around him, he attempts to make sense of his world through cataloging and defining, and then he forms a hypothesis and experiments (and is experimented upon) in order to find the truth about his father's death, and ultimately decide on an appropriate response. Scientific rhetoric and a mechanistic worldview are juxtaposed with poetic language and supernatural occurrences, and Hamlet must take on the role of scientist to sift through the layers of meaning and deception around him to uncover the truth.

Finally, I will conclude with a look at *The Tempest*, and specifically the character of Prospero. His practice, a combination of book learning and experimentation, is the

culmination of the types of knowledge creation I explore, and his choice to ultimately drown his books and break his staff is an interesting commentary on learning and power. I will show that in *The Tempest*, one of Shakespeare's last works, Prospero's practice—ability gained from an encyclopedic knowledge of nature, a study of its signifiers, and the practical application of this knowledge—is ultimately rejected in favor of embracing emotional connection. Indeed, even though many of Shakespeare's characters grasp at knowledge as a means of gaining power over other people or over their own lives, they find that ultimately it is knowledge of humanity and not nature or the cosmos that provides true power.

CATALOGING

My mistress' eyes are nothing like the sun;
Coral is far more red than her lips' red;
If snow be white, why then her breasts are dun;
If hairs be wires, black wires grow on her head.
I have seen roses damask'd, red and white,
But no such roses see I in her cheeks;
And in some perfumes is there more delight
Than in the breath that from my mistress reeks.
I love to hear her speak, yet well I know
That music hath a far more pleasing sound;
I grant I never saw a goddess go;
My mistress, when she walks, treads on the ground:
And yet, by heaven, I think my love as rare
As any she belied with false compare. (Sonnet 130)

Sonnet 130 is not merely a lover's brutally honest illustration of the object of his desire; it is also a catalog of her body parts, neatly labeled and qualitatively evaluated. Her eyes, hair, breasts, complexion, breath, and gait are all pieced apart and analyzed, and her entire being is never once mentioned, except in illustration of the act of walking. The speaker has torn her into bits and put each under a metaphorical microscope, defining the quality of her parts in relation to other bodies: her eyes are compared to the sun, her complexion to snow, her hair to wires.

This sort of breaking apart of the whole for the purposes of analysis and to discover how the components work was the driving mentality behind the boom in human autopsy during the second half of the sixteenth century. The desire to understand how the human body works behind the veil of flesh is not necessarily unique to this period, but the meticulous cataloging of the practice and the public interest in the spectacle was. Brian Ogilvie refers to this as the "cult of the fact," a sixteenth-century preoccupation with the necessity for everything to be defined and organized.[1] This idea manifested in private life, with personal collections of curiosities which the owner researched and cataloged, and in the more specialized worlds of natural scientists and surgeons. Plants were classified in intricately-illustrated botanicals, insects were dissected and placed in a taxonomy, and the human body was autopsied as often as the law allowed (and sometimes more often than that, if a surgeon thought he could get away with it). The natural world was broken down into wings, arms, lungs, legs, teeth, hearts, and leaves.

Private collectors, people who were not naturalists by profession but who gathered natural curiosities as a hobby and to boost their social status, were no longer content to simply own the pieces in their collection; they wanted to know about them and to be able to explain them to visitors. As a result, there was an increasingly greater market for books which could explain the natural world. Herbals, encyclopedias, and other "descriptive literature"[2] were published with greater frequency, and often could be found in curiosity cabinets alongside the objects which they described. Some of these books contained impressive illustrations, works of art in themselves. Curiosity cabinets grew in popularity from the sixteenth through the seventeenth centuries, emerging according to some from the Catholic Church's preoccupation

[1] Brian W. Ogilvie, *The Science of Describing: Natural History in Renaissance Europe* (Chicago: University of Chicago Press, 2008), 13.
[2] Ibid., 43.

with the collection of relics and other rare religious artifacts.[3] Instead of pieces of saints' bodies, private curiosity cabinets contained deformed animal specimens, drawings of humans with malformations or rare conditions, exotic animal remains or body parts, items said to have mystical or alchemical properties, and cultural items from newly-discovered lands. Arthur MacGregor relates this fascination with the collection and classification of curiosities to humanism: "The encyclopaedic aspirations of humanism are perfectly reflected in the programmes commonly adopted by the founders of such collections, who sought to have, in Francis Bacon's words, 'in a small compass, a model of universal nature made private.'"[4]

Art of the time was also starting to reflect the fascination with owning pieces of nature as a status symbol. "Ferrante Imperato's Museum," a 1599 engraving from Ferrante Imperato's *Natural History*, depicts his cabinet of curiosities, whose capstone was a stuffed crocodile.[5] And the natural scientist and the anatomist began appearing more frequently in paintings, reflecting the perceived pervasiveness of the professions. Perhaps the most famous of these paintings just post-dates Shakespeare, Rembrandt's 1632 "The Anatomy Lesson of Dr. Nicolaeus Tulp," but there were similar depictions of the profession for years before.[6]

The early modern era also saw the emergence of a new type of spectacle: the anatomy theatre, wherein surgeons would dissect human corpses in front of large audiences. The aforementioned Rembrandt depicts a group of men peering over the shoulders of one surgeon as he reveals the inner workings of the corpse's forearm. This is an intimate gathering of equals, and their reverent attitudes show both respect and wonder at the body before them. Certainly

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[3] Arthur Grant MacGregor, *Curiosity and Enlightenment Collectors and Collections from the Sixteenth to the Nineteenth Century* (New Haven: Yale University Press, 2007).

[4] Ibid.

[5] Paula Findlen, "Is a Crocodile a Work of Art? Seeing Objects in the Early Modern Cabinet of Curiosities" (presentation, Bard Graduate Center Seminar in Cultural History, New York, NY, April 2015).

[6] See Miereveld's "Anatomy Lesson of Dr. Willem van der Meer," for example.

small groups like this one were meeting throughout Europe, documenting and cataloging the human body and its parts in quiet and solemnity, but there were also large theatres erected for the purpose of performing anatomizations for the ticket-purchasing public. The early modern anatomy theatre was captured in illustration many times during the era, with such images usually depicting a circular arena surrounded by several levels of seating. The body would be displayed at the center of the stage, visible and exposed from all sides. Swanenburgh's woodcut of the Leiden Anatomy Theatre in 1610 shows skeletons walking among the spectators, unseen. Some of the spectators hold pieces of the body, most prominently a man in the right foreground with human skin draped over his arms. In this interpretation, the spectators are implicated in the act of dissection.

Shakespeare was not occupied with cutting open bodies and cataloging plants, as far as we know, but he was aware of the prevailing ideas surrounding the work of the barber-surgeons and the early modern botanists, especially the desire to dismantle and partition the living world into its various parts. His interpretation of this philosophy manifests in the sonnets as a lover's means of idolizing his mate, as mentioned earlier, but it also emerges in less positive or romantic ways. The anatomically-charged language his characters use to tear each other down, his characters' futile attempts to define each other based on their physical and emotional characteristics, and the various bodily injuries his characters experience and how they are portrayed or dealt with all point to the idea that life can be broken down into functional pieces—body parts, character traits, and beliefs—and the proper examination of these pieces can unlock the mystery behind the person. With the help of the early modern herbal, we can uncover how meaning and knowledge was being created through this process of itemizing and cataloging.

This chapter will first look at the prevalence and structure of early modern cataloging texts such as botanicals, herbals, and anatomies. With this baseline knowledge of these texts in place, the chapter will then examine Shakespeare's characters' knowledge and use of plants, and how the language of the catalog is used by characters as they attempt to define each other. Finally, the chapter will discuss cataloging as represented by anatomies, and how characters target specific body parts for attack, both figuratively and literally, as a means of gaining power.

Botany and Herbals

Herbals in some form had been published for centuries prior to the early modern era, so their existence in itself during the period is not revelatory or particularly noteworthy. However, the sixteenth century saw a definitive change in form and purpose as well as accessibility and popularity of the herbal. Eleanour Sinclair Rohde claims the earliest surviving written herbal in England dates to A.D. 900-950, *The Leech Book of Bald*. Written by a doctor, *The Leech Book* focuses mostly on the medicinal qualities of various herbs, and relies heavily on herb lore and superstition to define the plants.[7] *The Leech Book* is unillustrated, but *Herbarium Apuleii Platonici* (translated to the Saxon around A.D. 1000), contains many drawings of the herbs described within, though as Rohde points out, the drawings often bear no resemblance to the living object, indicating the drawings are copies of copies, perhaps going back several centuries. Rohde's work lists over 200 English herbals produced between the ninth and sixteenth centuries, and surely there are many more that either had not been discovered at the time of her writing in 1922[8] or which have been lost to time.

[7] Eleanour Sinclair Rohde, *The Old English Herbals* (New York: Longmans, Green and Co., 1922).

[8] Though dated, Rohde's work is still considered to be a good overview of the old English herbal and botanical practices.

It is a common theme amongst botany historians to broadly paint the sixteenth century as one which saw a dramatic uptick in botanical publications,[9] and yet one is hard-pressed to find in any of those assertions specific numbers. In conducting my own research, I discovered the difficulty of pinpointing exactly how many herbals were produced in that century. An English Short-Title Catalog search for "herbal" yields but 22 results in the 1500s, a number that would hardly suggest a surge in the genre when compared to the 200 texts Rohde enumerates in her bibliography from 800-1500, which lists over 120 in the fifteenth century alone (though many are presumably copies of the same publication). Widening the search parameters to include "botany," "herbal," "herball," or "plant" doubles the results to over 50.[10]

Perhaps it is more valuable to analyze the popularity of the herbal as an idea rather than looking for specific sales numbers. The sixteenth-century botanical, accessible both in readability and in relative ease of acquisition, is indicative of humanist and scientific thinking emerging at the time and which will be mentioned in this thesis in relation to mechanical science and astronomy.

The herbal served two purposes: firstly, it was a means for the reader to decipher one's surrounding plant life and make use of it. But the herbal could also be a reflection of political climate, and this was especially true of the late sixteenth-century herbal. With travel becoming more manageable, and as the herbal gained popularity, botanists became concerned not only with the flora of their native country but also with the flora found on the continent. Serious botanists would embark on expeditions to foreign countries to explore the plant life and document it; those who could not afford the journey would beg traveling acquaintances to return with seeds or

[9] See Rohde, *The Old English Herbals*.

[10] Blanche Henrey's *British Botanical and Horticultural Literature before 1800* provides a solid overview of botanicals and their authors, with volume one focusing on early modern texts.

specimens. Correspondence relationships were forged across countries whereby botanists could send local dried blossoms or seeds to each other. Further driving the globalization of the herbal was the humanist movement to re-evaluate all prior herbals and to create some sort of standardization with the taxonomy, though this wouldn't be accomplished until centuries later.[11]

The humanist desired truth, and the ideal text would get as near to nature as possible. The emphasis on precise detail in both description and image was part of this ideology. However, botany was uniquely situated to provide something a step further: the herbarium, or winter garden. An herbarium was a book which contained pressed, dried specimens within its pages rather than, or in addition to, illustrations. It allowed for the study of plants when they were out of season, or not readily available. In a way, it was a living book.[12]

This short history of sixteenth-century botany illustrates the mindset of the general English populace during Shakespeare's life, a time which coincides with this alleged "bumper crop" of herbal printings. For them, it was no longer enough to have a vague understanding of the natural world. As Peter Dear puts it, "Medieval learning … had stressed the ability to speak about matters of truth whereas now, instead, there was a stress on knowledge of what was in the world and what it could do."[13] For Shakespeare's characters, this process of coming to an understanding of the natural world through cataloging and naming seems a favorite pastime, as will be proven in the remainder of this chapter.

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[11] See chapter one of Deborah Harkness, *The Jewel House: Elizabethan London and the Scientific Revolution* (New Haven: Yale University Press, 2007).

[12] Brian W. Ogilvie, *The Science of Describing: Natural History in Renaissance Europe* (Chicago: University of Chicago Press, 2008), 42.

[13] Peter Robert Dear, *Revolutionizing the Sciences: European Knowledge and its Ambitions, 1500-1700* (Princeton: Princeton University Press, 2001), 2.

“In the catalogue, ye go for men.”

Nature is a common motif in Shakespeare’s plays, appearing at times to reinforce or reflect the actions of the protagonists, and at other times to be a source of conflict. Having grown up near the forest of Arden, Shakespeare was presumably at ease in and familiar with the natural world in a way that a born-and-bred Londoner might not be. Today it is common practice to perform Shakespeare out of doors to pay homage to and highlight the natural symbolism he employs.

There have been many studies of the plants employed in Shakespeare’s works, and it is not in the scope of this project to analyze each use and its meaning. However, I would like to provide a general overview of his references to plants, and then explore the parallels between botanical practices of the late sixteenth century and his characters’ actions. Henry N. Ellacombe’s dated but valuable 1884 *The Plant-Lore and Garden-Craft of Shakespeare* is an encyclopedic catalog of all plants mentioned in Shakespeare’s works, providing both a summary of the plant and also the lines in which it is referenced. According to Ellacombe’s exhaustive listings, every play contains some reference to a plant. As previously mentioned, this is hardly ground-breaking information considering the sixteenth-century man’s necessary interaction with nature on a daily basis. What is of note is the wide range of plants referenced in Shakespeare. Ellacombe’s work includes several hundred plants, ranging from the common (the apple) to the obscure (the mandrake).

Ellacombe uses Gerard’s *Herball* as his reference for Shakespeare’s plant knowledge, making the claim that “Whether they were acquainted or not we do not know, but it is certainly not improbable that they were; I should think it almost certain that they must have known each

other's published works."[14] I am inclined to agree that Gerard and Shakespeare would have been acquainted with each other's works, but whether Shakespeare made a great study of the *Herball* is of course unknown. However, it is unlikely that Shakespeare would have been familiar enough with the all the plants he references through first-hand experience alone, especially considering he was not known to have travelled extensively, and his time in a city like London was not likely to have lent itself to the study of nature. If Shakespeare did consult an herbal, Gerard's popular *Herball* would have been a probable choice. Regardless, we do know that the natural scientists at Lime Street were less than a mile from the Globe Theatre, and proximity alone may be enough to allow for the assumption that Shakespeare was influenced in some way by their work in botany.

Unsurprisingly, according to Ellecombe, *A Midsummer Night's Dream* contains the greatest references to plants with 56, followed by *The Tempest* at 43. Since both plays rely heavily on their natural setting for both plot and characterization, these numbers are logical. My initial hypothesis was that there would be a greater use of plant references in the comedies, and that the tragedies would contain the fewest. However, there is no pattern to his use of plant references. Tragedies, comedies, and histories all contain a range of frequencies, with *Julius Caesar* clocking in at the lowest frequency of just two references in the play, or one for every 9,800 words. This is especially intriguing considering the heavy reliance on natural phenomena in this play. Perhaps a more valuable study would be to look at the types of plants mentioned, along with their definitions, to determine how Shakespeare used the generally accepted meanings to foreshadow or reflect the events in his plays, these references being readily available in Gerard's *Herball.*

[14] Henry Nicholson Ellacombe, *The Plant-lore and Garden-craft of Shakespeare* (London: Edward Arnold, 1896), 5.

Rebecca Laroche did one such study, though brief, looking at Ophelia's flowers and their meaning. She points out that the stage directions for Act 4, scene 5 do not specify if Ophelia's flowers are real or imagined, though traditionally the scene has used the latter interpretation to underscore Ophelia's madness. However, Laroche insists that a sixteenth-century woman would have known the healing capability of plants, and may indeed have sought out the flowers of which she speaks in an effort to cure herself of her sadness. After painting a truly dismal portrait of Ophelia's life and circumstances in the play, Laroche asks her readers to place themselves in Ophelia's position. She writes,

> What if you knew there were medicines close by? ...That is, if you have been raised with the knowledge of how to restore yourself, would you give in to despair and madness without an attempt at prevention? ...A woman of Ophelia's age and station would be expected to have such a skill as readily as she would be expected to know sewing (as Ophelia does in II, i). For the early modern audience, the image of Ophelia holding flowers and herbs thus implies a potential attempt at self-administered medicine, however futile it may have ended up being.[15]

Ophelia carries—imaginary or not—rosemary, pansies, fennel, columbines, rue, and daisies. She lacks violets, which "withered all" (4.5.184) when Polonius was killed. According to Gerard, "Rosemary is given against all fluxes of blood; it is also good, especially the flowers thereof, for all infirmities of the head and braine, proceeding of a cold and moist cough; for they dry the

[15] Rebecca Laroche, "Ophelia's Plants and the Death of Violets," in *Ecocritical Shakespeare*, ed. Daniel Brayton and Lynne Bruckner (Burlington: Ashgate, 2011), 216.

braine, quicken the senses and memory, and strengthen the sinewy parts."[16] If Ophelia were feeling mentally imbalanced, rosemary's virtues would draw her to it. Pansies are listed under their more common name, hearts-ease, in Gerard, where he references the French origination of the name, *pensees*, meaning "to think."[17] When Ophelia says that pansies are "for thoughts," she is alluding to this title. According to Gerard, fennel preserves eyesight, and columbines assist with complaints of the liver. Rue seems to be the most versatile plant Ophelia offers: it is a cure for poisons and gut pains and is a labor expedient which also helps expel stillborn children from the womb. Ophelia's grief may have felt like a poison, something she desperately wished to have expelled from her system.

Perhaps the most appropriate plant Ophelia seeks out is the daisy, which Gerard notes "purgeth the head mightily of foul and filthy slimy humours, and helpeth the megrim."[18] According to the *OED*, this use of megrim may have referred to migraine headaches or to depression, both of which likely plagued Ophelia. Violets, which Ophelia is unable to procure since her father's death, would be the most valuable to her as they can "comfort and strengthen the heart."[19] Her father's death destroyed all the violets, and she therefore cannot get comfort for her sadness.[20]

Clearly Ophelia's flowers signify more than an ostensibly idyllic and feminine pastime; her botanical choices are intentional, and reflect not only a general familiarity with local flora but an expert study of them, and likely the possession and frequent consultation of an herbal very

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[16] John Gerard, *The Herbal or, General History of Plants: the Complete 1633 Edition as Revised and Enlarged by Thomas Johnson* (New York: Dover, 1975), 129. This edition is a reproduction of the 1637 version, which includes the 1597 version and additions.

[17] Ibid., 855.

[18] Ibid., 637.

[19] Ibid., 852.

[20] Laroche explores these plants in relation to Ophelia's madness and sexuality in great detail, as well as the feminist interpretation of Ophelia's picking flowers as related to her oppression in a man-oriented world.

like Gerard's. The line of thinking driving Ophelia here is very like Hamlet's mechanical inquiries, which will be explored in chapter 3. She recognizes there is something wrong with herself and is willing to experiment with many remedies to cure her ailment. Unfortunately for her, whereas Hamlet is eventually able to reach some sort of resolution—the confirmation of his uncle's guilt by his response to the Mousetrap—Ophelia's experiments do not cure her, either because the flowers are all in her mind or because the issue is beyond help (depending on the staging of Act 4, scene 5). In fact, her continued exploration of botanical remedies inevitably leads to her death, when in the process of collecting plants she purportedly falls into the brook and is drowned.

Friar Laurence in *Romeo and Juliet* has also made a study of the "virtues" (2.2.13) of plants, using the same word Gerard uses. Laurence ponders on the duality of plants' ability to both heal and poison, a metaphor for both Romeo—who is innocent and in love, but also a killer—and for love itself, which causes both great joy and great sorrow. Though never directly referenced, it is presumably Laurence's botanical knowledge which allowed him to create the "distilling liquor" (4.1.94) which he gives to Juliet to cause her coma. It is even possible that the liquor is a compound formed of the same flower he speaks of in Act 2, which looks so lovely and yet contains such poison. In this case Juliet finds greater success with her plants than did Ophelia. The concoction created by Friar Laurence does its job splendidly; it's the failure of his messenger that ultimately causes the deaths of the lovers.

There are many other instances of characters using plants for physic, often metaphorically. In *Much Ado About Nothing*, Margaret proclaims that Beatrice requires distilled Carduus Benedictus (3.4.68) for her cold (which, although a pun in this sense is also an appropriate remedy for the cold according to Gerard). Cerimon, in *Pericles*, says that through his

practice he has learned of the "blest infusions/ That dwells in vegetives" (scene 12, lines 32-33). In *Macbeth'*s final act, Macbeth implores the doctor to cure his wife's madness, and then asks, "What rhubarb, cyme, or what purgative drug/ Would scour these English hence?" (5.3.57-58). In a darker instance, the witches in *Macbeth* also make use of plants in a distillation of their own creation. In Act 4, scene 1 they add "root of hemlock digged i'th' dark" (25) and "slips of yew/ Slivered in the moon's eclipse" (27-28) to their wicked brew.

But these instances of characters using plants for healing are not of any great significance in relation to the changes in botanical science of the early modern era; herbs and plants had been used for this purpose for millennia. Perhaps more interesting is how the foundational ideas behind the creation of the botanical text infuse language and thought processes in Shakespeare's plays. At its most basic, an herbal is a list. But, in the case of Gerard's *Herball* especially, it is a series of lists within lists, a catalog, and a manual. The *Herball* not only contains the names of hundreds of plants, it also includes lists of Latin names, lists of virtues, lists of locations, lists of the anatomical components of the plants themselves, and in some cases gets even more granular and takes those components and lists what can be done with each of them. Necessary to this process is the standardization of these labels and the classifying of various pieces of information. The end result is that a plant is no longer one thing, but rather many different things which, when combined, make up the plant. It would be a stretch to claim that early modern herbals were an influence on Cartesian dualism, but it can be said that the method of seeing a living thing as the integration of many component parts is common in both ideologies.

According to the *OED*, the figurative use of the word "catalog" emerged in the 1590s. Previously the word had been used only literally when referencing an existing physical list, but around Shakespeare's time it took on a more abstract meaning. Shakespeare makes use of the

term in this manner in four plays. In Act 1, scene 3 of *All's Well That Ends Well*, the Countess tells Helen that she counts Helen as one of her own children, explaining, "I say I am your mother,/ And put you in the catalogue of those/ That were enwombed mine" (1.3.137-139). Here, the Countess is most definitely referring to a catalog in the abstract, as an idea of a list of like things which fall under one overarching category: beings I created. In *Coriolanus*, Shakespeare uses the word in the non-figurative when Sicinius asks, "Have you a catalogue/ Of all the voices that we have procured,/ Set down by th' poll?" (3.3.7-9) Again, this use of the word is in reference to a list. To Sicinius, the people are little more than tally marks.

Shakespeare's most interesting uses of the word appear in *Macbeth* and *Cymbeline,* where it is tied to ideas of taxonomy and classification of people. In the first act of *Cymbeline* Giacomo talks of Posthumus in phrasing that calls to mind an early modern botanical: "But I could then have looked on him without the help of admiration, though the catalogue of his endowments had been tabled by his side and I to peruse him by items" (1.3.3-6). Of note in this passage is the allusion to the process of using a catalog as a method for understanding an unfamiliar living thing. Replace Posthumus with a rare plant, and the process would have been the same in consulting an herbal. Also of importance here is the word "item," which acts as a tool of dissection, very clearly piecing apart Posthumus. He is no longer the man Posthumus, but rather the elements of Posthumus, as in Gerard's *Herball* the plants are their location, temperature, and virtues.

When Macbeth is attempting to stir the murderers to action against Banquo, he calls upon the imagery of the catalog to great length:

> Ay, in the catalogue you go for men,
>
> As hounds and greyhounds, mongrels, spaniels, curs,

Shoughs, water-rugs, and demi-wolves are clept
All by the name of dogs. The valued file
Distinguishes the swift, the slow, the subtle,
The housekeeper, the hunter, every one
According to the gift which bounteous nature
Hath in him closed; whereby he does receive
Particular addition from the bill
That writes them all alike. And so of men.
Now, if you have a station in the file,
Not i'th' worst rank of manhood, say't,
And I will put that business in your bosoms
Whose execution takes your enemy off… (3.1.93-106)

Here, Macbeth is not directly pointing to herbal catalogs; his reference to dogs implies a zoological catalog. While it wasn't until the eighteenth century that a standard taxonomy was published, during the early modern era there was in conjunction with the interest in botany a growing interest in zoology, especially in relation to the exotic animals being discovered as countries like England explored new lands. Published zoological catalogs were not as prevalent, presumably because they were not as serviceable as the herbal. Macbeth treats the murderers as objects to be classified. His use of the word "file" is also meaningful, much as "item" stands out in *Coriolanus*. The *OED* references Shakespeare's use of this word in *Henry IV pt 2* as well ("Our present musters grow upon the file/ To five-and-twenty thousand men of choice" (1.3.10-11)); both of these are instances of human beings relegated to the status of an object to be

counted. Sometimes this method is used for self-evaluation; Olivia catalogs herself in *Twelfth Night*:

> …I will give out
> divers schedules of my beauty: it shall be inventoried,
> and every particle and utensil labelled to my will, as,
> item, two lips, indifferent red; item, two grey eyes, with
> lids to them; item, one neck, one chin, and so forth. (1.5.233-237)

Though still relegating her being to physical attributes, Olivia is at least in control of her cataloging, dictating how she will be labeled.

Shakespeare's characters are occasionally preoccupied with defining what it means to be a man or woman. In *Coriolanus*, in his frustration, Martius exclaims, "You souls of geese/ That bear the shapes of men," (1.5.5-6) again sectioning off his men into spirit and body, as if they are attempting to buck their classification with artifice. He wants to define them as men, but their souls do not fit the definition. Similar sentiments were expressed outside the theater, by Queen Elizabeth before the attempted invasion of the Spanish Armada in 1593 when she declared, "I know I have the body but of a weak and feeble woman, but I have the heart and stomach of a king, and of a king of England too."[21] While this is a well-expressed sentiment for rallying the troops on the eve of battle, the idea behind it is extremely relevant to this study. Perhaps the inversion of power brought upon England by having a female ruler spawned some of the emphasis on defining the world which was the backbone of the emergence of herbals and catalogs. The sixteenth century saw the emergence of not one but three female crowned monarchs in England: Lady Jane Grey in 1553, followed by five years of Mary, and then

[21] Elizabeth I, *Elizabeth I: Collected Works*, eds. Leah S. Marcus, Janel Mueller, and Mary Beth Rose (Chicago: University of Chicago Press, 2002), 325.

Elizabeth from 1558 onward. Prior to that, only men had ruled England, and in that patriarchal society where the Church tied women to the negative qualities associated with Eve, women occupied a lower social status than men. By the time Shakespeare was in London, England had been under a woman's rule for more than thirty years, enough time to prove it was not a fluke occurrence that would be remedied soon. Thus the definition of the sexes necessarily needed to be modified in the consciousness of the country. It follows that if genders were being redefined, other parts of nature might be in need of examination, such as the plant or animal worlds.

Shakespeare explores this in *The Tempest* with Caliban, a human-like creature who occupies the island on which the action takes place. When Trinculo happens upon him in Act 2, scene 2 he does not know what sort of creature Caliban is, and tries to fit him into various categories:

> What have we here, a man or a fish? Dead or alive? – A fish, he smells like a fish; a very ancient and fish-like smell; a kind of not-of-the-newest poor-john. A strange fish! … Legged like a man, and his fins like arms! Warm, o'my troth! I do now let loose my opinion, hold it no longer. This is no fish, but an islander that hath lately suffered by thunderbolt. (2.2.24-36)

Julia Reinhard Lupton elucidates the many layers of reckoning Caliban causes for both the shipwrecked men and for the audience:

> Caliban … takes shape beneath the arc of wonder that moves throughout the play between "creatures" and "mankind," between animate beings in general and their realization in the form of humanity. Is he man or fish? Creature or person? This indeterminacy at the heart of Caliban also sets him adrift between the cosmos in

> its vast totality—the brave new world of primal Creation—and the particular worlds defined by culture and nation.[22]

Caliban has a similar reckoning of the two men before him. "These be fine things, an if they be not spirits./ That's a brave god, and bears celestial liquor." His prior experience with men being limited to his interactions with Prospero, what other conclusion can he reach but that Trinculo and Stefano, who have given him good liquor and who have not forced him to gather wood, must be gods? He may believe all men can work the wonders that Prospero can, and thus must be quite powerful and worthy of respect. Miranda, too, must interpret the shipwrecked Ferdinand. At first, she believes he must be a spirit, but Prospero explains, "No, wench, it eats and sleeps and hath such senses/ As we have, such" (1.2.415-416). Miranda explains that Ferdinand is the third man she has ever seen (after her father and Caliban), thus when she is faced with the rest of the shipwrecked party in Act 5, she exclaims

> … O wonder!
> How many goodly creatures are there here!
> How beauteous mankind is! O brave new world
> That has such people in't! (5.1.184-187).

Her paradigm shift is so encompassing as to feel to her as if she has discovered an entirely new planet.

"The heart and stomach of a king"

The examples in this chapter thus far have dealt with characters cataloging and classifying the natural world based on exterior elements—Caliban's smell and limbs, Ferdinand's body, the

[22] Julia Reinhard Lupton, "Creature Caliban," *Shakespeare Quarterly* 51, no. 1 (2000): 2.

"shapes of men" that Martius so disdains. When Queen Elizabeth spoke to her troops she spoke of both the exterior (her female body) and the interior (the heart and stomach of a king). While she was likely using those specific organs metaphorically, to convey her hunger and drive to defeat the Spanish, more literally the matter of Elizabeth's internal organs was definitely a topic of conversation. Would her womb ever bear an heir? At what age would she be physically unable to do so? Was she still a virgin?[23]

The rising popularity of the study of anatomy via autopsy and dissection manifested in several areas beyond the surgeon's table, most predominantly in general rhetoric. As the populace became more familiar with the practice of anatomizing the human body, many of them witnessing autopsies in surgical theatres previously mentioned, language used in the practice of the surgery became part of the larger vernacular. Richard Sugg uses the word "anatomy" as an example of this phenomenon, pointing out that it enjoyed a greater frequency of use in titles of works sometimes entirely unrelated to the study of the interior of the human body, such as Robert Greene's *Mamillia…Anatomie of Lovers' Flatteries* (1583) or John Lyly's *Euphues, the Anatomie of Wit* (1578). Sugg provides a list of nearly one hundred works printed between 1576

[23] Kaara Peterson provides a lengthy analysis of the contemporary writings about Elizabeth's virginity and bouts with presumed hysterica passio, informed by modern-day gynecology. The abundance of sources she points to, from letters written to and about Elizabeth to politically-motivated writings of figures in England and Europe, reveals the public preoccupation with the health of Elizabeth's hymen and uterus. She was examined by doctors many times who reported on both her virginity and her ability to bear children, and her ailments were the topic of gossip and intrigue in court. In life, she was exposed and continually cataloged—as much as could be done on a living being. Taken as a whole, the conversation around her body suggests there were many who would have liked to open her up to examine her insides if such a thing were possible without killing her.

However, even in death her physical interior remained a mystery as she requested that her body not be opened upon her decease. Peterson speculates that this desire stemmed from Elizabeth's fear that her autopsied body would reveal either a defect she had kept secret or the fact that she perhaps was not a virgin (and may have born bastard children). Having allowed the Barber-Surgeons access to the bodies of hanged men in the past, and the general prevalence of the culture of the post-mortem, she would have been aware of the sort of scrutiny her body would have been under if she allowed it to be properly embalmed. Clearly, she wanted to maintain some mystery about what exactly made up the monarch. Kaara L. Peterson, "Elizabeth I's Virginity and the Body of Evidence: Jonson's Notorious Crux," *Renaissance Quarterly* 68, no. 3 (2015): 840-871.

and 1650 with some noun form of anatomy in the title, and nearly fifty further titles using the verb form, a frequency which he claims shows a new or renewed interest in the practice. He writes,

> Around 1575 the wider English public appeared barely to have heard of anatomy; by 1600 it seemed at times unable to talk about little else. Often, indeed, uses of dissective rhetoric appear not merely fashionable but highly compulsive, sometimes lacking an integral semantic motivation to the extent that the body must be seen as actively invading the English literary imagination.[24]

There are ten instances of "anatomy" or its variants in Shakespeare, and another ten of some form of "to lay open," a reference to the act of cutting into a body and peeling back the skin to reveal the flesh within. Thus the language of anatomy is seen to have invaded Shakespeare's brain as Sugg claims it had done to the whole of England. Sitting in a round theater with the players visible in a raised stage projecting into the center of the space, and using phrases like these, it would not be difficult to draw a connection to the anatomy theaters with their circular construction and opened bodies on display at the heart of the room.

Language like this in Shakespeare is the most easily recognizable homage to the science of anatomy, but it is only the most superficial of the connections between the two. The more interesting question is, how does Shakespeare's work reflect the ideology behind the study of anatomy? Ideas of death and decay, disfigurement, the separation of the body from the soul, and the sectioning of the body into its parts are all infused into Shakespeare's works, both in language and sub-text and in physical manifestation.

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[24] Richard Sugg, *Murder After Death: Literature and Anatomy in Early Modern England* (London: Cornell University Press, 2007), 2.

One related motif in Shakespeare's works is that of resurrection, which relates to questions of the permanence of death and how death affects the body. Without the benefit of modern understandings of the relationship between the heart, brain, and lungs, how could the early modern man be certain of when death actually occurred? Was it when a person stopped breathing? When he grew cold? When he was unresponsive for a certain length of time? Premature burial was rare but did happen, as was the case for Laurence Cawthorn in 1661. The title of the pamphlet printed that year explains his story in brief: "The Most lamentable and deplorable accident which on Friday last, June 22, befell Laurence Cawthorn, a buccher in St. Nicholas Shambles in Newgate Market who being suspected to be dead by the two hasty covetousness and cruelty of his land-lady ... was suddenly and inhumanely buryed : together with the report of his moving of the body as it was carrying by the bearers to his grave, and the treating of his winding sheet with his own hands, and the lamentable shrieks and groans he made on the Saturday and Sunday following…"[25] If no autopsy or embalming were performed, family and physicians could only determine death by lack of breathing, a test that on occasion could prove deceptive. In the case of Laurence Cawthorn, it was clear that he had been prematurely buried, and had not been dead and then resurrected; however the image of a living person emerging from a grave is striking, and during a time when bodies were unceremoniously being hauled away to prevent spread of plague—sometimes very quickly after death— coupled with Christian beliefs in resurrection and early modern anatomists' study of what makes the body "tick", it is unsurprising that such an idea would emerge in Shakespeare's works.

In *Othello,* when the green-eyed monster of jealousy has finally overcome Othello's better judgment and he stifles Desdemona to her death, there is a moment when he has a chance

[25] Anonymous, "The most lamentable…" (London: W. Gilbertson, 1661).

to stop his actions in time to save her. She makes a sound and he realizes that she is not yet dead. He says, "What noise is this? Not dead? not yet quite dead?/ I that am cruel am yet merciful./ I would not have thee linger in thy pain./ So, so" (5.2.95-98) and continues to suffocate her until he believes her truly dead. Moments later, however, she rouses and proclaims her innocence before finally dying. Had Othello a surgeon's knowledge, he likely would have ended Desdemona's life more swiftly.

Shakespeare never employs a true resurrection in his works, though the illusion is created for some characters due to a miscommunication about death, a presumption of death, or a deliberate faking of a death. In *Romeo and Juliet*, Juliet will "appear like death," (4.1.103) in *The Winter's Tale* though Leontes must believe some sort of magic has resurrected Hermione from the grave through the form of a statue the audience assumes that Paulina has kept Hermione in secret for the previous sixteen years, and in *Much Ado About Nothing* the "Hero that was dead" (5.4.65) to Claudio was of course never dead at all, just in hiding. Though Shakespeare's characters may have believed resurrection was possible, it seems that he certainly did not.[26]

In Shakespeare, true death (not supposed death or almost-death) is unmistakable and brutal: sword and dagger stabbings, beheadings, and poisonings occur on multiple occasions, one character is mauled by a bear, one is torn apart by a mob, one is bitten by a snake, one is burned after being dismembered, one is buried and starved, one is cut into pieces, one eats hot coals, one drowns. Some of these deaths occur offstage and are reported upon, but there are many deaths and maimings that occur on stage. In some cases, the visible body count is staggering. In *Titus Andronicus*, the stage is littered with the bodies of Lavinia, Tamora, Titus, Saturninus, and in the previous scene those of Demetrius and Chiron. In *Hamlet* the final scene closes on the corpses of

[26] Thaisa in *Pericles* could be argued to represent a resurrection, however the haste with which she is thrown overboard leaves doubt that she was properly confirmed dead.

Gertrude, Claudius, Hamlet, and Laertes. Julius Caesar's body remains on the stage for the remainder of the lengthy scene in which he is brutally murdered (3.2), and for the entirety of Mark Antony's speech and the subsequent public revolt. The body is a prop for Antony, underscoring the sarcasm whenever he speaks of Brutus's honor. When he says, "The evil that men do lives after them;/ The good is oft interred with their bones" (3.2.76-77) the bones to which he refers are within reach. When he says "My heart is in the coffin there with Caesar" (3.2.107), he reminds his audience of Caesar's heart, hidden away in the body before them, stopped.

The body is violated in many ways on Shakespeare's stage, and pieces of the body serve as symbols and messages when parted from the whole. In this scene, Antony goes on to speak of Caesar's body through its parts:

> …they would go and kiss dead Caesar's wounds
> And dip their napkins in his sacred blood,
> Yea, beg a hair of him for memory,
> And, dying, mention it within their wills,
> Bequeathing it as a rich legacy
> Unto their issue. (3.2.133-138)

He points more specifically to the wounds a few lines later, calling on the people to observe the work of the senators:

> Look, in this place ran Cassius' dagger through:
> See what a rent the envious Casca made:
> Through this the well-beloved Brutus stabb'd;

> And as he pluck'd his cursed steel away,
>
> Mark how the blood of Caesar follow'd it (3.2.172-176)

This objectification of the body in this scene transforms Caesar from the single icon whom the people hated into pieces that they could pity and love. Antony has here verbally dismembered Caesar much as the senators attempted to do physically. He juxtaposes physical evidence (the oozing tears in Caesar's body) with the abstract (the honorability of Brutus, Cassius, and the others), and his audience is swayed more by the visual proof than the nine times Antony labels Caesar's killers as honorable. And Antony knows this will be the case; he refers to Caesar's wounds as "poor, poor dumb mouths" (3.2.220) which, though silent, speak convincingly.

Corpses do speak in Shakespeare, communicating the finality of death, the silence of the poor player who is heard no more. But there is also an interesting objectification of the living body that Shakespeare employs, one that very much mirrors the objectification of plant life observed in the early modern herbal.

In *Twelfth Night* Olivia says of Cesario, "Thy tongue, thy face, thy limbs, actions and spirit,/ Do give thee five-fold blazon" (1.5.282-283), recounting all the evidence that points to his being a gentleman. A blazon is a heraldic coat of arms, and the term specifically refers to the rules and codes associated with the makeup of that heraldry. The placement of symbols and the colors signified specific worthy attributes; a person's shield told what he valued, his lineage, and his family's character much as an entry in an herbal would describe a plant's virtues. In the early modern era, it became the fashion to blazon one's love, or to break her down into her parts and read her as one would read heraldry. Shakespeare does this most obviously in his sonnets, as was illustrated in the introduction to this chapter. This sectioning of the lover is a study in objectification, a reduction from the whole into parts. In doing so, the speaker is both ignoring

those parts of his lover that he might find less desirable and deifying those that he finds pleasing. As the Mona Lisa is often reduced to jocund hands and an enigmatic smile, the sonnet is an act of narrowed focus. Sonnet 20 illustrates blazoning especially in the first six lines:

> A woman's face with nature's own hand painted,
> Hast thou, the master-mistress of my passion;
> A woman's gentle heart, but not acquainted
> With shifting change as is false women's fashion:
> An eye more bright than theirs, less false in rolling,
> Gilding the object whereupon it gazeth … (1-6)

The subject of this sonnet is a face, heart, and eye (or gaze). As this particular sonnet is about a man, it is important to note that blazoning is not directed only from men to women. As the nature of blazoning is to admire selective parts of a person, it is possible even to never know the gender of the subject. Morrison and Uman write, "…the blazoned body undergoes a metamorphosis not of its own design; the body is wrenched into a dispersed catalog of parts, causing subjectivity to be bound up in a system of privations, making what should be discernible uncanny."[27] In this sense, blazoning is figurative dissection, mirroring with words the actions of the anatomy theater. Jonathan Sawday writes,

> …a dissection might denote not the delicate separation of constituent structures, but a more violent "reduction" into parts: a brutal dismemberment of people, things, or ideas. This violent act of partition tends to be associated with the related term (speaking conceptually) of "anatomization". In the literary sphere, dissection and anatomization have come to be associated with satire, and hence with a

[27] Deborah Uman and Sara Morrison, eds., *Staging the Blazon in Early Modern English Theatre* (Burlington: Ashgate, 2013), 67.

> violent and often destructive impulse, no matter how artfully concealed. A literary/satirical dissection, then, may be undertaken in order to render powerless the structures within which the dissector's knife is probing.[28]

Take, for example, Beatrice's mock blazoning of the perfect man in Act 2 of *Much Ado About Nothing*:

> BEATRICE: He were an excellent man that were made just in the midway between him and Benedick: the one is too like an image and says nothing, and the other too like my lady's eldest son, evermore tattling.
>
> LEONATO: Then half Signior Benedick's tongue in Count John's mouth, and half Count John's melancholy in Signior Benedick's face—
>
> BEATRICE: With a good leg and a good foot, uncle, and money enough in his purse—such a man would win any woman in the world, if a could get her good will. (2.1.6-15)

This Frankenstein's monster whom Beatrice has stitched together from the bodies of imaginary men is a warped blazon; for lack of one man whom she can truly admire, she must create a fiction out of many. Benedick mirrors this process later in Act 2 when he catalogs the qualities he desires in a woman, though his speech may not be considered a true blazon as his focus is on her abstract characteristics and not her physical:

> Rich she shall be, that's certain; wise, or I'll none; virtuous, or I'll never cheapen her; fair, or I'll never look on her; mild, or come not near me; noble, or not I for an angel; of good discourse, an excellent musician, and her hair shall be of what colour it please God. (2.3.29-34)

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[28] Jonathan Sawday, *The Body Emblazoned: Dissection and the Human Body in Renaissance Culture* (London: Routledge, 2006), 1.

Morrison argues that the mentality behind the language of blazoning correlates to a general disassociation of the person and the body, making the body the object of desire more than the being as a whole. She claims this is evident in *Measure for Measure*, when Angelo requires Isabella's body as payment for the release of her brother—and he makes it quite clear that it is her body and not her that he desires: "You must lay down the treasures of your body/ To this supposed, or else to let him suffer" (2.4.96-97). Angelo is drawn to the body that is hidden, aroused by the "enshield beauty" (2.4.80) and not the displayed. He does not mention Isabella's personality or character as attractive; this is strictly a physical transaction. While this is not technically rape—Angelo gives Isabella a choice—the verbal handling of her body in this interchange feels like a violation. Isabella continues this objectification of herself later, when she asks if her brother would rather "her body stoop/ To such abhorr'd pollution" (2.4.182-183) than he suffer the consequences of his actions.

Lavinia in *Titus Andronicus* is arguably the most violated character in Shakespeare. Introduced as "Rome's rich ornament" (1.1.52), she is objectified before she has uttered a word. She is physically possessed by Bassanius shortly thereafter, when he grabs her and then steals her away. "This maid is mine," he proclaims (1.1.276). Lavinia's handling by the men in her life has been the subject of many a feminist critique on sexual politics in a world ostensibly run by men. This study is not concerned primarily with the social undercurrents surrounding Lavinia's treatment, but rather with the connection between her physical misfortunes and the rising popularity of anatomy in Shakespeare's time, though gender cannot be ignored in such a conversation. Lavinia's injuries for the most part are decidedly feminine. Being stripped of voice and virtue is symbolic of the female plight in a patriarchal society, it's true, but looking at her injuries with a less emotionally-charged lens, the anatomical mechanics can come into the

spotlight. The loss of her tongue renders her mute, as silent as the corpses who are dissected in the anatomy theatre. The removal of her hands leaves her helpless, and at the mercy of her caretakers. The loss of her virtue and her husband makes her incapable of bearing children (or, at least, incapable of bearing children whom society would accept), thus effectively stripping her of her womanhood. She cannot speak, act, or reproduce. Having been reduced to an object from the beginning, she has been disassembled and is now a non-functioning thing. It was not a person whom Demetrius and Chiron destroyed, but rather a body. And, if bodies are cut apart in the anatomy theatre with little consequence, could not these two men do the same to this "body"? They do not murder her, or take their blades to her in random ways. Their actions are precise, like a surgeon's, carefully sectioning off from the body proper that which makes Lavinia a person. Adding insult to the assault, Marcus further objectifies her with a macabre blazon, as Lisa S. Starks-Estes points out. "Shakespeare juxtaposes the dismembered body with the figurative trope of the blazon most jarringly at the moment when Marcus discovers Lavinia, whose body is obviously framed for display."[29] He compares her arms to branches which have been cut short, the blood pouring from her sliced tongue to a fountain, her bloody lips to "rosed" lips. Hers is not the only mutilation in the play. Her father loses a hand, and Alarbus's limbs are cut off and then his entrails burned. In no other play are so many characters maimed with such precision. But Lavinia's loss is the one emblazoned.

Howard Marchitello takes the discussion of Shakespeare's representations of the body into the realm of semiotics, noting that it is not just the labeling of the body that matters, but the reason behind the labeling, namely to read the body. When this proves impossible, as in the case of Othello's quest to determine Desdemona's fidelity, it can have disastrous consequences.

[29] Uman and Morrison, eds. *Staging the Blazon*, 59.

Marchitello explains, "What Desdemona's body signifies, then, ironically, is an apparent illegibility, a refusal to make manifest its own knowledge."[30] Othello cannot read from her body whether or not she has been faithful to him, and so he lashes out, wishing to see inside her. "Othello's responses, 'I'll tear her to pieces' (3.3.438), 'I'll chop her into messes' (4.1.196), and 'O blood, Iago, blood!' (3.3.458), can be read as manifestations of a violence embedded within a reactive fantasy of dismemberment. … Othello's desire for violent revenge against Desdemona takes a specific form: he fantasizes not only of her punishment, but her anatomization."[31] Just as anatomists peered into the human body to learn its secrets, Othello desires an interior view of Desdemona to discover her actions. The idea that a definitive answer can be gleaned from an inspection of the anatomy may be linked to Vesalius, as Marchitello points out. *De Humani Corporis Fabrica Libri Septem*, printed in 1543, was one of the most influential anatomy texts of the sixteenth century. In it, Vesalius provides detailed images of the interior of the human body, instruction for how to use dissecting tools, and how various elements of the body function. Of the *Fabrica* Martin Kemp writes, "The level of knowledge in the *Fabrica* went far beyond the rude empirical procedures needed by a field surgeon or even the kind of court employee Vesalius was aspiring to become. The *Fabrica* was more in the nature of philosophical treatise on the architectural magnificence of the human body, bearing witness to Vesalius's heroic excavation of the inner truths of its fabric."[32] This interpretation is especially relevant to Lavinia and Desdemona; both women's bodies are read by others in an effort to discover truth—destroying them in the process.

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[30] Howard Marchitello, "Vesalius' *Fabrica* and Shakespeare's Othello: Anatomy, Gender and the Narrative Production of Meaning," *Criticism: A Quarterly for Literature and the Arts* 35, no. 4, http://search.proquest.com/docview/1311739327?accountid=8630.

[31] Ibid.

[32] Martin Kemp, "Vesalius's Veracity," *Nature* 393 (1998): 421.

Thus we see a systematic and regular effort at determining truth, “the cult of the fact,” through the reading of both plant life and human anatomy was part of knowledge-building in the sixteenth century. In attempting to understand the elements that make up a living thing, those living things were broken into their various components: leaf, stem, root, or eye, limb, organ. And as these parts made up the living organism, the destruction of them could lead to death. Obtaining this knowledge, then, could give one power over one weaker, or less-informed. But the living form, whether vegetable or animal, was not the only piece of nature to which the early-modern man attempted to catalog and decipher. As will be discussed in the next chapter, signs and symbols could be found all around, if one knew where to look and how to interpret them.

PREDICTION

At the opening of *Henry VI, part 1*, the Duke of Bedford and the Duke of Exeter lament the death of Henry V and the fateful celestial machinations behind his end. Bedford points to the "bad revolting stars/ That have consented unto Henry's death" (1.1.4-5), and Exeter curses "the planets of mishap/ That plotted thus [their] glory's overthrow" (1.1.23-24). In *Romeo and Juliet*, the prologue defines the two young lovers as "star-crossed." (prologue, 6) Hermione, in *The Winter's Tale*, claims that an "ill planet reigns" (2.1.108). Celestial signifiers are scattered throughout Shakespeare's works—both plays and sonnets, comedies and tragedies. While these references are particularly appropriate to the science of the time, as will be discussed in reference to such figures as Galileo and Copernicus, they reference more than the re-energizing of a fascination with the universe; prognostication, or predicting future events by reading signs was a very real practice sought out by people from all levels of the social strata. However, though prognostication was common, the extent to which it was believed to be reliable or permissible within the bounds of early modern Christian society has been debated in the past century.[1]

Skepticism in the early modern era was defined by a growing distrust of previously universally accepted truths, more specifically religious truths and classical ideals.[2] This skepticism questioned man's agency, the workings of the body, the relationship between spirit and physical world, the power of religious authorities, the veracity of miraculous occurrences, and the construction of the universe. Reading signs and predicting future events were not new ideas in the sixteenth century. The Oracle at Delphi, referenced in *The Winter's Tale*, dates from

[1] See, for example, Keith Thomas, *Religion and the Decline of Magic* (London: Penguin Books, 1991).

[2] See Benjamin Bertram, *The Time Is out of Joint: Skepticism in Shakespeare's England* (Newark: University of Delaware Press, 2004) and Millicent Bell, *Shakespeare's Tragic Skepticism* (New Haven: Yale University Press, 2002).

several thousand years before its appearance on the Jacobean stage. In the thirteenth century, Thomas Aquinas taught that it was possible for experts to foretell events by accurately reading the stars and planets.[3] And for every famous diviner remembered today there were countless local practitioners whose existence has been lost to time.[4]

Celestial bodies were not the only indicators of future events; terrestrial occurrences could also be read to predict the future. While there were many well-known omens, such as the direction of a wind likely bringing with it either health or disease, it would have taken an expert like John Dee to make an accurate reading of one's astrological chart and to have any success with predictions. Dee accurately predicted the beheading of Mary Stuart and the invasion of the Spanish Armada.[5] However, even with his mountain of work in prognostication and eschatology, his successful predictions are few.

I will begin this chapter with a brief overview of teleology and semiotics as it relates to early modern England, and how skepticism may have affected a revival of ancient Greek ideals in this area. With this working definition of semiotics, I will then look at both celestial and terrestrial signifiers, and discuss who would have been able to read these signifiers. I will also look at various examples of each from Shakespeare's plays, and examine how the inclusion of these signs would have affected his audience's perception of his characters' agency and fate. In order to understand how signs were interpreted, it will be necessary to explore the role of the translator, such as soothsayers, oracles, and witches. How do these characters appear in

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[3] *Summa Theologica* Part 1, Question 115, Article 4 addresses "Whether the heavenly bodies are the cause of human actions," to which Aquinas answers, "The heavenly bodies can directly and of themselves act on bodies... They can act directly indeed on those powers of the soul which are the acts of corporeal organs, but accidentally." Saint Thomas Aquinas, *The Summa Theologica: The Complete Edition* (New York: Catholic Way Publishing, 2014), ebook, location 2353.

[4] See chapter 8 "Cunning Men and Popular Magic" in Thomas, *Religion and the Decline of Magic*

[5] Deborah Harkness, *John Dee's Conversations with Angels* (Cambridge: Cambridge University Press, 1999), 140.

Shakespeare's work? Plays of particular interest in this chapter are *Julius Caesar*, *Macbeth*, and *King Lear*, though I will reference many others as well.

The Language of Signs

It may seem anachronistic to discuss teleology and semiotics alongside early modern witches and magi, especially since the terms would not come into existence until nearly a century after Shakespeare's death, and really only gained in popularity in the twentieth century.[6] John Locke referred to semiotics in his 1690 *An Essay Considering Humane Understanding,* which he concludes by breaking science into three parts: "The knowledge of things," "The Skill of Right applying your own Powers and Actions for the attainment of Things good and useful," and "σημιωτικὴ (semiotics) , the Doctrine of Signs."[7] Locke goes on to focus on language as a system of signs by which one man can know what another man means. Derrida, Saussure, and others would later build upon this idea.

But where it comes into play in early modern prognostication is the causal relationship between events and states of nature, and how people began to believe the two were in communication. A shooting star could mean the impending overthrow of a government, or misalignment of the stars could mean an outbreak of plague.[8] While some signs were commonly

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[6] "semiotics, n.". OED Online. June 2017. Oxford University Press. http://www.oed.com/view/Entry/175724?redirectedFrom=semiotics.
"teleology, n.". OED Online. June 2017. Oxford University Press. http://www.oed.com/view/Entry/198710?redirectedFrom=teleology.

[7] According to John Deely, the appropriate translation of this form of the word refers to natural signs, "a phenomenon of physical nature, such as the connection of smoke with fire or symptoms with disease." John Deely, "The 'Semiotics': Formation and Origins," *Semiotica* 146 (2003): 5.
John Locke, *An Essay Concerning Humane Understanding*, (London: Tho Basset, 1690), 361, *EEBO*. http://gateway.proquest.com/openurl?ctx_ver=Z39.88-2003&res_id=xri:eebo&rft_id=xri:eebo:citation:12746521.

[8] See Simon Goulart, *Admirable and Memorable Histoires Containing the Wonders of our Time,* trans. Edward Grimeston (London: George Eld, 1607), *EEBO*. http://gateway.proquest.com/openurl?ctx_ver=Z39.88-2003&res_id=xri:eebo&rft_id=xri:eebo:citation:99839112.

understood—even more so in hindsight—it was often necessary to consult someone who spoke the language of the stars in order to translate portents. Similarly, the language of the body was understood on a basic level by most, but a physician could read the signs in such a way as to prescribe cures.

There is surprising little written as general overview of the meaning of signs in nature in Shakespeare, and this is perhaps for good reason.[9] Skepticism's shadow makes it difficult to determine the extent to which the signifiers of previous generations were still being recognized. It also seems that the opposite may be true, that this language of meaning was so deeply understood that few early modern writers felt the need to define it explicitly. For example, Simon Goulart's *Thresor d'histoires admirables et memorables de nostre temps* (Paris, 1600), which was translated into English by Edward Grimeston in 1607, provides a catalog of strange events ranging from earthquakes to an instance of a "tooth of gold in the mouth of a child of Silesia."[10] On initial reading, the events are delivered almost clinically. Goulart does not explicitly state, for example, that earthquakes were caused by God's wrath because of man's wickedness. However, as Peter Platt points out, Goulart's seemingly offhand comments regarding those events implicate supernatural forces. Platt writes, "In incident after incident, place after place, the hand of God is seen in operation throughout the natural world", such as rain or clouds signifying "The forerunners of the judgements of God."[11] Keir Elam's "'Understand Me by my Signs': On Shakespeare's Semiotics," which deals primarily with three of Shakespeare's comedies, contains an interesting observation about early modern semiotics:

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[9] For work on sign-reading in the era, though not tied to Shakespeare, see Ian Maclean, *Logic, Signs and Nature in the Renaissance* (Cambridge: Cambridge University Press: 2007) and Alexandra Walsham, *Providence in Early Modern England* (Oxford: Oxford University Press, 1999).

[10] Goulart, *Admirable and Memorable Histoires*, 183.

[11] Peter Platt, *Wonders, Marvels, and Monsters in Early Modern Culture* (Cranbury: Associated University Presses: 1999), 177.

> There is thus no single area of intellectual or cultural endeavor in the Elizabethan period that is not radically marked by controversy, and at times outright conflict, as to the nature of signs and symbols and their signifying capacity … One can, then, simply define the late Renaissance crisis of the signs as a clash between two fundamental semiotic and specifically semantic models: namely, the model of a fixed, motivated 'natural' sign belonging to a vertical and hierarchical world order, against the model of an unstable, arbitrary, and man-created conventional sign belonging to a horizontal world order.[12]

As a result of the difficulty in pinpointing exactly how much of Shakespeare's audience would have believed in the signs in the natural world, I am going to have to make a few generalizations and assumptions in the following analysis of specific plays, most importantly that Shakespeare's audience, though perhaps made up of skeptics and believers alike, would have been familiar with the supposed meanings behind popular signs.[13] Considering there is no indication that Shakespeare would have had any special training in prognostication, we can reasonably conclude that his use of signifiers would have been indicative of the average level of semiotic understanding of his audience.

Prognostication falls into a gray area between science and religion, logic and superstition. At what point does interpreting a change in wind direction shift from memory recall of cultural signifiers to an occult practice? What is the difference between John Dee, Queen Elizabeth's official philosopher, and the cunning man in the local village who reads a person's personality by

[12] Keir Elam, "'Understand Me by my Signs': on Shakespeare's Semiotics," *New Theatre Quarterly* 1 (1985): 87.

[13] This is backed up, to some extent, by the existence of such texts as Goularts *Thresor*.

the position of stars at his birth? These are some of the questions the rest of this chapter will pursue.

Reading the Stars

In an order of prayer distributed by Queen Elizabeth at the encouragement of Dee in 1580 she describes the earthquakes and civil wars which took place throughout Europe in previous years, suggesting these incidents occurred because God's wrath was stirred against those peoples. She reminds her people that England has also encountered God's wrath, and that "we have signs and tokens now at home, if we can use them for our benefit."[14] She enumerates famine, earthquakes, eclipses, comets, an "unmeasurable abundance of snow," and other extraordinary occurrences as proof of God's "sore displeasure for sin."[15] While Elizabeth's official employment of Dee would seem to indicate support of his brand of prognostication, in fact late-sixteenth-century England was far from welcoming of judicial astrology, and by the reign of James I it would be outlawed, though still practiced in quiet around the country.[16] For more general inquiries relating to health and agriculture, an almanac could take the place of an astrologer while maintaining a distance between the patron and the act of reading the signs.

Both natural and judicial astrology dealt in prophecy and prediction. Natural astrology looked at the effect of the celestial bodies on the natural world, specifically weather and living things. To today's readers, natural astrology would seem the most "scientific" of the two. As Moriz Sondheim defined it, natural astrology was "the scientific explanation of atmospheric and

[14] William Keatinge Clay and Parker Society. *Liturgical Services: Liturgies and Occasional Forms of Prayer Set Forth in the Reign of Queen Elizabeth* (Cambridge: Cambridge University Press: 1847): 569.
[15] Ibid., 570.
[16] Warren D. Smith, "The Elizabethan Rejection of Judicial Astrology and Shakespeare's Practice," *Shakespeare Quarterly* 9, no. 2 (1958): 159-176.

terrestrial phenomena, which it attributed to non-terrestrial influences. It was no more a superstition than Aristotle's four elements, or the system of Ptolemy."[17] This view of the cosmos is mechanistic, and treats the movements of the planets much like the workings of a clock or musical instrument; one movement produces another movement. With an understanding of cause and effect, one could predict future events based on these movements. Just as Hamlet predicted the result of the performance of The Mousetrap, which I will discuss in detail in the final chapter, natural astrologers could read the signs in the stars to forecast weather, crop production, or the general health of a society.

The process of forecasting was labor-intensive; it was not simply a matter of gazing at the night sky or a star map and drawing conclusions. Simon Forman, an early modern physician whose casebooks detail his interactions with thousands of patients during his career, incorporated astrology into his medical practice. His casebooks reveal a standard process he used to discover the cause of his patients' maladies: after inquiring the name of the afflicted person and the age, he would draw an astrological figure, which consisted of the twelve signs of the zodiac and the positions of planets, moon, and sun. Lauren Kassell details how Forman interpreted the resulting figure, with each house aligning with a part of the body or with a relationship. After interpreting the figure, he would decide an appropriate remedy.[18] This distinct process of inquiry, calculation, and conclusion was also used by Dee and other astrologers, which contradicts Cumberland Clark's assertion that "To call astrology a science is really a misnomer, for it possessed no fixed principles and was unable to offer convincing demonstrations of its claims."[19] While it's possible

[17] Moriz Sondheim, "Shakespeare and the Astrology of His Time," *Journal of the Warburg Institute* 2, no. 3 (1939): 245.

[18] Lauren Kassell, *Medicine and Magic in Elizabethan London: Simon Forman: Astrologer, Alchemist, and Physician* (Oxford: Oxford University Press, 2005), 123.

[19] Cumberland Clark, *Shakespeare and Science* (Honolulu: University Press of the Pacific, 2005), 37.

that the majority of claims made by astrologists were never proven to be true, this should not overshadow the fact that the casting of figures and the reading of horoscopes was very much a calculated and detailed endeavor. It must also be considered that for those astrological readings which resulted in negative forecasts, it is likely the customer or patient would take action to avoid the outcome if possible. Many forecasts were general or took such a long view that it was nearly impossible to "offer convincing demonstration of its claims," which Clark asserts is a criterion for the art to be considered a science.[20] But the early modern astrologer did not claim to have specific and immediate answers to any question put to him. He could not query the universe, and the process was not a dialogue (though it must be noted that Dee claimed to converse with angels). Rather, he could read what was available and form reasonable conclusions.

Judicial astrology took prediction into the realm of the private life. Practitioners claimed that the movement of the heavens could indicate humans would act certain ways, or feel certain emotions. There was some uncertainty about causality, however. It was unclear if the movement of the stars caused these events to come about, or if they were merely indicative of a general series of movements that would lead to the events. And how this integrated with the notion of an almighty God wasn't always clear. Were people really free to act as they wanted, or was their destiny determined by the alignment of planets at their birth? One of the glaring questions Shakespeare's *Macbeth* raises deals with this: does Macbeth's hearing of the weird sisters' prophecy cause the chain of events which bring about the prophesied result?[21]

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[20] Ibid.

[21] There seems to have been a rise in inquiry into Shakespearean astrology during the 1920s and 1930s, likely due to a revival of spiritualism at that time. In the past decade there have been few valuable additions to the conversation, which I attribute to a general oversaturation of discussion of the occult in Shakespeare (particularly regarding feminism and witchcraft). Lauren Kassell, Deborah Harkness, and others have instead focused on astrology, prognostication, and other crossovers between the supernatural and science in the early modern era in general, and more specifically in relation to key figures like John Dee and Simon Forman.

The early modern man's understanding of the movement of these influential celestial markers became more defined with Galileo's 1609 use of a telescope to examine the night sky, revealing that there were more celestial bodies than previously believed. This discovery also pointed to the fallibility of the eyes, much as skeptics questioned the senses previously. *Cymbeline*, *The Winter's Tale*, and *The Tempest* post-date Galileo's first recorded use of the telescope, and all three of these plays reflect a preoccupation with the stars and the movements of celestial bodies, though in distinct forms. *Cymbeline* personifies the planets as the Roman gods for which they are named; *The Winter's Tale* looks at the movement of the stars as the passage of time, as well as portents of ill-will; the protagonist in *The Tempest* is a magus whose knowledge of the universe gives him the ability to manipulate it.

Though Shakespeare's characters refer to celestial bodies both in colloquial expressions and in reference to specific astrological omens, he does not go so far as to claim that what is written in the stars is absolute. His emphasis is always on the actions of man, though these actions may be in response to what they have interpreted from the heavens. As Cassius says in *Julius Caesar,* "Men at sometime were masters of their fates./ The fault, dear Brutus, is not in our stars,/ But in ourselves, that we are underlings" (1.1.140-2). Later, Casca points to recent, strange occurrences and claims that they are portents of the evil about to be committed against Caesar, and Cicero dismisses his fears, saying that "men may construe things after their fashion,/

No consensus has been reached about the extent to which judicial astrology was accepted in early modern England. Warren Smith vehemently rejected what he believed to be the "injudicious assumptions" among critics of his period that judicial astrology was embraced during the early modern era, asserting that they put too much stock in Queen Elizabeth's relationship with John Dee: "The tendency to overemphasize the association of Elizabeth with Dee, I suspect, is partly due to its really being the only available evidence in support of her acceptance of judicial astrology." Smith makes a valid point; aside from the occasional gesture toward the idea that the realms of heaven and earth are connected in some way, we have no extant records of Elizabeth claiming particular affinity for judicial astrology. Warren D. Smith, "The Elizabethan Rejection of Judicial Astrology and Shakespeare's Practice," *Shakespeare Quarterly* 9, no. 2 (1958): 159-176.

Clean from the purpose of the things themselves" (1.3.34-35). Is this a jab at judicial astrology in Shakespeare's world?

In 1572 a supernova appeared in the Cassiopeia constellation and continued to burn for over a year. Danish astronomer Tycho Brahe took note, and later published a thorough analysis of the celestial event, *Learned: Tico Brahae, his Astronomicall coniectur of the new and much admired star which appered in the year 1572*. In his analysis, he notes that many of his readers would expect him to comment on the "Physicall and Prognosticall explanation of this Starre," but that he preferred not to venture into the realm of "conjecturall probabilitie" as it had no basis in "Mathematicall Principles."[22] He does relent a few pages later, and clarifies that it is not so much the prognostication itself which he opposes, but rather when it is done in haste or without enough study. "We ought not to imagine that God and Nature doth vainely mocke us, with such new formed bodies, which doe presage nothing to the world," he writes.[23] His philosophy is that miraculous occurrences like the 1572 supernova did have meaning and effect in the lives of humans, but that it was impossible to know what that was.

Shakespeare was only a child when the supernova appeared, but it is likely he would have been aware of this significant celestial event, which was written about across Europe and which lasted for such a length of time. However, when Shakespeare references stars he rarely interprets them as foretelling specific events; rather, the stars are either metaphors for people who stand out, constancy (as in the North Star), or in reference to the astral nativity of a character (such as being born under a dancing star, as Beatrice says she was in *Much Ado About Nothing*). *Hamlet* contains the most uses of the word "star," with six, followed by *All's Well that Ends Well* at four.

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[22] Tycho Brahe, *Learned: Tico Brahae his Astronomicall Coniectur of the New and Much Admired [star] which Appered in theYear 1572* (London: BA and TF, 1632) 8. *EEBO*, http://gateway.proquest.com/openurl?ctx_ver=Z39.88-2003&res_id=xri:eebo&rft_id=xri:eebo:citation:22142171.

[23] Ibid., 13.

Shakespeare refers to stars in comedies, tragedies, and histories, as well as the sonnets, but in only one work is an astrological prediction made which comes to fruition: in *Henry VI, part 2*, Suffolk discusses the prophecy made of his death in Act 4, scene 1. Generalities abound, as in *Troilus and Cressida*:

> … When the planets
>
> In evil mixture to disorder wander,
>
> What plagues and what portents, what mutiny?
>
> What raging of the sea, shaking of earth? (1.3.94-97).

Here, an unfortunate aligning of the planets is connected to catastrophic terrestrial occurrences, such as disease or earthquakes. The Earl of Kent in *The History of King Lear* takes a similar view: "It is the stars,/ The stars above us govern our conditions" (4.3.33-34).[24] Romeo and Juliet are "star-crossed" (prologue, line 6); Benedick was "not born under a rhyming planet" (5.2.39); an "ill planet reigns" (2.1.107) in *The Winter's Tale*; Imogen claims that if an astronomer knew the planets as she knows Posthumas, he would be able to "lay the future open" (3.2.29). Clearly the stars are characters in these stories, albeit in minor, supporting roles.

Reading the Earth

The early modern man was not restricted to looking only heavenward to uncover the invisible operations of the universe. Just as the activity in the skies signified possible future events or explanations of past occurrences, so too the terrestrial environment was believed to reflect the actions and future consequences of mankind's movements—sometimes with more specificity or

[24] 1608 quarto text, from *The Oxford Shakespeare: Complete Works*, ed. Stanley Wells and Gary Taylor (Oxford: Clarendon Press, 2005).

accuracy than astral projection, and often with greater accessibility. Visiting an astrologer was a luxury, and not something a laborer or member of the lower classes would have been able to afford. As it was such a complicated process requiring a specific knowledge it was not something he could do for himself beyond consulting an almanac. However, possession of an almanac required literacy and expense, though these books were very popular in spite of their cost, and "could fit nearly everyone's needs and budget" in some form: "one-page broadside or a more lavish volume with a multiyear format and diagrams of the human body."[25] But even if one was able to obtain an almanac, the interpretation and use of the book required discernment as well.

But reading the signs closer to home required nothing more than a cultural awareness. One may not understand the significance of the prominence of a particular house of the zodiac at one's birth, but one likely knew that substantial winds meant that disease and plague would be cleared away for some time. No figures needed to be drawn, and no calculations made. Astrological prognostication may have been more mysterious, controversial, and political, but natural prognostication was more consistent and widespread.

The early modern humanist movement espoused a reinvestigation of ancient Greek philosophy (which the later skepticism would often renounce or re-invent). Aristotle's *Meteorologica* saw a renewed popularity in the sixteenth century across Europe. His work claimed that weather and nature were made up of the four elements, and that meteorological activity was caused by the imbalance or mixture of these elements—a view very similar to Galenic medicine and humoralism, which were based on ancient Greek philosophies. As Craig Martin explains it,

[25] Deborah Harkness, *The Jewel House: Elizabethan London and the Scientific Revolution* (New Haven: Yale University Press, 2007), 105.

> Aristotelian meteorology, as opposed to astro-meteorology, was primarily causal in its goals, not predictive. For Aristotle, knowledge of the causes of many meteorological subjects was based not on syllogistic deduction but was the result of interpreting signs that helped to confirm the hypothesis that meterological phenomena result from two exhalations that circulate in the sublunary region.[26]

William Fulke, early modern mathematician and astronomer, wrote a handbook for reading meteorological signs, referencing Aristotle in the text and specifically the four elements in the title: *A goodly gallerye with a most pleasaunt prospect, into the garden of naturall contemplation, to behold the natural causes of all kynde of meteors, as well fyery and ayery, as watry and earthy* (1563). He writes about the mixture of elements which cause meteorological events, then breaks down the specific events by element: when discussing fire, he defines meteors and other blazing nighttime occurrences, "fyre Drakes," and many types of fires (such as candles or lightning); air-related occurrences are winds, earthquakes, or thunder; the water section discusses rainbows, lakes, rivers, and rain; and he ends by enumerating many metals, like quicksilver and gold. For each of these, he describes what it is, what it is made of, and how it interacts with other elements, and if there is any consequence of the occurrence.[27] For example, thunder is caused by a "whote and dry Exhalation" in the sky, and is common in summer because it is so much hotter at that time of year. The thickness of the clouds determines the sound of the

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[26] Craig Martin, "Conjecture, Probabilism, and Provisional Knowledge in Renaissance Meteorology," *Early Science and Medicine* 14 (2009): 268.

Fulke defines exhalations as "smokes that be hoat and drie, whiche because they be thinne, & lygther then vapors, passe the lowest and middle region of the ayre, and are carried vp euen to the highest region." William Fulke, *A Goodly Gallerye with a Most Pleasaunt Prospect* (London: William Griffith, 1563), 2, *EEBO*, http://gateway.proquest.com/openurl?ctx_ver=Z39.88-2003&res_id=xri:eebo&rft_id=xri:eebo:citation:99838455.

[27] This is another instance of a type of cataloging, or attempt at defining the natural world.

thunder. Thunder is a good thing, as it brings rain and also "for that it purgeth and purifieth the ayre by the swift mouvinge of the Exhalation."[28]

Shakespearean ecocriticism, or the analysis of nature in Shakespeare, touches on weather, green spaces, animals, monsters (like Caliban), and even colonization. The majority of publications of this type of analysis have occurred since the late 1990s, perhaps in response to global warming and climate change conversations developing at that time. In fact, a basic search for the word "ecocriticism" in conjunction with "Shakespeare" reveals no results at University of Birmingham prior to 1998, and the *OED* shows no use of the word prior to the 1980s. Most of the published ecocritical analysis of Shakespeare deals with nature as a political or economical player, or even goes so far as to ask, "Can reading, writing about, and teaching Shakespeare contribute to the health of the planet?"[29] Few of these critics delve into issues of supernature or natural prognostication, except for Kristen Poole, whose focus is not so much ecocriticism as the supernatural environment around Shakespeare's characters.[30] While Poole's work aligns with this study insomuch as it looks at general beliefs in the supernatural of the early modern era which are reflected in Shakespeare's works, and even noting emerging mathematics and sciences like geography and physics, her focus is more on the three-dimensional space and space/time as it relates to the supernatural realm, whereas I am interested in looking at the abstract ideas of science and the supernatural.

The rest of this chapter will focus on specific examples of natural prognostication, or reading signs in nature to determine future events or consequences of human actions. Most of

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[28] Fulke, *A Goodly Gallerye*, 25.

[29] Lynne Dickson Bruckner and Daniel Brayton, eds., *Ecocritical Shakespeare* (Surrey: Ashgate Publishing, 2011), 2.

[30] Kristen Poole, *Supernatural Environments in Shakespeare's England* (Cambridge: Cambridge University Press, 2011).

these signs could have been translated by the common Elizabethan playgoer with a basic cultural awareness, while others are dependent on context for meaning. But in all cases, it is clear that no special scientific skill is needed to read nature, beyond perhaps a familiarity with an almanac or the general concept of what would be contained therein.

Foul Days

For an example of the perceived connection between supernatural forces and nature, one need look no further than the first scene in *Macbeth*. The Weird Sisters are concluding their gathering and, to the sounds of thunder and lightning written in the stage directions, they plot their next meeting:

> FIRST WITCH: When shall we three meet again?
>
> In thunder, lightning, or in rain?
>
> SECOND WITCH: When the hurly-burly's done,
>
> When the battle's lost and won.
>
> THIRD WITCH: That will be ere the set of sun.
>
> FIRST WITCH: Where the place?
>
> SECOND WITCH: Upon the heath. (1.1.1-7)

This short exchange not only introduces the witches' parliamentary procedures, but also ties their activities to natural events: a time, a circumstance, and a place. They only meet in extreme weather (at least, those are the only options presented in this exchange), and the wording of the first two lines is ambiguous as to whether the witches actually cause the weather for their gatherings. It's possible the First Witch is asking which occurrence the others prefer to be brought about rather than inquiring which occurrence they will have to wait for to cue their next

meeting. The Third Witch notes the time of their next meeting in relation to a celestial body, the sun. And the Second Witch pinpoints the location: the heath, an inhospitable, natural space. They conclude their discussion with the famous contradiction which will define much of the rest of the play: "Fair is foul, and foul is fair,/ Hover through the fog and filthy air" (10-11). Not only does this comment on the quality of the atmosphere reflect the conflict to come, but it defines the thick air as a transportation vessel for these acquaintances of the devil.[31]

Just a dozen lines later, the Captain mentions the "multiplying villainies of nature" (1.2.11) that allowed Macdonald's army to stand strong against Duncan's for so long. The witches' conversation in such proximity to this bleeds through, and suggests that Macdonald's short-lived good fortune is a result of the same evil forces at work in the foul weather. Indeed, the change in weather is what aids in his downfall, causing the "shipwrecking storms and direful thunders" (1.2.26) that halted the assistance he was getting from his allies. The curtain is pulled back further, revealing the witches at the controls in scene three, when they meet again and discuss how they will use the winds to do their mischief. They then name themselves "posters of the sea and land" (1.3.31), suggesting ownership of the natural world, an idea repeated later when Macbeth marvels at their disappearance: "into the air, and what seemed corporal/ Melted as breath into the wind" (1.3.79-80).

This setup connecting the weather to occult practices comes into play in Act 2, when Lennox comments on the weather the night of Duncan's death, complaining that it had been "unruly," suggesting misbehavior, and that "chimneys were blown down … lamentings heard i'th' air" (2.3.53-55), signs the audience would be connecting to the murder though Lennox does

[31] James I's *Daemonologie* addresses the question of witches flying to their secret gatherings, explaining they can be carried on the wind short distances, the length of time they can hold their breath. *Daemonologie in Forme of a Dialogue, Diuided into Three Bookes* (Edinburgh: Robert Walegrave: 1597), 39. *EEBO*, http://gateway.proquest.com/openurl?ctx_ver=Z39.88-2003&res_id=xri:eebo&rft_id=xri:eebo:citation:99843273.

not yet know of it. In the next scene, Ross says that his father "seest the heavens, as troubled with man's act" (2.4.5). Just before Banquo's death, he notes, "It will be rain tonight" (3.3.16). The weather in all of these comments denotes a bridge between evil deeds and natural manifestations of them. Lady Macbeth calls on the "dunnest smoke of hell" (1.5.50) to shroud the night, hoping a dense fog will hide her actions. Most illustrative of the belief that the witches controlled the winds is Macbeth's later plea to them for more information about his fate, even if it means they will

> …untie the winds and let them fight
> Against the churches, though the yeasty waves
> Confound and swallow navigation up,
> Though bladed corn be lodged and trees blown down,
> Though castles topple on their warders' heads,
> Though palaces and pyramids do slope
> Their heads to their foundations, though the treasure
> Of nature's germens tumble all together
> Even till destruction sicken. (4.1.68-76)

It is no great stretch to see the parallel between the repeated image of structures of hierarchy and status being physically toppled by the actions of the witches and the destruction of Macbeth's own realm by his own actions. Here, Macbeth has accepted that the witches can cause atmospheric disturbances; it is a wonder that when the witches tell him that he "shall never vanquished be until/ Great Birnaum Wood to high Dunsinane Hill/ Shall come against him" (108-110), his immediate response is disbelief that nature could ever behave in such a way. Accepting that witches can command the air and sea is easy; that trees can move, less so.

However, he directly contradicts this belief in Act 3, when he says, "Stones have been known to move, and trees to speak" (3.2.122) in order to reveal a man's crimes. Here, Allan Park Paton believed Shakespeare was referring to the *clacha breath*, stones which Druid priests used to test a person's innocence.[32] The priests would have the accused touch one of the *clacha breath*, and if it moved then it proved the person was innocent. The stone would not move if touched by a guilty person, even if he attempted to do so with great force.[33] It has been claimed that the trees to which Macbeth is referring are from *Aenied*, in which the trees reveal the murder of Polydorus.[34] Macbeth claims these unnatural—or supernatural—occurrences, along with the interpretation of certain bird cries ("maggot-pies and choughs and rooks" (3.4.124)) can all be interpreted by auguries, which will then reveal the truths of evil deeds. Here again we see the reference to authority to interpret the language of nature.

Reading signs in weather is just one layer of foreshadowing in *Macbeth*; it seems that all of nature is responding to the evil deed. Lady Macbeth hints at this when she speaks—perhaps figuratively—of the raven who "croaks the fatal entrance of Duncan" (1.5.38). Ravens are mentioned in many of Shakespeare's plays, and were commonly known to be an omen of death. Morris Palmer Tilley's extensive *A Dictionary of the Proverbs in England in the Sixteenth and Seventeenth Centuries* defines the croaking raven as boding misfortune, parenthetically death, and he points to Shakespeare as well as Marlowe, Nashe, and several other writers of the early

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[32] Allan Park Paton, "Notes on *Macbeth*," *Notes and Queries* Vol 4-IV, Issue 97 (6 November 1869): 384-385.

The Scots Magazine and Edinburgh Literary Miscellany for July 1814 points out that this Gaelic spelling is problematic, using a plural for "stones" where there should be a singular, but I have maintained Paton's conjugation as part of the general citation of his idea. Paton believes Shakespeare traveled to Scotland, and would thereby learned this lore as there was a *clacha breath* by Glamis Castle.

[33] Paton believes Shakespeare traveled to Scotland, and would thereby learned this lore as there was a *clacha breath* by Glamis Castle.

[34] For example, Albert S. Cook, "Trees and Stones as Informers," *The Journal of English and Germanic Philology* 5, no 2 (1903): 183-185.

modern era who use the raven for this connotation.[35] Othello speaks of the raven crying over a plagued house, and in The Mousetrap, Hamlet prompts the player with the line "the croaking raven doth bellow for revenge" (3.2.241). Lady Macbeth's comment about the sound of the raven brings in an auditory element to what had until that point been only visual cues about supernature. She is more preoccupied with the sounds of the animals than Macbeth, commenting in Act 2, scene 2, "It was the owl that shrieked, that fatal bellman/ Which gives the stern'st good-night" (2.2.3-4), and then just a dozen lines later repeats, "I heard the owl scream and the crickets cry" (2.2.15).

Simon Forman saw the play at the Globe in 1610, and noted that "there were many prodigies seen that night and the day before" the murder of King Duncan, picking up on the natural signs that Shakespeare included, though the latter never used the word "prodigy" or any variation in this particular play.[36] Other "prodigies" include Ross's observation that the aviary world had been disrupted. "A falcon, tow'ring in her pride of place,/ Was by a mousing owl hawked at and killed" (2.4.13). Lennox notes that "the obscure bird [the owl]/ Clamoured the livelong night," which he interprets as a prophecy of the "woeful time" (2.4.58-59). Even the well-bred and obedient king's horses rebel "as they would/ Make war with mankind" (2.4.17-18) and then eat each other, a similitude of the actions of Macbeth within the king's ranks.

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[35] Morris Palmer Tilley, *The Proverbs in England in the Sixteenth and Seventeenth Centuries* (Ann Arbor: University of Michigan Press, 1950), 566.

[36] Modernized/Translated transcription from *Shakespeare Documented*, which also includes the digitized images of the Bodleian's holding of Simon Forman, *The Bocke of Plaies and Notes therof per Forman for Common Pollicie*, 1611 (MS Ashmole 208, fol. 200-207v), http://www.shakespearedocumented.org/file/ms-ashmole-208-folio-207-recto.

Ingrid Benecke notes that there is discrepancy about dating of the play and some controversy surrounding authorship of the journal: Ingrid Benecke; "The Shorter Stage Version of Shakespeare's *Macbeth* as Seen through Simon Forman's Eyes," *Notes and Queries* 61, Issue 2 (2014): 246–253.

Lauren Kassell, who has worked extensively with his casebooks, quotes from Ashmole 208 in *Medicine and Magic in Elizabethan England*.

The predominant philosophy behind the characters' preoccupation with all these abnormal occurrences is summed up in Act 5 by the doctor who, after witnessing Lady Macbeth's tortured sleepwalking, says, "Unnatural deeds/ Do breed unnatural troubles" (5.1.68-69). Until this point none of the characters has vocalized succinctly the idea that anyone but the witches have any control over natural phenomena. However, the characters do not shy away from referring to nature and its influence on humans. The word nature is used 23 times in *Macbeth*, a higher frequency than any other play. Some usages of the word are in reference to a person's character, specifically mercy or what we today would call "good nature." Lady Macbeth hopes that she is able to maintain her cruelty and have no "visitings of nature", which would compel her to change her mind about the murder (1.5.44). Malcom talks of a "virtuous nature" being unable to withstand the rigors of "an imperial charge" (4.3.20). Macduff claims that "boundless intemperance/ In nature is a tyranny" (4.3.68-69).

But the majority of the uses of the word refer to the world at large and how it operates, the mechanical function of the surrounding environment, and the rules that govern all living things and cause them to act or react in specific ways. In reference to Lady Macbeth's sleepwalking, the doctor calls it a "great perturbation in nature" (5.1.8). She is doing something natural—sleeping—in an unnatural way. Duncan's cannibalistic horses were "Turn'd wild in nature" (2.4.16). The night of Duncan's murder, "nature seems dead" because it is shrouded in darkness (2.1.50). The stab wounds in Duncan's body are "a breach in nature" (2.3.113). All of these signs indicate something is working "'Gainst nature," as Ross explains (2.4.27).

This phrase, "against nature," contains two very significant subtexts. First is the notion that nature is supposed to act a certain way.[37] Boyle, Newton, Descartes, and others would later refine this idea with laws of motion and laws of nature, but the seed of this thought was already taking root in Shakespeare's time and even before, with the Copernican theory that redefined the machine of the solar system. It was not uncommon to think of the world as a musical instrument or a clock, something that had many components all working in concert with each other.[38] In *Macbeth*, the machine begins to break, starting with a day that is both fair and foul, and ending with a forest uprooting and relocating.

The second major concept hidden in the two-word phrase "against nature" is that it is possible for someone or something to cause the breakdown of the natural machine. In other words, the machine is malfunctioning because of a calculated effort to force it into actions incongruous with its normal function. The witches have already proven themselves masters of the air and water, and their relationship with familiars would suggest they can also control animals. But in spite of their powers it is not the actions of the Weird Sisters that are to blame for the disruption of the natural order, but rather Macbeth. Though the sisters predicted Macbeth's rise to power, and shared that with him, it is his actions in service of that prediction that murders sleep and causes the natural world to revolt. The fair and foul day on which the play opens is not only an atmospheric setting, but representative of the choice Macbeth will face. Will he choose his pride, which leads to foul days? Or will he choose the proper natural order, which condemns regicide and leads to fair days?

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[37] For a recent study of natural law and its connection—both symbolically and legally—to society's laws see Lorraine Daston, *Natural Law and Laws of Nature in Early Modern Europe: Jurisprudence, Theology, Moral and Natural Philosophy* (New York: Routledge, 2016).

[38] Joscelyn Godwin, *Music, Magic, and Mysticism: A Sourcebook* (London: Arkana, 1987).

In such a defined world, where the Great Chain of Being dictated a person's place among all living creatures and within the social hierarchy, the murder of a monarch or a parent was greatly disruptive.[39] Irving Ribner, in looking at *Macbeth* as a parallel of the fall of Satan, writes that ambition beyond one's place would necessarily mean that man "must break the bond which ties him on the one hand to God and on the other to humanity."[40] When Macbeth says

> Come, seeling night,
> Scarf up the tender eye of pitiful day,
> And with thy bloody and invisible hand
> Cancel and tear to pieces that great bone
> Which keeps me pale (3.3.47-51)

Ribner claims Macbeth is referring to the bond which situates him in his spot in the Great Chain of Being. By breaking that bond, he is able to rise to the level of king; he has also disrupted the strata of all living things around him, and the ripple effect of that action can only be calmed when Macbeth is dead. Macbeth says earlier in this same scene "let the frame of things disjoint" (3.3.18), a reference to the unseen construction of the natural world being dismantled.

A necessary element of making accurate predictions is to understand the rules governing the world, and what types of consequences can be brought about by the bending or breaking of these rules. When Macbeth commands the stars to "hide your fires,/ Let not light see my black and deep desires" (1.4.50-51), he is afraid not only of the task he must perform, but also of the possibility that his actions will be revealed to others through the reading of the stars. Such a

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[39] There is some debate about the extent to which the philosophy was truly embraced in the early modern era. Arthur Lovejoy's work on the Great Chain of Being is especially influential, and was challenged by William F. Bynum years later. See Arthur O. Lovejoy, *The Great Chain of Being: A Study of the History of an Idea* (Cambridge, Mass: Harvard University Press, 1936) and William F. Bynum, "The Great Chain of Being after Forty Years: An Appraisal," *History of Science* 13 (1975): 1-28.

[40] Irving Ribner, "Macbeth: The Pattern of an Idea and Action," *Shakespeare Quarterly* 10, no 2 (1959): 149.

heinous act must surely have echoes in the celestial world, he reasons. It is unclear who he thinks will read such a thing, though, as the Weird Sisters seem to be the only ones who engage in any sort of prognostication. Banquo calls them oracles (3.1.9), and Macbeth calls them prophets (3.1.60). But his actions would surely come as no surprise to them since they foretold the events.

A similar disruption of the natural order occurs in *King Lear*, and has comparable reverberations in the natural world. Starting with Cordelia's unexpected performance in the love test in Act 1, the social structure begins to spin onto its head. The king becomes like a peasant, the daughter who is most deserving is cast out, the father becomes the needy child, the legitimate heir becomes the disfavored son, the fool speaks truth, and the man who sees the evil in others is blinded.[41]

When Lear asks, "What is the cause of thunder?" (3.4.145), the early modern audience might have answered that he had caused the thunder. The disruption of the natural order—brought about by his own love test—had broken down the natural world around him, and allowed chaos to reign. In this, *Lear* and *Macbeth* have much in common. When the natural order is corrupted, by Macbeth killing Duncan or Lear giving his kingdom to Regan and Goneril, nature rebels.

Yet this is not to say that the characters in *Lear* accept the storm for such an omen. Indeed, Lear includes many elements of humanism and early modern skepticism, which points to the fact that although the story may take place in some pagan pre-Britannia, the philosophical

[41] Charles Nicholl asserts that the motif of the alchemical wheel, a process of inversion and re-stabilization, is at play in *Lear*. He writes, "The Wheel becomes, in Shakespeare's hands, a process of spiritual growth. Its message for the characters is that in order to attain knowledge and love, they must first travel through negation and no love." Nicholl claims Shakespeare and his contemporaries would have been very familiar with the alchemical process, by reputation if not by experience, and likely would have felt an alchemical motif would have been universally recognized. Charles Nicholl, *The Chemical Theatre* (New York: Routledge, 1980), 145.

theories of the early modern era color how the characters perceive their world.[42] Benjamin Bertram defines Edmund's paganism as a form of skepticism, writing,

> A Jacobean audience would have immediately recognized a dangerous religious skepticism in Gloucester's son Edmund. Even in a pagan context, his naturalism marks him as a threat to fundamental Christian beliefs. In his first soliloquy, Edmund tells us that he serves the goddess Nature and that he is not bound by morality of any kind, since there is no Christian "natural law" or God-given, universal moral structure guiding human behavior.[43]

Taking this idea further, though perhaps an earlier audience may have linked the storm to the power of God, it seems plausible that the appropriate interpretation is that the storm is simply the result of a fundamental law of nature. It is not so much supernatural as it is natural. And, if nature is abiding by predetermined laws, then they are ostensibly something that can be learned and perhaps mastered or manipulated. Thus it becomes crucial to see the world as it is, something that many of the main characters in *Lear* fail to do. Bertram explains, "If vision cannot accurately grasp the nature of objects in the external world, given the prevalence of illusions and simple mistakes, it follows that our capacity for reason is extremely limited."[44] This calls into question Lear's failure to comprehend his daughters' true feelings, and Gloucester's inability to see his sons' motivations, a failure later symbolized when his eyes are plucked out.

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[42] Jonathan Dollimore refutes the claim that Lear is humanist, asserting that the lack of positive outcome disproves a truly humanist interpretation. However, I would argue that a "happy ending" is not necessary for a story to fall under the umbrella of humanism, and indeed it is this lack of a positive catharsis in Lear that illustrates that man is truly on his own. Jonathan Dollimore, *Radical Tragedy: Religion, Ideology, and Power in the Drama of Shakespeare and his Contemporaries* (Durham: Duke University Press, 1984).

Gwilym Jones writes, "Contained in the notion of the heath is the attractive paradox that the further Lear recedes from civilization and companionship, the more he understands his humanity and that of others." Gwilym Jones, *Shakespeare's Storms* (Manchester: Manchester University Press, 2016), 68-69.

[43] Benjamin Bertram, *The Time Is out of Joint: Skepticism in Shakespeare's England* (Newark: University of Delaware Press, 2004), 142 fn.

[44] Ibid., 156

The Fool, in social status the lowest of the characters, is the truth-teller and the women who rule the realm are the deceivers, and few have the sight to recognize either for what they truly are.

Early on, Lear connects his paternal role to the natural world and its supernatural roots. When Cordelia refuses to participate in his love test, he cuts her off by swearing to

> The sacred radiance of the sun,
>
> The mysteries of Hecate and the night
>
> By all the operation of the orbs
>
> For whom we do exist and cease to be (1.1.109-12).

Here, Lear claims the sun is tied to God and goodness and the night to evil, and that the workings of the celestial bodies are responsible for mankind's survival. Cordelia's supposed dishonor of her father (as he sees it) makes her "a wretch whom nature is ashamed/ Almost t'acknowledge hers" (1.1.211-12). The upset of this family unit is an insult to nature itself.

In a parallel family drama, Gloucester looks to nature for signs of what the future holds:

> These late eclipses in the sun and moon portend no good to us. Though the wisdom of Nature can reason it thus and thus, yet nature finds itself scourged by the sequent effects ... This villain of mine comes under the prediction: there's son against father. The King falls from bias of nature: there's father against child. (1.2.101-110)

Again, the actions of the heavens signify the actions of mankind, in this case the eclipsing of the sun and moon for the eclipsing of the father by the child. But the younger generation—the generation doing the eclipsing—does not hold the same views. Edmund claims this mentality is the "foppery of the world" (1.2.116), and takes away any blame or choice from mankind because they are merely acted upon.

> We make guilty of our disasters the sun, the moon, and stars, as if we were villains on necessity, fools by heavenly compulsion, knaves, thieves, and treachers by spherical predominance, drunkards, liars, and adulterers by an enforced obedience of planetary influence, and all that we are evil in by a divine thrusting on. (1.2.118-124)

Edmund believes that placing the blame on the stars is a happy distraction, which hides the true, villainous nature of man. He disdains not only the broad notion of one being fated to act a certain way, but specifically derides judicial astronomy, sarcastically crying, “My father compounded with my mother under the Dragon’s tail and my nativity was under Ursa Major, so that it follows I am rough and lecherous” (1.2.126-8). He elsewhere negates this, proclaiming that he would be just as evil “had the maidenliest star in the firmament twinkled on my bastardizing” (1.1.130).

Edmund plays on his father's beliefs in Act 2, when he lies about Edgar’s intentions to murder Gloucester. He hints that Edgar had been dealing with witchcraft (“wicked charms, conjuring the moon” (2.1.38)) and then pretends to espouse his father's beliefs in natural law and the idea that “the revenging gods/ ‘Gainst parricides did all their thunders bend” (2.1.44-45). Though Edmund is not in earnest, the storm in Act 2 would suggest otherwise. It begins just as Lear has learned that Regan and Goneril have turned against him, an unnatural act to his mind (he calls them “unnatural hags” (2.2.452)), and he has declared that he will have revenge for his mistreatment. The storm lasts for several scenes, underscoring the rupture of the family unit and ceases only when Lear is able to see beyond his pain to the pain of another, Edgar. Lear even seems to be commanding the storm in Act 3, scene 2:

> Blow, winds, and crack your cheeks! Rage, blow,

> You cataracts and hurricanoes, spout
> Till you have drenched our steeples, drowned the cocks!
> You sulph'rous and thought-executing fires,
> Vaunt-couriers of oak-cleaving thunderbolts,
> Singe my white head; and thou all-shaking thunder,
> Strike flat the thick rotundity o' th' world,
> Crack nature's moulds, all germens spill at once
> That makes ingrateful man. (3.2.1-9)

Though the storm is mentioned by many characters, Lear's interaction with it acts as the crescendo. Whether or not the various elements of the storm are depicted on the stage, his reference to the hurricane-level winds, flood waters, lightning and consequent structural blazes and destroyed trees, and thunder so loud it shakes the earth create an apocalyptic image. Lear attributes the storm to the elements, and later to the gods, but many members of an early modern audience would have likely seen causality between his personal tragedy and the raging storm.

Shakespeare implements the storm motif in *Julius Caesar* as well, again in relation to the disturbance of the natural order and as a foretelling of the fate of the king, a sequence that begins much as *Macbeth* does: with a prophecy. When the soothsayer bids Caesar to "beware the ides of March" (1.2.19), Caesar brushes him off as a "dreamer." The warning is said three times in six lines, twice by the soothsayer and once by Brutus, so even among the pomp engulfing Caesar and his retinue, the repetition of the simple phrase reverberates with significance to the audience. Cassius plays the part of sceptic, voicing denial of prognostication and destiny. When he tells Brutus that the fault "is not in our stars,/ But in ourselves, that we are underlings," he rejects the notion of judicial astrology, likening it to superstition (1.2.141-142). "Conjure with 'em:/

'Brutus' will start a spirit as soon as 'Caesar,'" he claims (1.2.147-148). When Caesar later comments that Cassius "thinks too much," "reads much," and "is a great observer," the implication is that learning has forced any belief in higher power from his mind. Where *Macbeth* shows a world in which everyone believes in omens, signs, and prognostication, *Julius Caesar* is a world in which people doubt these signs in spite of the evidence of their veracity.

In another parallel with *Macbeth*, the storm occurs at night and keeps the main characters from a restful sleep. As the senators plot the overthrow of Caesar, the sky is filled with thunder and lightning, and Casca remarks of the unusual severity of the storm:

> Are you not moved, when all the sway of earth
> Shakes like a thing unfirm? O Cicero,
> I have seen tempests when the scolding winds
> Have rived the knotty oaks, and I have seen
> The'ambitious ocean swell and rage and roam
> To be exalted with the threat'ning clouds;
> But never till tonight, never till now,
> Did I go through a tempest dropping fire.
> Either there is a civil strife in heaven,
> Or else the world, too saucy with the gods,
> Incenses them to send destruction. (1.3.3-13)

In *Macbeth*, written seven years after *Julius Caesar*, Shakespeare mirrors this account of a storm with a description given by Lennox about the storm the night of Duncan's murder, again a signifier of evil deeds performed. Though in *Macbeth* the characters do not doubt that the strange meteorological occurrences are connected to man's actions, in *Julius Caesar* there are

two voices of skepticism. Cicero points out that though the weather is odd, it is easy for people to misinterpret it based on their emotions and insecurities. “Men may construe things after their fashion,/ Clean from the purpose of the things themselves,” (1.3.34-35) he says in response. Cassius is more vehement in his rejection of prognostication, claiming to walk about the thunder and lightning bare-chested, in defiance, and assured in the knowledge that the earth is “full of faults,” the storm being one of them (1.3.45).

But the omens go beyond the weather, and bring to mind Goulart’s *Thresor*, mentioned at the start of this chapter. Casca enumerates them: a slave’s hand erupted into flames and was left without a mark, a lion walked right by Casca, men on fire paraded down the streets, and the “bird of night” (1.2.26) shrieked in the town at noon. [45] Cinna confirms that “there’s two or three of us have seen strange sights” (1.3.137). In spite of these accounts, Cassius stands firm in his skepticism, and just as Caesar read the danger in Cassius’s calculating mind, Cassius recognizes Caesar’s belief in the supernatural as something to be worked around. He says Caesar is

> …superstitious grown of late,
> Quite from the main opinion he held once
> Of fantasy, of dreams and ceremonies.
> It may be these apparent prodigies
> The unaccustomed terror of this night,
> And the persuasion of his augurers,
> May hold him from the Capitol today (2.1.195-201).

[45] Philemon Holland’s translation of Pliny’s *Natural History* indicates this phrase refers to the owl, whose screeching (as mentioned in reference to *Macbeth*) was an omen of ill. “The night birds haue also crooked tallons, as the Owles, Scritch-Owle, & Howlets. All these see but badly in the day time. The Scritch-Owle alwaies betokeneth some heauie newes and is most execrable and accursed, and namely, in the presages of publick affaires” Pliny, *Pliny’s Natural History*, trans Phlemon Holland, Book 10 (London: George Barclay, 1847), 276.

Caesar and Calpurnia both, like Macbeth and Lady Macbeth, see supernatural elements in the events around them. Calpurnia adds to the list of strange occurrences mentioned by Casca that a lion gave birth in the city, corpses have risen from the earth, soldiers on fire have fought in the sky, blood fell from the sky onto the Capitol, and ghosts wailed in the streets. She believes that all these signify the downfall of Caesar, for "When beggars die there are no comets seen;/ [But] The heavens themselves blaze forth the death of princes" (2.2.30-31). Caesar uses Calpurnia's belief that these are "warnings and portents/ Of evils imminent" (2.2.80) as an excuse not to meet with the Senate, but his heart is turned when Decius is eloquently able to offer an alternative interpretation of the dreams and portents. Of course, as Caesar learns just minutes later, Calpurnia's reading of the signs was correct.

In all three of these plays, Shakespeare ties his characters to a destiny written in the world around them: the stars, the weather, and the animal kingdom. A reader may wonder if the inclusion of these elements is merely atmospheric, or if it brings something else more fundamental to these stories. John P. Beifuss argues that it is impossible to separate the supernature and the story in these instances.

> As Shakespeare develops, his heroes become more and more the masters of their fate—but fate is not forgotten; the order of the universe descends from the stars in their courses to become a vital part of the play, so embedded in the language, imagery, theme, and action that it cannot be removed without destroying the play.[46]

In *Julius Caesar* the characterization of Brutus and others is partly colored by the premeditation of the act of murder, which the soothsayer is able to identify in his reading of the natural world.

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[46] John P. Beifuss, "The Supernatural as a Tragic Dimension in Shakespeare's Tragedies," *Interpretations* 8, no. 1 (1976): 27.

This is not an act of passion, but a calculated coup, one which nature knows is coming and rebels against. In *King Lear* the storm is a physical manifestation of the turmoil Lear feels, but also illustrates the significance of the natural order and the magnitude of the schism created between father and child. Without it, Lear walks away from Regan but maintains much of his dignity. With it, he is humbled, beaten, and reborn. And in *Macbeth*, both of these ideas—the political overthrow and the upset of the natural order—are brought together with characters who not only recognize the signs around them, but also use them to inform their choices in a desperate bid to control their fates.

The characters in these plays do not always manage to read the signs in nature successfully, which is often what leads to the tragedy. Being able to identify and define the elements of the natural world and read signifiers in terrestrial and celestial movements arms Shakespeare's characters with the tools to move from the passive role of observer to the active role of scientist, where they can use this knowledge for hypothesizing and experimentation. Nowhere is this process more evident than in *Hamlet.*

PROOF

Annie Dorsen's *A Piece of Work* premiered in Seattle in 2013 and was an interpretation of *Hamlet* reconstructed into what the writer calls "algorithmic theater," a model that uses a computer to shuffle the play and reproduce it based on—in this instance—five criteria:

1. Excerpt five percent of the play by length, skipping through the scenes in order.
2. Sort lines of the play by chosen keyword, snaking through the play, finding repetitions and echoes.
3. Parse all the soliloquies, looking for grammatical structures. Replace nouns with other nouns and verbs with other verbs, group selections of the most-used grammatical phrases (determiner-adjective-noun, or preposition-determiner-verb)
4. Generate new scenes by re-sequencing words using Markov chaining…
5. Generate a new final scene (only using lines from Act 5, scene 2 of Hamlet) by resequencing letters using Markov chaining.[1]

The algorithm was re-run nightly, so that each performance was unique within the constructs of the algorithm. The chronology of the play stayed intact as did the major events, but the language varied. Acts 1, 2, 4, and 5 were performed by computer-generated voices or projected images, and Act 3 was performed by a live actor who was fed the lines through an ear piece, memorization being impossible as the Act was only constructed minutes prior. Dorsen's team tagged the text with emotional rankings and parts of speech so the algorithm could make syntactic decisions, and so the system could implement the appropriate lighting and music. But

[1] Annie Dorsen, "Talk about *A Piece of Work*: A Group Self-Interview," *TDR: The Drama Review* 59, no. 4 (2015): 133.

after that initial work of inputting the text and tagging, the computer produced the show nightly with minimal human intervention. Dorsen called this a "machine-made *Hamlet*," a nod to Heiner Müller's1986 *Hamletmachine,* a deconstructed *Hamlet* set in East Berlin which included a dumb show and projected scenes interjected into the action.

Just as Dorsen's algorithm shuffled lines and characters behind the scenes in the mind of the computer, Shakespeare's play opens with a transition and a shuffling of characters. The disorder in a country grappling with the death of its monarch, the installment of his successor, and preparations for defense against a possible invasion is manifest in Dorsen's work through the chaotic stitching together of the text, but in Shakespeare's play is manifest in small part in the late night activities of the castle's defense. It is time for the changing of the guard on the ramparts of Elsinore. Francisco is leaving his post, to be replaced by Barnardo. What would normally be a routine shift change, something of no consequence, is colored by the addition of Horatio and a discussion of an abnormality that has been observed in the otherwise smooth clockwork of the guard: the appearance of a ghost. In scene 4, Marcellus exclaims upon seeing the Ghost leave with Hamlet, "Something is rotten in the state of Denmark" (1.4.67). He is referring to this abnormality—the Ghost—and the ostensibly nefarious purpose to which it has beckoned Hamlet. The machine of Denmark's government has been disrupted with the appearance of this ghost. Hamlet refers to this disruption as a break, "The time is out of joint" (1.5.189), an idea that will continue to surface and be compounded as more pieces of the organism of the ruling class of Denmark become diseased and malfunction.

The appearance of the Ghost is the origin of two synergetic motifs which will work throughout the remainder of the play: mechanical science, or the process of piecing together machines and leveraging their consistent and measurable output toward a defined purpose, and

experimental science, or the process of testing hypotheses to determine a truth. In this chapter, I will demonstrate how the actions of the main characters in Hamlet are representative of these two branches of science as they were emerging in the early modern world, and that it is through the use of these modes of thinking that Shakespeare crafts his themes about revenge, fate, and ultimately the purpose of life itself.

I will highlight the steps in today's scientific method as I explore experimentation as means of determining truth within *Hamlet*: hypothesis, experiment, analysis. First, I will examine language and logic as characters use these tools to form hypotheses about their environment. Then I will look at the various ways the concept of the machine is presented and utilized by the characters. Finally, I will examine the various experiments the characters conduct using these "machines" and discuss the resulting truths that are revealed through those experiments.

Formulating the Hypothesis

Actions emerge from thought. Just as Dorsen's algorithmic theater required input and defined rules in order to run the process necessary to produce *A Piece of Work*, so, too, must the characters in *Hamlet* first engage in a defined cognitive process before they can take action (hypothesize and then experiment), starting with discernment, or coming to an understanding of the premise upon which action must be taken. In Act 1 we see this as Marcellus, Horatio, Barnardo, and Hamlet try to make sense of the appearance of the Ghost. They situate the appearance of the Ghost in time:

> When yon same star that's westward from the pole
> Had made his course t'illume that part of heaven
> Where now it burns, Marcellus and myself,

The bell then beating one— (1.1.34-37)

They question the Ghost to determine its motives:

If there be any good thing to be done

That may to thee do ease and grace to me,

Speak to me.

If thou art privy to thy country's fate

Which happily foreknowing may avoid,

O speak!

Or if thou hast uphoarded in thy life

Exhorted treasure in the womb of earth—

For which, they say, you spirits oft walk in death—

Speak of it, stay and speak. (1.1.111-120)

Hamlet asks for particulars of the visit, and the responses from the witnesses demonstrate the specificity with which the men mentally recorded the encounters:

HAMLET: Armed, say you?

MARCELLUS AND BARNARDO: Armed, my lord.

HAMLET: From top to toe?

MARCELLUS AND BARNARDO: My lord, from head to foot.

HAMLET: Then saw you not his face.

HORATIO: O yes, my lord, he wore his beaver up.

HAMLET: What looked he? Frowningly?

HORATIO: A countenance more

in sorrow than in anger.

HAMLET: Pale or red?

HORATIO: Nay, very pale.

HAMLET: And fixed his eyes upon you?

HORATIO: Most constantly.

HAMLET: I would I had been there.

HORATIO: It would have much amazed you.

HAMLET:

Very like, very like. Stayed it long?

HORATIO: While one with moderate haste might tell a hundred.

MARCELLUS AND BARNARDO: Longer, longer.

HORATIO: Not when I saw't.

HAMLET: His beard was grizzly, no?

HORATIO:

It was as I have seen it in his life,

A sable silvered. (1.2.225-241)

The text does not reveal if any of these men have prior experience with supernatural beings, but perhaps this fact alone is enough to assume not. Any firsthand knowledge of how to deal with a ghost would surely have been shared at this point as the men dissect what has occurred. Their knowledge of such a thing is academic, and thus the details become crucial as they piece together a new reality, one in which ghosts exist. Echoes of this paradigm shift occur with the audiences at *A Piece of Work*; elements of their experience are familiar, such as the theater space and the cultural history and awareness of *Hamlet*. However, as the algorithmic theater presents an

entirely different version of the play, they are forced to extract meaning from an altered "reality," a process that was not universally successful.

Critical response to *A Piece of Work* was mixed; one reviewer, noting how in Act 5 the algorithm removed grammar rules making for a sometimes incomprehensible text, wrote that this "coupled with the utter lack of humanity through four-fifths of the performance, led the audience from occasional discomfort and tittering, to confusion and, in my case, disappointment and a complete lack of interest."[2] The text had become too mechanical. Jim Findlay, the video designer for *A Piece of Work*, explained that the moment when the play becomes "garbled into unintelligibility" is when the machines (the terms "machines" and "algorithms" were used sometimes interchangeably in this conversation) "are just doing it for themselves…They've stopped making sense for us, and now they're making sense for themselves."[3] The algorithms do not have emotions or memory, and so their language can be difficult for humans to interpret. Dorsen says, "They don't know what grief is, or revenge, or an entrance, or an exit. They make decision after decision, over and over, generating a nonstop flow of effects without causes, and causes without effects."[4] Levy's experience was that audience members were forced to abandon any meaning they had brought with them from their previous interactions with the play and instead had to discern and recreate meaning from the "meaning-free machination of a computer."[5] Rather than passive spectating, the audience had to perform mental acrobatics to follow the performance. Each word, color, lighting cue, and sound became significant, an element that when placed with the others could create meaning.

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[2] Jemma Alix Levy, "*A Piece of Work*: A Machine-Made Hamlet by Annie Dorsen by 2013 Next Wave Festival (review)," *Shakespeare Bulletin* 32, no. 3 (2014): 508.

[3] Dorsen, "Talk about *A Piece of Work*," 135.

[4] Ibid.

[5] Levy, "*A Piece of Work*," 509.

So, too, do Hamlet, Horatio, Marcellus, and Barnardo attempt to create meaning from even the smallest detail of the Ghost's visit. A certain amount of scrutiny of such an event would presumably be common for any observer, but the laser-like focus with which these men—especially Hamlet—attempt to dissect what they have witnessed speaks to a deeper need for truth and proof. Certainly Hamlet is emotionally invested in the Ghost's visit, but he has also made a point in the previous scene that he has distanced himself from falseness. He says,

> Seems, madam? Nay, it *is*. I know not 'seems'…
>
> For they are actions that a man might play;
>
> But I have that within which passeth show—
>
> These but the trappings and the suits of woe. (1.2.76, 84-86)

Seeming, acting, and trickery will become a motif throughout the play, something Hamlet will use against others and which will be used against him. He navigates through doubt as he seeks truth and meaning, and this manifests in his inability to trust his senses, his friends (all except Horatio), his religious beliefs, his mother, and his lover.

Hamlet's skepticism is indicative of the general philosophical shift toward a questioning attitude in the early modern era. Millicent Bell's *Shakespeare's Tragic Skepticism* outlines the skeptical attitudes that permeate his texts. She claims that Shakespeare "put contrary views into combat to test their strength," to reflect the "doubt of the human capacity to perceive life truly."[6] This doubt permeates *Hamlet* and is voiced by several characters. With King Hamlet's death, Hamlet is left wondering if anything he knew is as he believed, or if his surroundings are nothing

[6] Millicent Bell, *Shakespeare's Tragic Skepticism* (New Haven: Yale University Press, 2002), 10.
Benjamin Bertram also places this judgment process in the realm of skepticism: "In his third soliloquy—"To be or not to be"--Hamlet borrows a move from classical skepticism, 'equipollence,' weighing two opposing possibilities and suspending judgment." Benjamin Bertram, *The Time is Out of Joint: Skepticism in Shakespeare's England* (Newark: University of Delaware, 2004), 14.

but "seeming" reality. Those who see the Ghost wonder if they can believe their eyes. Horatio says, "I might not this believe/ Without the sensible and true avouch/ Of mine eyes (1.1.54-56). Hamlet doubts the Ghost's claims when he wonders if the spirit "may be the devil" (2.2.601).[7] Ophelia doubts Hamlet's sanity; when Polonius asks if Hamlet is "mad for [her] love," she replies, "Truly I do fear it" (2.2.87), and then later exclaims over Hamlet's actions, "O what a noble mind is here o'erthrown" (3.1.153). Hamlet doubts Ophelia's love for him, as evidenced in Act 3 when he compares her change of heart to the actions of all two-faced women. Polonius doubts Laertes's honor, and has him spied upon in France. Hamlet doubts his ability to express his feelings when the players seem to convey emotion better than he can. Upon hearing the player's monologue, he laments that he is "a dull and muddy-mettled rascal" who "lack[s] gall" (2.2.569, 578). He also doubts Rosencrantz and Guildenstern's motives almost from the moment they arrive, questioning them about why they have come until they finally concede that they were sent for. Hamlet never questions Horatio, though, which speaks to the constancy of their relationship amidst the chaos of Hamlet's life.

Though Hamlet claims in Act 1 to only see and feel what is real ("I know not seems" (1.2.76)), he later comes to doubt the veracity of his surroundings. Mark Caldwell analyzes Shakespeare's use of the senses in *Hamlet,* pointing out that it has the greatest frequency of sense words of all of Shakespeare's works, and that a twentieth-century audience may not appreciate the distrust associated with the senses in the early modern era. He explains that though our modern definitions would point to the senses as "transparent lenses" which relay information to the mind, Elizabethans would have distrusted the senses as their primary function was to

[7] See David Bevington, *Shakespeare's Ideas: More Things in Heaven and Earth* (London: Blackwell, 2008) for discussion of Laertes as empiricist.

interpret reality—and that interpretation could be faulty.[8] Thus it becomes necessary for the characters, especially Hamlet, to create a method by which they can learn the truth amidst the lies. They begin to experiment on their surroundings, and the first step in these experiments is the creation of a hypothesis and a statement of purpose. The most significant of these is provided by the Ghost in Act 1: "If thou didst ever thy dear father love … Revenge his foul and most unnatural murder" (1.5.23-25). It is this statement that drives the rest of Hamlet's actions, and it is loaded with significance as it is an example of the linguistic and philosophical dichotomy that will permeate Hamlet's thoughts and ultimately fuel his inaction. The if/then statement which will come to be part of the hypothesis phase of experimental science is married to the call on the heart. Simple though the command may be, it pulls at the two opposing forces at work in Hamlet's mind: the workings of the scientific philosopher/scholar, and the workings of the emotional son. It is the struggle of the early modern skeptic, who even struggles with interpreting simple statements like this from the Ghost. In order for Hamlet to act, he must first decipher what is truth, then form a hypothesis. But the layers of meaning and falsity make that difficult. Language, meaning, and logic are all connected and the ways Hamlet questions the words that surround him before he is able to form his own conclusions are indicative of these connections.

The skeptic is primarily concerned with discovering truth beneath the layers of (perhaps faulty) sensory stimuli and otherwise unquestioned social paradigms. This includes language. Philip Sidney's "In Defence of Poesy," published in 1595, only a few years before *Hamlet* appeared in the Stationers' Register in 1602,[9] is an argument for the superiority and necessity of

[8] Mark Caldwell, "Hamlet and the Senses," *Modern Language Quarterly* 40, no. 2 (1979): 135-54. See also John D. Cox: "Shakespeare's skepticism is anything but a straightforward drowning in unbelief." John D. Cox, *Seeming Knowledge: Shakespeare and Skeptical Faith* (Waco: Baylor University Press, 2007), 2.

[9] William Shakespeare, *The Oxford Shakespeare: The Complete Works*, ed. Stanley Wells ed. (Oxford: Clarendon Press, 2005), 681.

poetic language in conveying truth through metaphor. Sidney was writing in response to Stephen Gosson, whose 1579 *School of Abuse* in part blamed theater and poetry for the downfall of English society. Gosson claimed the English's preoccupation with

> banqueting playing, pipyng, and dauncing, and all suche delightes as may win vs to pleasure, or rocke vs a sleepe. Oh what a woonderfull chaunge is this? Our wreastling at armes, is turned to wallowyng in Ladies laps, our courage, to cowardice, our running to ryot, our Bowes into Bolles, and our Dartes to Dishes. We haue robbed *Greece* of Gluttonie, *Italy* of wantonnesse, *Spaine* of pride, *Fraunce* of deceite, and *Dutchland* of quaffing. Compare *London* to *Rome,* & *England* to *Italy,* you shall finde the Theaters of the one, the abuses of the other, to be rife among vs.[10]

Sidney's scathing retort lays out the fundamental difference between those who believe that "the planet-like music of poetry" can reveal truth (as Sidney did), and those who believed it hid the truth under layers of language.[11] Hamlet's search for the reality under deceptions at the Danish court might be summed up in his exchange with Polonius in Act 2, scene 2 when his seemingly nonsensical responses to Polonius are actually hiding deeper truths. His explanation that he reads "Words, words, words" (2.2.195) speaks not only to the interactions he is forced to have, but also to the lack of substance in those interactions. He reads words, but they mean nothing; he hears words, but they are lies. Sidney explains the shortcomings of the "earth-creeping mind" of the

[10] Stephen Gosson, *The Schoole of Abuse, Conteining a Plesant Inuective against Poets, Pipers, Plaiers, Iesters and such like* (London: Thomas Woodcocke: 1579), 16. *EEBO*, http://gateway.proquest.com/openurl?ctx_ver=Z39.88-2003&res_id=xri:eebo&rft_id=xri:eebo:citation:99899035.

[11] Philip Sidney, *The Defense of Poesy: Otherwise Known as An Apology of Poetry* (London: William Ponsonby, 1595), 37. *EEBO.* http://gateway.proquest.com/openurl?ctx_ver=Z39.88-2003&res_id=xri:eebo&rft_id=xri:eebo:citation:99854412.

philosopher and the historian, and claims the poet is the only one who can enlighten because he speaks truth and is understandable:

> For the philosopher, setting down with thorny arguments the bare rule, is so hard of utterance and so misty to be conceived, that one that hath no other guide but him shall wade in him till he be old, before he shall find sufficient cause to be honest. Now doth the peerless poet perform both… A perfect picture, I say; for he yieldeth to the powers of the mind an image of that whereof the philosopher bestoweth but a wordish description, which doth neither strike, pierce, nor possess the sight of the soul so much as that other doth.[12]

Two centuries before Sidney, Petrarch was claiming a correlation between one's use of words and one's moral well-being. John S. Mebane writes, "Rhetoric—at the center of humanistic education—was valued as a tool of moral and political persuasion; Petrarch asserted that harmonious words expressed the essence of a harmonious soul, and oratory thus uplifted and refined the personality."[13] Hamlet's interactions with the players reflect his appreciation for what he believes is a perfect melding of straightforward language and emotional oratory. He requests a speech from a play that, though not popular, was

> …set down with as much modesty as cunning. I remember one said there was no sallets in the lines to make the matter savoury, nor no matter in the phrase that might indict the author of affectation, but called it an honest method, as wholesome as sweet, and by very much more handsome than fine. (2.2.443-448)

[12] Philip Sidney, *The Defense of Poesy*, 15.

[13] John S. Mebane, *Renaissance Magic and the Return of the Golden Age* (Lincoln: University of Nebraska Press, 1989), 9.

With no "sallets" (seasonings or embellishments), the play found honesty or truth, which Hamlet prized above ornament. And yet, he later marvels at the façade the players project in the "dream of passion" (2.2.554) when they recite the speech and how they are able to convey performed emotion with such eloquence and seeming truth.[14] They recreate, in the controlled environment of the stage, emotions in their audience.

This effect was present outside the realm of players as well. Demonology and witchcraft were bound by rhetorical patterns, and the way in which one spoke of a thing could mimic the act itself, which became especially significant when discussing the supernatural in the late sixteenth century. Stuart Clark writes,

> Close analogies existed between the logical and rhetorical structures for expressing demonology and the (alleged) behaviour of witches. Like the humanist historians studied by Nancy Struever, writers on witchcraft assumed that the forms of their arguments were also the forms of the events they described … Presented as a natural and unchanging truth, demonism became so dependent on particular linguistic strategies—particularly, binary oppositions—that it came to be seen as the product, rather than the subject-matter, of its own language. What was implicit in its formation became explicit, with damaging implications for its credibility.[15]

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[14] Hamlet's marveling at the players' realistic portrayal of grief is ironic considering his own outward manifestation of grief is the topic of the first scene in which he appears. Claudius asks, "How is it that the clouds still hang on you?" (1.2.66), and Gertrude follows with a comment on his "nightly colour" (68), referencing his mourning clothes and his sorrowful demeanor. Clearly Hamlet has been communicating his grief effectively until that point. Claudius and Gertrude's insistence that he stop grieving, coupled with the edict from the Ghost that Hamlet take action, forces him to hide his grief. Thus another interpretation of Hamlet's 2.2 soliloquy is not that Hamlet is incapable of projecting his grief with the effectiveness of the player, but rather that he is not allowed to do so.

[15] Stuart Clark, *Thinking with Demons: The Idea of Witchcraft in Early Modern Europe* (Oxford: Clarendon, 1997), 10.

But beyond the purported association with the occult, poetic language was beginning to be cast aside by those who simply believed it was clouding the truth, as represented by Hamlet's request for no sallets. Ryan Stark points out that "To be rhetorically plain in the experimental sense was to be epistemologically sound, religiously levelheaded (i.e. non-superstitious), and ontologically enlightened, and moreover to have all of those other qualities that signaled an unruffled refinement that mystics and sorcerers could never achieve."[16] Juliet Cummins and David Burchell add that "the relationships between words and things, the named and the unnamed, topics of argument and 'matters of fact,' were starting points for the new ways of presenting and understanding knowledge, and affected the development of both the arts and the sciences."[17] As late as 1667, the Royal Society's resident scribe Thomas Sprat wrote, "eloquence ought to be banish'd out of all civil Societies as a thing fatal to Peace and good manners."[18] However, in *Advancement of Learning* (1605) Francis Bacon was arguing that it is impossible to separate meaning and rhetoric.[19]

Regardless of the reception or its perceived effectiveness, there was emerging during Shakespeare's life a new and very defined "scientific" mode of speech, evidence of which can be found in the casebooks of the likes of Simon Forman,[20] Sidney's argument against it in *In Defense of Poesy,* and Bacon's *Advancement of Learning,* where he writes, "So there is none of

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[16] Ryan Stark, *Rhetoric, Science, and Magic in Seventeenth-Century England* (Washington D.C.: Catholic University Press of America, 2009), 9.

[17] Juliet Cummins and David Burchell, *Science, Literature, and Rhetoric in Early Modern England* (Burlington: Ashgate, 2007), 2.

[18] Thomas Spratt, *The History of the Royal Society of London for the improving of natural knowledge* (London: J. Martyn, 1667), 112. *EEBO*, http://gateway.proquest.com/openurl?ctx_ver=Z39.88-2003&res_id=xri:eebo&rft_id=xri:eebo:citation:13362760

[19] Of Bacon's philosophy in *Advancement of Learning,* Diana B. Altegoer writes, "The link between word and thing will always be provisional and arbitrary, sustained by an artificial collusion between authorizing agents and knowing users." Diana B. Altegoer, *Reckoning Words: Baconian Science and the Construction of Truth in English Renaissance Culture* (Madison: Fairleigh Dickinson University Press, 2000), 101.

[20] For more on Forman, see the introduction. Forman's papers can be accessed through The Casebooks Project at University of Cambridge: http://www.magicandmedicine.hps.cam.ac.uk/

Hercules followers in learning, that is, the more seuere, and laborious sort of Enquirers into truth, but will despise those delicacies and affectations, as indeede capable of no diuinesse."[21]

Aside from the absence of figurative language—or the very sparing use of it—this rhetoric also consisted of antithetical statements, syllogisms, and if/then (conditional) statements, such as the one issued by the Ghost and several other characters, and an overarching interrogative or skeptical tone. R.W. Serjeanston contrasts the rhetoric of *scientia* with that of other sciences this way:

> The techniques of rhetorical persuasion – including circumstantial arguments directed to specific audiences, figures of speech, and the appeal to trusted authorities – were considered particularly appropriate for the practical, human sciences of history and moral philosophy. In contrast, within the theoretical science of university natural philosophy – and sometimes, for polemical purposes, outside it – the use of rhetoric and argument from authority tended to be frowned upon in favor of formally correct syllogisms, unadorned arguments, and universal rather than particular conclusions. The reason for this was that, from the Aristotelian perspective, which remained institutionally dominant throughout the sixteenth century and in some places retained its dominance throughout the seventeenth century as well, natural philosophy was considered a science

[21] Frances Bacon, *The Tvvoo Bookes of Francis Bacon. Of the Proficience and Aduancement of Learning, Diuine and Humane To the King* (London: Thomas Purfoot and Thomas Creede, 1605), 18. *EEBO,* http://gateway.proquest.com/openurl?ctx_ver=Z39.88-2003&res_id=xri:eebo&rft_id=xri:eebo:citation:468826195.

Jennifer Richards' work on honesty in early modern conversation is an appropriate tangential study here, and discusses the early modern emphasis on honesty in one's courtly conversation and relationships. Jennifer Richards, *Rhetoric and Courtliness in Early Modern Literature* (Cambridge: Cambridge University Press, 2003).

> (*scientia*); that is, a body of knowledge potentially capable of certain demonstration.[22]

Both of these modes of rhetoric are present in *Hamlet*, illustrating the existential struggle of the main character as he sorts through his various emotions and motivations. At times, he is poetic; at times, philosophical; at times, logical. But he rarely maintains one mode for long, flitting between them—sometimes within the same speech. It is as if he is seeking truth in either medium, hoping one will deliver.

This first soliloquy is abundant with figurative language, which indicates that at this stage of the play Hamlet has not made a transition to more scientific thinking. He compares the world to an "unweeded garden that grows to seed," (1.2.136), his mother's love for his father as an organism whose appetite grows "by what it [feeds] on" (1.2.145); he wishes his body would melt away. And yet couched within these metaphors and allusions are abrupt references to time, which seem by contrast cold and inexorable. He mentions that it was but a month since his father's death when his mother remarried, "a little month" (1.2.147), with "wicked speed" (1.2.156). His diction slides between the divine poetic ("the winds of heaven" (142)) and, in a later scene, the mundane ("weary," "stale," "flat," "unprofitable," "rank," "gross," "reason" (1.1.133-150)). He is trapped between the ideal of his father's memory and the reality of his present circumstances. He is also lodged between the eloquence of the poet—comparing his father to Claudius as "Hyperion to a satyr" (1.2.140) and "no more like my father/ Than I to Hercules" (1.2.152-153); his mother in her grief is like Niobe, weeping after the loss of her husband—and the plainness of the scientist, much like the humanist looks at both the classical

[22] R. W. Serjeanston, "Proof and Persuasion" in *The Cambridge History of Science, eds.* Katharine Park and Lorraine Daston (Cambridge: Cambridge University Press, 2006), 137.

ideal and the stark present. Once he sees his father's ghost, however, his rhetoric shifts toward the scientific and philosophical.

This shift begins when he starts to reject this reliance on the classical in Act 2 when the players arrive, and he witnesses the First Player recite the monologue about Hecuba. This scene is generally regarded as a commentary on theatre and acting, but for the purposes of this analysis I am interested in how Hamlet's reaction to the players causes introspection and an evaluation of his senses and the function—or dysfunction—of his body and mind. Hamlet sees the false emotion behind the moving performance. Hamlet seems to reject the entire notion of the utility of poetry, perhaps in direct argument against Sidney, when he tears apart the player's performance as untrue—though quite persuasive. To Hamlet's mind, the player's words—poetic though they may be—do not bring the audience closer to truth, but farther from it. He knows true loss, and also knows that it does not appear in the form or words the player utilized.

A comparison of the player's recitation in 2.2.471-521 and Hamlet's nearly immediately following soliloquy in lines 552-590 is a revealing example of the two forms of rhetoric. The player's lines are filled with instances of figurative language, such as personification ("his antique sword,/ Rebellious to his arm" (471-772), "with a hideous crash/ Takes prisoner Pyrrhus' ear" (479-480), "the bold winds speechless" (488), allusion ("And never did the Cyclops' hammers fall/ On Mars his armour, forged for proof eterne,/ With less remorse than Phyrrhus' bleeding sword/ Now falls on Priam" (495-492)), and apostrophe ("Out, out, thou strumpet, Fortune!" (496)). Hamlet's soliloquy is by contrast plain and interrogative. He asks ten questions in the fifty lines, and recalls events from the recent past in list form:

> Is it not monstrous that this player here,
>
> But in a fiction, in a dream of passion,

> Could force his soul so to his whole conceit
> That from her working all his visage wanned,
> Tears in his eyes, distraction in 's aspect,
> A broken voice, and his whole function suiting
> With forms to his conceit? (2.2.553-559)

The natural philosopher also emerges in his discourse with Polonius, a mask Hamlet wears to hide his true motivations. His lecture on old men (2.2) is one such example, but he also remarks on the shapes of (nonexistent) clouds, and on the natural order. It is in Act 2, scene 2, just before he engages the players to enact The Murder of Gonzago, that his speech takes a definite turn toward scientific, particularly when he remarks to Rosencrantz and Guildenstern that he does not see the purpose of the workings of the world. His description of the world reads like an inventory of parts:

> This most excellent canopy the air, look you, this brave o'erhanging, this majestical roof fretted with golden fire—why, it appears no other thing to me than a foul and pestilent congregation of vapours. What a piece of work is man! How noble in reason, how infinite in faculty, in form and moving how express and admirable, in action how like an angel, in apprehension how like a god—the beauty of the world, the paragon of animals! (2.2.300-309)

In this selection Hamlet catalogs the components of his world and mankind: the sky, the air, the brain, man's movements, his feelings, his demeanor. Hamlet adds these things and calculates that the world is nothing but a "stale promontory" from which he gains no delight. These descriptions again show the dichotomy in Hamlet's thoughts between the poet, who used to see a "roof fretted with golden fire" when he looked at the sky, and the scientist, who sees a mechanism made of

component parts (or the natural philosopher, who sees the anatomy of the world). This idea emerges later when he compares himself to a recorder being operated by those around him who conspire against him.

This shift in perspective may explain some of Hamlet's depression later; he may perceive himself merely as a machine—like a recorder—and as such his inability to act would mean he is defective or malfunctioning. Quarto 2 includes the following lines in Act 4, scene 4, after Fortinbras departs. Hamlet ponders,

> What is a man
> If his chief good and market of his time
> Be but to sleep and feed?—a beast, no more.
> Sure, he that made us with such large discourse,
> Looking before and after, gave us not
> That capability and god-like reason
> To fust in us unused
> Why yet I live to say "This thing's to do",
> Sith I have cause, and will, and strength, and means,
> To do't. (24-35)

Again Hamlet questions the utility of mankind, particularly the synergy of the mind and the body. If humans are destined just to exist, to sleep and feed, then they are just beasts. But if there is a God with a purpose in mankind's creation, then surely it is in man's ability to reason that man's purpose exists. And, if mankind can reason, the correlating function is to take action based on that reasoning—or, in other words, to hypothesize and then experiment.

In the famous "To be, or not to be" soliloquy, Hamlet asks the same question in a different way: what is the purpose of living, if the majority of one's life is spent in pain? If the machine or instrument of the body is subject to only stress, isn't it better to put it out of commission? Aristotelian logic, as Christopher Crosbie explains it, would argue that value—even the value of life—is fluid, and can be defined by what it is not as much as what it is. After a brief mention of Elizabeth I's attempts to find the true value of currency amidst what had been rampant inflation, Crosbie relates that the value of abstract ideas such as virtue and courage could also be called into question. He writes, "Consistent across varying perspectives and concerns, the contested discourses of value shared a governing presupposition, however, that true value not only existed but also required deciphering."[23]

According to Crosbie, Aristotelian logic asserts that true value is found in the middle of two extremes, with allowances for context and circumstances.[24] Thus Hamlet's query "To be, or not to be" is a logical conundrum, for there is no mean between life and death. Hamlet's view of this may be skewed, though, having seen his father's ghost (alive in its own way) after the body had ceased living. However, Hamlet does not end his question after that one famous line, but then adds context and meaning to better approximate the value of life. While he acknowledges that there is value in death in the absence of the troubles of life, he is hesitant to accept death as the truly better option because it is the unknown, "undiscovered country." Life offers "heartache and the thousand natural shocks that flesh is heir to" (3.1.64-65),

> Th'oppressor's wrong, the proud man's contumely,
>
> The pangs of disprized love, the law's decay,

[23] Christopher Crosbie, "Fixing Moderation: *Titus Andronicus* and the Aristotelian Determination of Value," *Shakespeare Quarterly* 58, no. 2 (2007): 150.

[24] Ibid.

The insolence of office, and the spurns

That patient merit of the'unworthy takes (71-76),

but the uncertainty of the afterlife "puzzles the will/ And makes us rather bear those ills we have than to fly to others we know not of" (83-84). Just as Hamlet is unable to act to avenge his father's death, he is unable to bring about his own death because the unknown has made a coward of him ("Thus conscience does make cowards of us all" (85)). He knows there is some sort of supernatural realm, if he decides he can trust what he saw of his father's ghost, but he has no proof of the quality of that realm. And he cannot bring himself to kill Claudius when the opportunity presents itself because religion has taught him that the rules governing sin and redemption dictate that to kill a man during prayer would result in his automatic acceptance into heaven, a fate Hamlet does not wish to gift to his murderous uncle.

Thus Hamlet's inability to avenge his father's murder need not be seen purely as lack of will on Hamlet's part, but a result of the constriction of the rules of his society; in an effort to obey the rules and do the thing justly he cannot act until provided with adequate proof (which he will attempt to extract through hypothesis and experimentation), and when he finally is provided with such he cannot act because religious law forbids him. Doubt and certainty too are often juxtaposed in Hamlet's speech, as in his letter to Ophelia:

Doubt thou the stars are fire,

Doubt that the sun doth move,

Doubt truth to be a liar,

But never doubt I love. (2.2.116-119)

Here Hamlet calls into question the movement of the cosmos while declaring emotion the certainty.

Questioning is omnipresent; over the course of the play over a hundred questions are asked, with over half of them probing *how* something came about.[25] Sometimes these questions come in rapid-fire succession, as is the case in Act 1 when Hamlet is questioning Horatio, Barnardo, and Marcellus about the appearance of the Ghost. Polonius engages in a similar probing—albeit hypothetical—when he instructs Reynaldo to learn more about Laertes in Paris: "Enquire me first what Danskers are in Paris,/ And how, and who, what means, and where they keep,/ What company, at what expense" (2.1.7-9). Characters are frequently asking each other "How now?" or "How is it?" as they probe their surroundings and the senses of those around them. They are particularly interested in the motivations of others. In Act 1 Claudius and Gertrude are occupied with discovering why Hamlet "persever[s] in obstinate condolement" (1.2.93). In Act 2, they and Polonius try to understand "the cause of this effect—/ or rather say 'the cause of this *defect*',/ For this effect defective comes by cause" (2.2.102-104).

This exploratory process is also manifest in syllogistic language, or hypotheses—an if/then statement, the first of which is issued by the Ghost: "If thou didst ever thy dear father love…Revenge his foul and most unnatural murder" (1.5.23-25), or translated "If you loved me, then you would avenge my death." The command is both a test of Hamlet's love and a call for retribution. Hamlet seems to have no problem proving the first as he speaks with others about the god-like status his father held in Hamlet's life, but he cannot bring himself to the correlated action. A type of conditional is an assertion, which assumes that the "if" portion of the statement is true, and proceeds to the next action. The Ghost's statement is an assertion in this sense; he assumes Hamlet's love, and therefore assumes Hamlet will deliver on the conditional conclusion: revenge for King Hamlet's murder.

[25] I came to this statistic by searching uses of interrogative phrases in the play, then parsing them by the type of question being asked, and then looking further into those I classified as "how" questions.

Hamlet's hypothesizing starts out simple, with a conditional statement very like computer programmers use today. A basic concordance search reveals that *Hamlet* contains about 90 uses of the word "if," which equates to approximately one use every 340 words. *Othello*, a play which like *Hamlet* relies heavily on proof and experimentation, has a 1:234 frequency. *King Lear* has a 1:270 frequency. It is beyond the scope of this project to dissect each instance of "if" in every play to determine how it is being used, and if it is used in conjunction with a "then" statement. However, the frequency of usage mentioned above should provide a general idea of Shakespeare's penchant for pointing to theoreticals. For example, upon hearing of his father's appearance to Horatio, Hamlet muses on what he would do if the Ghost appeared again: "If it assume my noble father's person/ I'll speak to it though hell itself should gape/ And bid me hold my peace" (1.2.243-245). The hell mouth appeared in many of the era's plays, but most notably in Marlowe's *Doctor Faustus* (1592). The reference to hell brings attention to the trap door mechanism from which King Hamlet would appear, which draws an interesting connection between the physical machines associated with the stage, and the abstract machine of, say, the body and soul. Harold Jenkins notes that just ten lines later Hamlet does not question that the Ghost is his father's spirit, indicating that "there being no hallucination, it must be one of the other."[26] When the Ghost does appear in that condition, Hamlet speaks to it. The resulting conversation provides the hypotheses for the rest of his experiments, starting with his determination to put on an "antic disposition" (1.5.173) to hide his true motivations from his supposed-guilty uncle, that hypothesis being that the Ghost is indeed Hamlet's father's spirit, and that what he has said is true: Claudius killed King Hamlet. Everything Hamlet does thereafter is in direct response to this revelation.

[26] William Shakespeare, *Hamlet*, ed. Harold Jenkins (London: Thomson Learning, 1982), fn 196.

The pattern of syllogistic or conditional speech repeats throughout the play, reinforcing the feeling that characters do not trust their senses and/or do not have the knowledge about their surroundings that they require. Take this instance in Act 3, when Gertrude swears her loyalty to Hamlet: “Be though assured, if words be made of breath,/ And if breath of life, I have no life to breathe,/ What thou hast said to me” (3.4.181-183). The logic in this conditional statement is simple, and yet it is indicative of a mental process which occurs repeatedly in the play: premise, proposition, conclusion. Gertrude, having just been convinced of her error in allowing Claudius into her life and having accepted that Hamlet’s lunacy has been an act, agrees not to reveal his secret. The premise is the veracity of Hamlet’s accusations against Claudius, the proposition is Hamlet’s wish that she not continue in confidence with Claudius, and her conclusion is that she will not. Hamlet utilizes this logic in Act 5 when he converses with the grave diggers. Discussing the eventual decay of all living things, he says,

> Alexander died, Alexander was buried, Alexander returneth into dust, the dust is earth, of earth we make loam, and why of that loam whereto he was converted might they not stop a beer-barrel?
>
> Imperial Caesar, dead and turned to clay,
>
> Might stop a hole to keep the wind away. (5.1.204-207)

This logic diminishes the life of a great leader to the elements that remain once he is dead, an interesting syllogism considering a dead leader—whose body is decaying— was the instigator of the action of this play. But the logic here is very clear: all living things become dead things eventually, and their remains serve the purposes of the living. Hamlet uses a similarly deterministic logic later in Act 5: “If it be now, ’tis not to come. If it be not to come, it will be now. If it be not now, yet it will come” (5. 2. 166). Again, the conditional makes an appearance

here, this time in an echo of "to be or not to be," which is in itself a conditional: if I choose to live, then I do not choose to die; if I choose to die, then I do not choose to live.

The characters in Hamlet rely on rules to govern life and define life processes, their understanding of which is phrased in syllogisms and hypotheses. This is similar to establishing the conditions of an experiment in a laboratory today; the constants must be understood in order to better identify the variables, and the purpose of the experiment and its projected outcome is stated in a hypothesis. This is first mentioned in Act 1 when the men witnessing the Ghost's return turn to logic to interpret how and why the Ghost may be visiting. Marcellus and Barnardo charge Horatio to speak to the Ghost as Horatio is a scholar, which they believe makes him qualified for such a task, the insinuation being that Horatio's greater education would have provided him with the necessary skills and intelligence. They believe if they produce a scholar, then the Ghost will speak and be understood. Marcellus reminds the group that the time of year allows for spirits to walk abroad. The conditions are ripe:

> Some say that ever 'gainst that season comes
> Wherein our saviour's birth is celebrated
> The bird of dawning singeth all night long;
> And then, they say, no spirit can walk abroad,
> The nights are wholesome; then no planets strike,
> No fairy takes, nor witch hath power to charm,
> So hallowed and so gracious is the time. (1.1.139-145)

Skepticism is evident in Horatio's response, that he believes this only "in part" (1.1.146). The Ghost confirms that he is bound by supernatural laws, telling Hamlet that at a certain time he will be forced to return "to sulph'rous and tormenting flames" (1.5.3-4), and that he will remain in his

current state until “the foul crimes done in [his] days of nature are burnt and purged away” (1.5.13). Though Hamlet would undoubtedly wish to understand more the forces at work in control of his father’s spirit, the Ghost is not allowed to impart “the secrets of [his] prison-house” (1.5.14).

Just as the supernatural world is bound by laws, so too is the physical world. The clowns who dig Ophelia’s grave in Act 5 elucidate these rules for the audience, albeit in a roundabout fashion, defining in conditionals how to tell if someone has committed suicide (“If the man go to this water and drown himself, it is, will he nill he, he goes. Mark you that. But if the water come to him and drown him, he drowns not himself; argal he that is not guilty of his own death shortens not his own life” (5.1.16-20)); how long it takes for a body to decompose (“some eight year or nine year,” (162)); and how the status of a person determines his or her burial (“If this had not been a gentlewoman, she should have been buried out o’ Christian burial” (23-25)).

Hamlet is often preoccupied with natural philosophy and natural laws, sometimes using them as a distraction and other times as a means of solving the riddle of existence and purpose. When he is putting on an act of insanity in Act 2, scene 2, he hurls natural philosophy at Polonius as an insult and to seem aloof:

> Old men have grey beards, that their faces are wrinkled, their eyes purging thick amber, or plum-tree gum, and that they have a plentiful lack of wit, together with most weak hams. All which, sir, though I most powerfully and potently believe, yet I hold it not honesty to have it thus set down; for you yourself, sir should be old as I am—if, like a crab, you could go backward. (2.2.200-206)

As Polonius observes, though Hamlet’s language is nonsensical, “there is method in’t” (2.2.208).

One of the markers of revenge tragedy is the rejection—often un-meditated and as the result of the instinct toward revenge—of the rules that govern civil society. As Robert N. Watson puts it so succinctly, "Revengers are specialists in the tragic contradiction of shattering the most fundamental rules of civil behavior on behalf of fundamental justice."[27] Hamlet, Othello, Macbeth, and many other of Shakespeare's tragic heroes break social rules in the name of revenge. Hamlet interrupts, steers conversations to impolite topics, is vulgar, insults the king and queen (and pretty much everyone else as well), and in many stage interpretations becomes physically abusive to his mother and Ophelia.

Polonius is very aware of the rules governing the social world, and tries to impart this knowledge to Laertes in Act 1. Over nearly fifty lines, Polonius instructs his children on finances ("neither a borrower nor a lender be" (1.3.75)), friendships ("The friends thou hast…grapple them to thy soul" (1.3.62-63)), deportment ("be thou familiar but by no means vulgar" (1.3.61)), fashion ("Costly thy habit as thy purse can buy,/ But not expressed in fancy; rich not gaudy" (1.3.70)), and love ("Set your entreatments at a higher rate/ Than a command to parley"(1.3.122-123)). Societal rules seem to motivate most of his interactions, and he uses these rules as fuel for his charges against Hamlet, for Hamlet cannot seem to do any right in Polonius's eyes. Even the words Hamlet uses break with unwritten social laws. Polonius disapproves of Hamlet's use of the "ill phrase, a vile phrase, 'beautified'" in his letter to Ophelia, for example (2.2.11). For Polonius, the world operates under this social code, and when that is broken he does not know how to react, as evidenced by his floundering for the appropriate responses in his conversations with Hamlet, who uses this social inflexibility against him.

[27] Robert N. Watson, "Tragedy," in *Cambridge Companion to English Renaissance Drama*, eds. Robert N. Watson, A.R. Braunmuller, and Michael Hattaway (Cambridge: Cambridge University Press, 1990), 320.

In this broken Denmark where social codes are bent or discarded entirely, deceit is commonplace, and the senses prove fallible, Hamlet does have one reliable element. In the hypotheses Hamlet formulates based on the unknown variables of the provenance of the Ghost, his feelings about his mother, the seeming betrayal on the part of Ophelia, and the suspect motivations of Rosencrantz, Guildenstern, Polonius, and Claudius, he relies time and again on his one constant: Horatio. Hibbard writes, "Horatio is essentially a piece of the dramatic mechanism, a *Johannes fac totum* who will say or do whatever the plot requires of him, even to the extent of appearing from nowhere at a call from Hamlet (3.2.48). What remains constant in him is his fidelity to the Prince."[28] Hamlet declares that Horatio "is not passion's slave" (3.2.70), and this steadfastness is what allows Hamlet to rely on him. They also share a philosophical makeup; both are scholars, and presumably both have been versed in similar ideas about logic, reason, and emotion. Horatio is present in all the major moments of the play, from the initial appearance of the Ghost until the ultimate destruction of Denmark in Act 5. He is Hamlet's sidekick, partner, and (in keeping with the theme of scientific reasoning heretofore established), lab partner. In the second half of this chapter we will determine if Horatio's privileged status as omnipresent spectator results in any significant knowledge creation. By Act 3, Hamlet has accepted this premise: my uncle is guilty of killing my father. His hypothesis: if my uncle is guilty, he will reveal his guilt when acted upon a certain way. Hamlet has been commanded by the Ghost to avenge this murder, but first he must test the hypothesis.

[28] William Shakespeare, *Hamlet*, ed. George Richard Hibbard (Oxford: Oxford University Press, 1987). 166 fn.

Conducting the Experiment

Once the premise has been understood and a hypothesis formulated, an experiment can be performed to test that hypothesis and deliver a result. Like the *assert* command in computer coding mentioned earlier, the experiment will assume the syllogism or conditional statement is true, and will either fail or succeed based on that truth. In this sense, experimentation and mechanical science are closely related.

In Act 2, scene 2 Polonius reads a letter Hamlet has given to Ophelia in which he professes his everlasting love. He signs it "Thine evermore, most dear lady, whilst this/ Machine is to him,/ Hamlet" (2.2.123-125). The use of the word "machine" may bring up images of factories or robots in the minds of modern day readers, but the word in its early modern context would have referred to a more basic idea. Machinery was prevalent in the early modern era, making appearances in the art and literature of the time.[29] Agostino Ramelli's 1588 *Various and Ingenious Machines* includes a depiction of a machine that the magazine *The Atlantic* called "The Kindle of the 16th Century,"[30] which was one of countless unrealized inventions of the era, but which gives the modern reader a good idea of the machine-oriented solutions emerging at the time. Brian Scott Baigrie discusses the interconnectedness of art and the emerging science of the early seventeenth century, such as the prevalence of botanical and anatomical drawings (mentioned in chapter 1), cross-sectional diagrams, and even artistic cartography. He writes, "The Renaissance artist, like the Renaissance scientist, is a 'quantifier' of reality, and thus the possessor of powerful new tools to describe the natural world."[31] Water-powered machinery,

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[29] Jonathan Sawday, *Engines of the Imagination: Renaissance Culture and the Rise of the Machines* (New York: Routledge, 2007) provides an overview of instances of machinery in art of the period.

[30] Megan Garber, "Behold, the Kindle of the 16th Century," *The Atlantic* (February 27, 2013). https://www.theatlantic.com/technology/archive/2013/02/behold-the-kindle-of-the-16th-century/273577/.

[31] Brian Scott Baigrie, *Picturing Knowledge Historical and Philosophical Problems concerning the Use of Art in Science* (Toronto: University of Toronto Press, 1996), 23.

looms, clocks, tools for building and smithing were all common in the Renaissance, however the use mentioned above is the only instance of the word "machine" in Shakespeare's works. His plays focus more on characters as agents of change than on man-made machinery, but in *Hamlet* we see many instances in which characters use others as components in their own human machines, with the product desired being proof. Shakespeare takes the idea of the physical machine and transforms it into an abstract idea, a method of thinking by which a process can be achieved. This process is used by many characters to various degrees of effectiveness. As Jessica Wolfe illustrates, the ostensible purpose of the machine in the early modern era was to provide an alternative to sensory experience, to "intercede between the external world and the subjective experience of the human intellect or senses."[32] The characters in *Hamlet*—and indeed most often Hamlet himself—rely on the mechanical process in the abstract to make distinctions between reality and what their senses are leading them to believe. But machines also were the result of a shift in thinking about method, and acted as the "master metaphor and a model for these new techniques."[33] Method, famously referenced in *Hamlet* ("Though this be madness, yet there is method in it"), was redefined by Bacon in *The Advancement of Learning* (1605) and *Novum Organum* (1620) to refer to a systematic approach to learning emphasizing experimentation and observation.

A machine will, in theory, perform an action the same way each time, an idea that proponents of method would have appreciated for its predictability and reliability. The creation of a machine is possible only when the creator understands the method behind the action the machine will need to perform. In this chapter, I have referred to this as the premise, upon which

[32] Jessica Wolfe, *Humanism, Machinery, and Renaissance Literature* (Cambridge: Cambridge University Press, 2004), 4.
[33] Ibid., 5.

the hypothesis is based. Thus, as machinery becomes more acceptable it becomes necessary to define processes. In *Hamlet* the characters hypothesize about method and outcome based on their understanding of the component pieces of the machine: each other. They attempt to categorize each other, to place one another in clearly identifiable models which will fit into the machine they are creating, and to point out when someone is not acting within acceptable or defined parameters. Hamlet's grief is "unmanly," Claudius says (1.1.94); Horatio and Marcellus are "friends, scholars, and soldiers," as defined by Hamlet (1.5.145); Hamlet describes Gertrude as "the Queen, your husband's brother's wife./ But—would you were not so—you are my mother" (3.4.15-16); in Q2 Osric describes Laertes as "the card or calendar of gentry" (5.2.111). Often this dogged cataloging and labelling leads to chaos or failure rather than success.

There is a lexical field around machinery which becomes important to understand, especially concerning the implications of the machine working at the macro and micro levels, in order to lay bare the elements of machinery within *Hamlet.* As Wolfe points out, accurately defining and situating many of the words we have come to associate with method today is a difficult task. She writes,

> The use of terms such as 'engine,' 'device,' 'motion,' and 'instrument,' as well as 'subtle' and 'artificial,' demonstrates that machinery belongs to a larger semantic network which includes in its purview any witty device from an emblem or an epigram to a morsel of political advice.[34]

Harold Jenkins explains that the machine to which Hamlet is referring is his body, which was "a complicated structure composed of many parts. [Timothy] Bright, e.g., thinks of the body as an 'engine' stirred into action by the soul."[35] Chapter 13 of Bright's *Treatise of Melancholie*

[34] Ibid., 8.
[35] William Shakespeare, *Hamlet* ed. Harold Jenkins (London: Thomson Learning, 1982), 243.

(1586) looks at the mechanical function of the soul: "How the soule by one simple facultie performeth so many and diuerse actions."[36] He compares the soul to the wheel in a watch, which when turned causes other parts to move and respond: "We see it euident in automaticall instrumentes, as clockes, watches, and larums, howe one right and straight motion, through the aptnesse of the first wheele, not only causeth circular motion in the same, but in diuerse others also."[37]

By this definition, the soul could be interpreted as one of Aristotle's four causes (mentioned in the introduction), and thus was indistinguishable from the physical form. However, the way Hamlet's wording has divided him (his thoughts) from his machine—his soul from his body—makes it seem that he may believe the two are distinct, and that the machine only serves a function so long as the soul requires it ("whilst this machine is to him"). Descartes would later argue this same idea in *Meditation on First Philosophy* (1641), where he observes,

> Although perhaps (or rather certainly, as I shall shortly claim) I have a body, which is very closely conjoined to me, yet because, on the one hand, I have a clear and distinct idea of myself, in so far as I am a thinking and not an extended thing, and, on the other, a distinct idea of the body, in so far as it is only an extended and not a thinking thing, it is certain that I am really distinct from my body, and can exist without it.[38]

To put this in Hamlet's frame of reference, Descartes would say that Hamlet's thoughts are his own, and are full of love for Ophelia; his body is separate from his consciousness, and he can

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[36] Timothy Bright, *Treatise of Melancholie* (London: Thomas Vautrollier, 1586), 67. *EEBO*, http://gateway.proquest.com/openurl?ctx_ver=Z39.88-2003&res_id=xri:eebo&rft_id=xri:eebo:citation:99842180.

[37] Ibid., 68.

[38] Rene Descartes, *Meditations on First Philosophy: With Selections from the Objections and Replies*, trans Michael Moriarty (Oxford: Oxford University Press, 2008), 55.

offer it up to Ophelia for her to command until it stops working (dies, or is no longer under his command and is instead forced to operate according to the social rules of the court).[39] In other words, the body is an automaton which can be maneuvered, and the consciousness is separate from it. This simplistic interpretation would suggest that agency is not a universal principal, but rather that one's actions can be a forced response to stimuli. However, Gail Kern Paster's work investigating the humoral body rejects the idea of pre-Cartesian dualism, claiming it is our modern ideologies which influence many critics to embrace the more comfortable idea of the mind-body separation where it may not have existed historically. In *Humoring the Body*, she explains,

> Clearly it matters to our understanding of such familiar and important plays to read the passions represented in them with historical care. What most impedes our ability to do so, I argue, is our tendency as post-Enlightenment readers—with a residual tendency toward mind-body dualism even in an age of cognitive science—to underestimate the materialism governing pre-Enlightenment thought about the embodied passions and thus to find abstraction and bodily metaphor where the early moderns found materiality and literal reference. *Often what is now emotional figuration for us was bodily reality for the early moderns.*[40]

Thus, according to Paster's logic, when Hamlet states that Horatio's "blood and judgment are so well commeddled" (3.2.69) he is not being metaphorical, but rather literally claiming Horatio's anatomy and thoughts are connected. This again suggests a limiting factor to agency; if Horatio's

[39] Most historians date mechanical science in the mid-to-late seventeenth century, citing Boyle and Descartes among the first to champion the mode. However, I believe the precursor to this philosophy is evident in such works as *Hamlet*, though it is not well defined. For more, see Helen Hattab "The Mechanical Philosophy," in *The Oxford Handbook of Philosophy in Early Modern Europe*, eds. Desmond Wilson and Catherine Clarke (Oxford: Oxford University Press, 2011).

[40] Gail Kern Paster, *Humoring the Body* (Chicago: University of Chicago Press, 2004), 26. My emphasis.

thoughts are dictated by a physiological condition, he may not be in control of his actions. If the same philosophy were applied to Hamlet, his mental conflict would be the result of an anatomical imbalance of some sort; his "seeming" insane might actually be insanity. Though Paster does claim that this would have been the more common early modern paradigm, I would argue that Hamlet's struggle with his decision-making and his clear conflict over the actions he must take would indicate that his mind, at least, is not confined to a static state of being anchored in a physiological cause. He is too changeable and aware of his inner turmoil for Paster's explanation to be wholly viable.

Along these lines, Paul Cefalu points out that metacognition independent of other factors is not a determiner of dualistic thinking: "To recognize that inward states exist is a necessary but not sufficient condition for Cartesianism."[41] While Paster's argument is intriguing, I would point to the rising popularity of Paracelsan philosophies during the late sixteenth century as evidence for the validity of the argument of dualism in *Hamlet* and other early modern texts. While Paracelsus cannot be placed squarely in the dualist camp, his break from Galenic traditions of the connected mind/body reveals a dualist tendency in his treatments. Rather than focusing on balancing the whole being, Paracelsus focused on treating the single cause of an ailment. Hamlet's use of "machine" might more closely align with the Paracelsan idea of the body as a series of connected but separate systems.

The adoption of dualism is in keeping with the skeptical pattern of the rejection of classical ideals, though of course this does not prove that it was the philosophy Hamlet uses. Descartes broke from Aristotle, who believed that the body and soul were connected. Hamlet has been away at university, and may have been exposed to the precursors to this philosophy in his

[41] Paul Cefalu, "Damned Custom … Habits Devil: Shakespeare's Hamlet, Anti-Dualism and the Early Modern Philosophy of Mind," *ELH* 67, no. 2 (2000): 407.

studies. In fact, much of Hamlet's struggle may be related to the clash between his new knowledge and the older or more traditional views of his home. John Cottingham explains that

> In a purely mechanical Cartesian universe… there is an important sense in which there is no real difference between 'living' and 'dead' matter… When this purely mechanical view of biology is combined with Descartes' thesis that the conscious mind is a separate incorporeal substance, the upshot is that bodily death becomes, in a sense, wholly irrelevant to the question of personal immortality.[42]

This mentality colors the gravedigger scene, when Hamlet muses on the decomposition of bodies: "To what base uses we may return, Horatio!" (5.1.196). According to Descartes, however, though Hamlet may be holding Yorick's decayed skull, Yorick may still be "alive" if his consciousness still exists, albeit unrecognized by Hamlet. This seems somewhat contradictory to his firsthand experience with his father's ghost, who he believes is the same body which was buried. He is in wonder that the grave has "cast [his father] up again" and that he is quite literally the "dead corse, again in complete steel" (1.4.47, 51-52). He laments that his knowledge of nature is so limited as to be unable to comprehend how such a thing is possible, labelling himself as a fool for his ignorance. Perhaps this interpretation of the body is the most mechanistic of all, relying on the idea that the broken machine can be once again animated with the right stimulus, regardless of the presence or state of the soul.

The Oxford English Dictionary (*OED*) tracks a slightly different meaning for machine in the sixteenth century (specifically attributed to 1545): "A material or immaterial structure, esp. the fabric of the world or of the universe; a construction or edifice."[43] Interestingly, the term "quintessence," especially in relation to alchemy, is defined as "divine breath," or literally the

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[42] John Cottingham, *The Cambridge Companion to Descartes* (Cambridge: Cambridge University, 1992), 239.
[43] *OED Online*, s.v. "machine," accessed February 7, 2015.

substance which creates life, the fifth element. Putting these two definitions together, when Hamlet refers to a "quintessence of dust," he is describing a machine made of and powered by the elements. This definition also seems appropriate to Hamlet's situation, especially in his role as lover. When he offers his "machine" to Ophelia, he is offering that which makes up (his) universe: his being. However, the *OED* specifically defines Shakespeare's 1604 use of the word in a new way: "A living body, esp. the human body considered in general or individually."

While reference to the individual body is immediately relevant to Hamlet, the general living body of humanity is also relevant to the play, as it is the collective humanity around him which works as a force against him. Bright clearly followed this definition of the body as a microcosm when he wrote in *A Treatise of Melancholy*, "So many actions diverse in kinde rise from one simple first motion, by reason of variety of joints in one engine. If to these you adde what wit can devise, you may find all the motion of heaven with his planets counterfetted, in a small modil, with distinction of time and season, as in the course of the heavenly bodies."[44] Bright was not alone in correlating the human body to celestial counterparts.[45] As Penelope Gouk points out, Robert Fludd's depictions of musical relationships between celestial bodies and corresponding relationships within the human body suggest a view that specific shared properties governed both entities, and that the human body was a universe in itself.[46]

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[44] Timothy Bright, *A Treatise of Melancholy* (London: John Windet, 1586), 65, *EEBO*, http://gateway.proquest.com/openurl?ctx_ver=Z39.88-2003&res_id=xri:eebo&rft_id=xri:eebo:citation:99842180

[45] See chapter two of this thesis for a discussion of the movement of celestial bodies as relating to the fate of man.

[46] See Robert Fludd, *Utriusque cosmi, majoris ... et minons, metaphysica, physica atque technica historica.* (Oppenheim: J.T. DeBry, 1617).

It is not a given, however, that Hamlet espoused this pre-Cartesian dualism. William W. Demastes qualifies this claim by explaining that Hamlet may have held this belief in the separation of the body and mind early in the play, but that by the end he has learned the two are more connected than he originally believed. Having experienced the very real consequences of acting mad, for example, Hamlet has learned that there is little difference between pretending to be mad and actually being mad. Demastes points to the downfall of Hamlet's relationship with Ophelia as an example of the repercussions of Hamlet's playing; Ophelia doesn't know if he is pretending or not, and the result is that she is hurt regardless. Demastes writes, "Dualism is itself the illusion that Hamlet's odyssey in

Leo Salingar theorizes that perhaps Hamlet (and, by extension, Shakespeare) was familiar with Giordano Bruno's *De gli eroici furori* (1585), in which Bruno comments on the body/soul relationship. Bruno wrote, "Let the body help itself with matter and bodily subject, and the intellect be content with its own objects; in order that this combination should hold firm, that this machine wherein soul is united to body by means of the spirit should not be dispersed."[47] Could this use of the word "machine" be coincidence?[48] If nothing else, it points to the prevalence of this mechanical mindset. All of this is to say that the early modern audience would have seen machinery at work in the cosmos, in everyday industry, and within their bodies, and thus the translation of that idea into experimental science as seen in *Hamlet* may have been more familiar than we might first think.

The senses as an extension of the body could be seen as elements of the human machine. But perhaps the machine is on auto-pilot. Does the spirit have any choice over its function? As mentioned earlier, the mind/body relationship was not definitively understood, and one's control over one's actions and environment was uncertain. Hamlet struggles with all of these questions at some point, and indeed struggles to gain and then maintain control over his circumstances. Katharine Park articulates this question thus:

> If nature were a single world machine, for instance, this might show that God – the divine artisan – had produced it for a transcendent purpose. But it could equally well show that the world is simply an eternal mechanism that needs no

Elsinore (and beyond) unearths (literally reflected in the unearthing of poor Yorick's skull) and then buries (in Ophelia's earthy grave)."

[46] William W. Demastes, "Hamlet in His World: Shakespeare Anticipates/Assaults Cartesian Dualism," *Journal of Dramatic Theory and Criticism* (2005): 30.

[47] Giordano Bruno and Giovanni Gentile, *Opere Italiane* vol 2 (1927): 386, quoted in Leo Salingar, "Shakespeare and the Ventriloquists," *Shakespeare Survey* 34 (2007): 57.

[48] I have been unable to find an Italian source comparable to the *OED* to confirm my suspicion that the word in Italian carried the same connotations as it did in English. Anecdotal evidence—discussions with Italian speakers—suggests I am correct.

> divine creator and has no purpose beyond the systematic functioning of its parts. Moreover, although the intricate designs of parts of animals such as the human eye might be construed as works of God, such natural designs might also be regarded as evidence that denies God's role as a final cause.[49]

The gravedigger scene, especially Hamlet's handling of Yorick's skull, is a visual reference to the machine uncovered, or laid bare. The purpose of any machine is to use energy to perform a function which results in a pre-determined product. The algorithm in *A Piece of Work,* which was sometimes called a machine by its creative team, produced a new version of *Hamlet* nightly. An example of an early modern machine would be a water mill, which would use energy provided by flowing water to turn the wheel, moving cogs which were connected to mill stones which would then grind wheat. A machine like the water mill was nothing particularly new to Shakespeare's era, but what is novel is the coupling of machines with experimentation. In *Hamlet,* the machine produced is not built of wooden wheels and grinding stones, but of human interaction; the product is not flour, but proof. *Hamlet* embraces the new concepts of experimentation furthered by Paracelsus (a reliance on "untutored experience,"[50] as mentioned in the introduction), disowns the emphasis on dogma put forward by reiterations of Aristotle, and then uses the idea of the machine to find proof, and thereby learn what is real and what is farce.

In addition to the various verbal experiments and syllogisms Hamlet employs, his culminating experiment is the play he causes to be enacted at court.[51] Uncertain of the

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[49] Katharine Park *Cambridge History of Science*, eds. Katharine Park and Lorraine Daston (Cambridge: Cambridge University Press, 2006), 81.

[50] Ibid., 110.

[51] It is important to note that Aristotle's syllogistic form remained vital during this period, though what was acceptable as a premise changed. One's own experience became both acceptable and—later—a preferred basis for a premise. See *Organon*. Syllogisms contain a major premise, minor premise, and conclusion. For example: Major Premise: "All women wear polka dots." Minor Premise: "Jane is a woman." Conclusion: "Therefore, Jane wears polka dots."

provenance of the spirit he has seen, he feels he cannot commit murder at its command without proof that what the Ghost claimed was true.

HAMLET: The spirit that I have seen
May be the devil, and the devil hath power
T'assume a pleasing shape;[52] yea, and perhaps,
Out of my weakness and my melancholy—
As he is very potent with such sports—
Abuses me to damn me. I'll have grounds
More relative than this. The play's the thing
Wherein I'll catch the conscience of the King. (2.2.600-607)

Aside from the obvious pun about family connections and modern definitions of "relative," which would suggest an outcome based on a relationship with a given circumstance, the term in Shakespeare's time would have meant "pertinent to the situation at hand."[53] There is more certainty coloring the early modern use of the word, and thus it could be seen how having relative proof would be a cure for doubt—something that could not be explained away but instead was directly correlated to that unique circumstance. It is of note that Hamlet recognizes that the Ghost may be using him as a cog in a machine to bring about evil works (the Ghost perchance "abuses [him] to damn [him]" as he postulates in 2.2.99), and perhaps his later outburst to Rosencrantz and Guildenstern about being played upon is a result of his feeling abused not only by them but by the Ghost as well.

[52] Both Jenkins and Hibbard reference Protestant publications on demonology which specify the Devil's ability to shapeshift, and assert this idea would have been widely accepted among Shakespeare's audience. See *Demonologie*.

[53] *OED Online*, s.v. "relative," accessed February 7, 2015.

Hamlet uses the players as the machinery to bring about the product he seeks: confirmation of his uncle's guilt as evidenced by his reaction to "The Murder of Gonzago." He even calls the play "The Mousetrap," evoking images of a deadly but simple machine. In 1589 Leonard Mascall published an extensive guide to trapping small animals and fish: *A booke of fishing with hooke & line, and of all other instruments thereunto belonging. Another of sundrie engines and trappes to take polcats, buzards, rates, mice and all other kindes of vermine & beasts whatsoeuer, most profitable for all warriners, and such as delight in this kind of sport and pastime.*[54] There are over a dozen traps specifically for the use of mice in Mascall's guide, generally consisting of boards with holes and string arranged in such a way to activate upon contact with the mouse. The machines are simple, so much so that modern-day engineering has adopted the phrase "build a better mousetrap" as a euphemism for gaining the competitive edge through innovation. For Hamlet, he is going to build a better mousetrap in that he will catch who he believes to be the ultimate vermin: his father's murderer. His hypothesis is that if Claudius is guilty, he will act a certain way and reveal his guilt:

> I have heard that guilty creatures sitting at a play
> Have by the very cunning of the scene
> Been struck so to the soul that presently
> They have proclaimed their malefactions;
> For murder, though it have no tongue, will speak
> With most miraculous organ. (2.2.591-596)

[54] Leonard Mascall, *A booke of fishing…* (London: John Wolfe, 1590). *EEBO*, http://gateway.proquest.com/openurl?ctx_ver=Z39.88-2003&res_id=xri:eebo&rft_id=xri:eebo:citation:99855278.

The idea that a wicked person could be compelled to confess his or her sins by the appropriate use of religious authority was the basis of many contemporary tales of exorcisms.[55] Hamlet sets his own mousetrap into action, and watches it play out: the players enact the murder, Claudius reacts, and Hamlet decides to "take the Ghost's word" (3.2.274). The use of the word "creature" in the above quote equates Claudius with something non-human, an animal like a mouse, furthering the mousetrap motif. Claudius never publicly confesses his guilt, but his actions betray him. His own bodily machine gives him away, acting in response to the environmental stimuli. The play also provides Hamlet with his next course of action, which he attempts to complete in Act 3, scene 4: to kill Claudius.

Hamlet is not the only character who uses others to conduct experiments. The diminishing of others' status to elements in an experiment is shorthand for a show of power in the Danish court, and it is utilized by the patriarchs as a means of establishing their position at the top of their family units. When Laertes has returned to Paris, Polonius seeks the aid of Reynaldo in an experiment to determine the character of his son. Polonius's hypothesis is that by having Reynaldo claim Laertes's character is less than completely honorable, those who know Laertes will either confirm or deny that assertion, thus revealing how Laertes conducts himself outside the influence of his father. He explains to Reynaldo,

> Your bait of falsehood takes this carp of truth;
> And thus do we of wisdom and of reach
> With windlasses and with assays of bias
> By indirections find directions out. (2.1.62-65)

[55] Hibbard believes that if Shakespeare were using a specific instance of a person being compelled to confession through observing a play, he may have been thinking of a story in *Warning for Fair Women* (1599), in which a woman confesses to the murder of her husband after watching a play reminiscent of the act. (Fn. 235)

The subtext here is that Polonius's fatherly privilege extends beyond his physical presence, and past country borders. He sets the experiment into motion through Reynaldo, wielding power through a manipulation of Laertes's social circle, presenting an engineered reality which he can read and analyze. He never gets to see the result of his experiment as he is killed before Reynaldo can return with the information.

Polonius is also the architect of another experiment in deception later in Act 3, scene 1 when he conspires with Claudius to use Ophelia to deduce Hamlet's level of sanity.

> We have secretly sent for Hamlet hither,
> That he, as 'twere by accident, may here
> Affront Ophelia.
> Her father and myself, lawful espials,
> Will so bestow ourselves that, seeing unseen,
> We may of their encounter frankly judge,
> And gather by him, as he is behaved,
> If't be th'affliction of his love or no
> That thus he suffers for. (3.1.31-39)

Here, the hypothesis is that by adding Ophelia as the variable, Claudius and Polonius will be able to see how Hamlet's nature changes, and thereby accurately deduce if she is the cause of his lunacy (as Gertrude hopes is the case). Polonius later tries to duplicate this experiment by hiding behind the arras in Gertrude's rooms and having her call for Hamlet. Unfortunately for him, this covert operation costs him his life.

Hamlet is also experimented upon by his mother, when Gertrude and Claudius send for Rosencrantz and Guildenstern to visit Hamlet in an effort to determine the cause and cure of his transformation.

> I entreat you both
> That, being of so young days brought up with him,
> And since so neighboured to his youth and humour,
> That you vouchsafe your rest here in our court
> Some little time, so by your companies
> To draw him on to pleasures, and to gather,
> So much as from occasions you may glean,
> Whether aught to us unknown afflicts him thus
> That, opened, lies within our remedy. (2.2.10-18)

The result of this experiment is inconclusive as Hamlet becomes aware of their purpose and thereby taints the outcome. It is no wonder that by Act 3 Hamlet has begun to recognize and despise his place as laboratory rat, likening himself to a pipe on which he is played by others. In modern parlance, the experiment has transitioned from single-blind to open. He accuses, "You would play upon me, you would seem to know my stops, you would pluck out the heart of my mystery, you would sound me from my lowest note to the top of my compass… Call me what instrument you will, though you can fret me, you cannot play upon me" (3.2.351-360).

Just as Hamlet set a trap for Claudius with "The Murder of Gonzago," Claudius sets a trap for Hamlet through Laertes. He puts into motion a sequence of events that he believes will lead to his desired outcome, Hamlet's death, using Laertes and Hamlet's pride as the active agents. Claudius refers to this plan as his "device" (4.7.63), a phrase fitting with Hamlet's use of

The Mousetrap. Claudius's device malfunctions when Gertrude drinks the poisoned cup in Hamlet's place, and the plan is discovered.

The play itself is a type of machine created by the genre: the revenge tragedy. Hallett and Hallett strip down the genre to its fundamental and recurring motifs: "the ghost, the madness, the delay, the play-within-a-play, the multiple murders, and the avenger's death,"[56] all of which are clearly defined in *Hamlet*. Shakespeare's sources for *Hamlet* were also revenge tragedies, namely Thomas Kyd's *The Spanish Tragedy* (1587) and the *Ur-Hamlet*, which many believe was also authored by Kyd (1596). Though we have no surviving copies of the *Ur-Hamlet*, critics have pieced together many critical plot points from the records of contemporaries who saw the play performed. We know the *Ur-Hamlet* had a ghost,[57] and that the play contained "handfuls of tragical speeches."[58] *The Spanish Tragedy*, as was typical of many Elizabethan revenge tragedies, culminates in the play-within-a-play, whereas the motif occurs much earlier in *Hamlet.* But overall the connection between the two is unmistakable: the geo-political strife between two opposing countries, a woman driven insane by the death of a family member, her subsequent suicide, a ghost seeking vengeance, a political advisor who does more harm than good, lovers who cannot be together, many murders, and the final death of the avenger. *The Spanish Tragedy* reads as more political than *Hamlet*, concerned with achieving peace between Portugal and Spain, whereas *Hamlet* is concerned more with Hamlet finding peace within himself. Fortinbras and Poland, though coloring some important moments of action, seem a distant threat, a reminder of King Hamlet's political career, rather than impetus for characters' decisions. It seems Fortinbras's sole purpose is to remove the bodies at the end of the play.

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[56] Charles Hallett and Elaine S. Hallett, *The Revenger's Madness* (Lincoln: University of Nebraska Press, 1980), 8.

[57] Thomas Lodge, *Wit's Misery* (1596) qtd. in Jenkins, 83.

[58] Thomas Nashe, preface to Greene's *Menaphon* (1589) qtd. in Jenkins, 84.

More relevant to our discussion of experimentation is another element of the revenge tragedy, as defined by Wendy Griswold: trickery. She writes,

> Protagonists in revenge tragedy are unable to achieve their desired ends through orthodox or officially sanctioned means, and so, like their city comedy counterparts, they resort to trickery … The revenge tragedy includes contrivances such as planted letters and rumours, feigned madness, and the deadly play-within-a-play, which is frequently allegorical on more than one level.[59]

Social norms do not usually include acts of revenge, and thus the protagonist is often delayed as he struggles with his will to obtain justice at any cost and the societal pressures not to murder. Hallett and Hallett describe this beautifully as a "volcano of smoldering rage" hidden beneath polite exteriors. "Although repressed, the fire is not extinguished. And occasionally, when it can disguise itself as something else, something more acceptable to the individual himself as well as to society, it finds release. Revenge is one of these self-justifications."[60] Before the final cathartic act of the revenge murder, the "smoldering rage" leaks out in the minor acts of trickery enumerated by Griswold, examples of which are shown in *Hamlet* in the previous pages of this chapter: surveilled conversations, pretended dispositions, The Mousetrap, and virtually every action Polonius takes.

When placed into this machine of the revenge tragedy, the characters' actions are predictable. The protagonist will kill to avenge a murder, someone will go mad, there will be a play within a play, tricks will be played, and many people will die. Much as Hamlet or Polonius try to force a sequence of events by placing other characters into contrived circumstances,

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[59] Wendy Griswold, *Renaissance Revivals: City Comedy and Revenge Tragedy in The London Theatre 1576-1980* (Chicago: University of Chicago Press, 1986), 62.

[60] Hallett and Hallett. *The Revenger's Madness*, 7.

Shakespeare has done the same with his characters. It is likely that the Elizabethan theater-goer would have known from the moment King Hamlet implores his son to "revenge his foul and most unnatural murder" (1.5.25) that certain plot points would come about.

Lest it be perceived that this lengthy analysis of *Hamlet* indicates this is the only play in which experimentation is used as a tool for determining truth or for uncovering proof, it is important to note that many of Shakespeare's plays are filled with instances in which characters play tricks on each other, scheme, and deceive in order to achieve an end. In *Much Ado About Nothing,* Don Pedro "fashions" a benevolent scheme to "bring Signor Benedick and the Lady Beatrice into a mountain of affection th'one with th'other" (2.1.42-44). Don John's malevolent scheme works in counterpoint, to "despite" Claudio and Don Pedro (2.2.28). Both men use versions of Hamlet's mousetrap, setting up false realities to cause a response in the viewers of those realities: Benedick, Beatrice, Claudio, and Don Pedro. However, the difference between these schemes and the various mechanisms put into play in *Hamlet* is that Don Pedro is seeking to create (the union of the two lovers); Hamlet—and Polonius and Claudius—are seeking revelation of truth.

There are some characters who create experiments and put other characters into situations in order to reveal the truth, as Hamlet does. Perhaps the most obvious is Othello, whose insistence on "ocular proof" (3.3.365) drives his downfall. Hamlet would likely agree with Iago, that "men should be what they seem" (132). Had this been true in *Othello,* the title character may have seen through Iago's deception—or, more acurately, there would have been no deception. He would have never doubted Desdemona's faithfulness, and the story would have had a dramatically different ending. But because Othello cannot trust his heart, he allows Iago's game to play out, whereby he grasps at the constructed proof at the expense of the truth. Here, too, is

the motif of the human as instrument, to be manipulated. In Act 2, scene 1, Iago says of Othello, "O, you are well tuned now,/ But I'll set down the pegs that make this music,/ As honest as I am" (200-202). His plan isn't complete, however, until he acquires Desdemona's handkerchief, at which time he states, "This may do something" (3.3.328), the same root thought that drove Hamlet's use of The Mousetrap.

King Lear opens with an experiment gone wrong. His premise was that Cordelia loved him the best out of his three daughters, and as such he had predetermined to give her the largest inheritance. When she refuses to profess her love, he "disclaim[s] all paternal care" (1.1.114) and casts her out. Her refusal to participate in his experiment marred his planned outcome: to divide his kingdom three ways. In Act 3, when the blinded Gloucester is united with Edgar, Edgar maintains his disguise instead of revealing his identity. This could be another example of experimentation in the play, through which Edgar hopes to understand his father's true feelings.

The examples above give a sample of the many instances of experimentation and hypothesizing in Shakespeare's plays, and there are many not here noted due to the scope of this work. However, *Hamlet* is the best example of this method of experimental thinking playing out over the entirety of the play and by many different characters.

Reading the Results

Theoretically once an experiment has been performed the scientist need only observe the results to determine the veracity of his original hypothesis. However, in a world in which the senses—including sight—are not trusted, coming to a conclusion about a hypothesis can be problematic. As in *Othello*, visual proof becomes important in *Hamlet*, however Hamlet begins to doubt what he has seen and Othello trusts too easily what he believes he has seen. Horatio calls it the

"sensible and true avouch of mine own eyes" (2.1.55), and perhaps Hamlet would not later doubt his ocular proof if not for the fact that he had been seeing his dead father already, in his "mind's eye" (1.2.184). For that matter, Ophelia sees things which are not there in Act 4 when she has gone mad. In fact, she has seen things which are not real much earlier; in Act 3 when she is used as the catalyst for Hamlet's emotional outbursts as Claudius and Polonius observe, Ophelia witnesses what she believes is Hamlet's true character but which is in fact an act. Compare the following speech to Hamlet's "What a piece of work is man" musings in Act 2, scene 2:

> O what a noble mind is here o'erthrown!
> The courtier's, soldier's, scholar's eye, tongue, sword,
> Th'expectancy and rose of the fair state,
> The glass of fashion and the mould of form,
> Th'observed of all observers, quite, quite, quite, down!
> And I, of ladies most deject and wretched,
> That sucked the honey of his music vows,
> Now see that noble and most sovereign reason
> Like sweet bells jangled out of tune and harsh;
> That unmatched form and feature of blown youth
> Blasted with ecstasy. O woe is me,
> T'have seen what I have seen, see what I see! (3.1.153-164)

Hamlet has just told Ophelia that he deceived her when he professed love, and yet here she still trusts her senses, the ocular proof of Hamlet's changed personality, rather than suspecting that perhaps he is deceiving her again. Perhaps the larger question addressed in *Hamlet* is not "What proof can I find?" but instead "Can I trust the proof?"

All of the experiments in *Hamlet* occur prior to Act 4: Polonius using Reynaldo to determine Laertes's true character, Claudius calling in Rosencrantz and Guildenstern to determine if Hamlet's behavior is curable, Claudius and Polonius using Ophelia to determine if Hamlet's madness is caused by his love for her, Hamlet using the players to determine if Claudius is guilty of Hamlet Sr.'s murder, and Polonius using Gertrude to determine Hamlet's true grief. With Polonius's death, the experiments are ended. What remains of the play are the consequences of those experiments, none of which are pleasant: Laertes, Hamlet, Claudius, Polonius, and Gertrude are killed, and Ophelia devolves into madness which brings about her accidental drowning (or suicide). The most successful experiment, meaning that the hypothesis was satisfactorily tested and a conclusion aptly drawn, is The Mousetrap. With Claudius's very visible response to the play, and his subsequent attempt to have Hamlet killed by the English in an effort to escape retribution for his crime, Hamlet has achieved his primary purpose: to determine Claudius's guilt. However he has not fulfilled his responsibility to his father to avenge the murder, having botched his spontaneous attempt at completing the deed and killing Polonius instead of Claudius.

The ultimate question is this: through all these experiments and machinations, has any valuable or substantive knowledge been created? Polonius does not survive long enough to hear Reynaldo's report, and he and Claudius are deceived by Hamlet's antic disposition and thus never truly understand his motives nor his true feelings. Hamlet gains a confirmation of Claudius's guilt, but it is not new information; he was told of it by the Ghost. It is not any of these characters who carries the truth of the events, but rather Horatio, who witnessed all the events that led to the death of Denmark and who survives to convey this knowledge to the unwitting public and Fortinbras. Only Horatio saw or was privy to all the components that made

up the machine of the downfall of Denmark: the appearance of the Ghost and its command to Hamlet, Denmark's military preparations against Fortinbras, Hamlet's determination to present a false persona to his family and friends, the duplicity of Rosencrantz and Guildenstern (and, by extension, the calculating and distrustful actions of Claudius and Gertrude), Hamlet's execution of The Mousetrap, the meddling of Polonius which caused his death, Ophelia's subsequent madness and death, and the ultimate deaths of the ruling family and the claiming of the throne by Fortinbras.[61]

Even as he lay dying, Hamlet turns again to questions and a desire for knowledge both for himself and for the witnesses to the scene. He asks "What warlike noise is this?" (5.2.302) as the sounds of Fortinbras's approaching army grow louder. He "cannot live to hear the news from England" (5.2.306), nor can he tell his story to the "mutes or audience" (5.2.287) around him. Instead, he charges Horatio, "Report me and my cause aright/ To the unsatisfied" (5.2.343-344). The play ends as it began, with a conditional command. Whereas the Ghost commanded, "If thou didst ever thy dear father love … Revenge his foul and most unnatural murder" (1.5.23, 25), Hamlet now commands Horatio,

> If thou didst ever hold me in they heart,
>
> Absent thee from felicity awhile,
>
> And in this harsh world draw they breath in pain
>
> To tell my story. (351-354)

With his telling of

> carnal, bloody, and unnatural acts,

[61] Hamlet is aware or present for all of these except for Ophelia's madness, and he does not seem aware of the threat of Norway—or, at least, does not mention it—until Act 4. Thus Horatio is the only character who has firsthand knowledge of all these events.

> Of accidental judgments, casual slaughters,
> Of deaths put on by cunning and forced cause,
> And, in this upshot, purposes mistook,
> Fall'n on the inventors' heads, (335-339)

Horatio hopes to dismantle the machine of destruction and prevent further experiments ("plots and errors" (5.2.348)). Presumably Horatio, the possessor of knowledge and one whose "blood and judgment are so well commeddled" (3.2.67) as to not make him passion's slave, will be able to fulfill this command in the way Hamlet was unable to do so for his father. It is Horatio's ability to understand the foibles and motivations of those around him without the need of experimenting or playing upon others that allows him to exist outside the tragedy, and thus survive when Hamlet, Ophelia, Polonius, Laertes, Claudius, and Gertrude could not. The conclusion will explore the character of Prospero in this vein to determine if he is able to overcome his circumstances because of his experimentation and book learning (like Hamlet), or his humanity (like Horatio).

CONCLUSION

In this thesis I have claimed that in response to the rise of skepticism the early modern man (or woman) developed tools for knowledge creation, which manifested in different scientific modes of thought and action, and that many of Shakespeare's characters use these tools or methods in their struggle to find truth and thereby gain some control over their world. These methods had their limitations, but regardless Shakespeare's characters attempt to supersede these limits to knowledge in a quest for power—over their destiny, over their circumstances, or over each other. They try to understand their world using the language of cataloging, found in herbals and anatomies, as they reduce each other to pieces of a person, re-defining what it means to be a man or woman, a lover, a parent. By doing so, they are able to anticipate behavior or lay open the motives of others. They also acknowledge the language of the stars and the natural world, reading omens and making predictions based on the movement of celestial bodies or the patterns of wildlife or weather. Armed with this well-defined world and the tools of prediction and prognostication provided by nature, characters can then attempt to control their world through experimentation. Truth, then, can be made to reveal itself through the proper manipulation of variables. And yet, in spite of this perceived control, Shakespeare's characters' attempts to force desired outcomes or to uncover truth do not seem to go well for them.

Shakespeare's final play, *The Tempest*, contains all of these methods of knowledge creation and experimentation, and as his final single-authored play—and one for which there doesn't appear to be an obvious single source text—it is interesting to note what he might be saying about attempts at learning truth through scientific pursuits. In concluding this study of science as a means of knowledge creation in Shakespeare's works, I would like to examine

Prospero, whose academic study and use of experimentation make him unique among Shakespeare's characters.

Prospero is a hybrid. Part scholar and part magus, he is the embodiment of what many of Shakespeare's other characters have been trying to achieve: control gained through knowledge. He has been compared to an alchemist—Ben Jonson's *The Alchemist* was written around the same time as *The Tempest* and the main characters share many qualities—and while this form of science has only been alluded to thus far in this thesis, it is a perfect amalgamation of the different sciences I have enumerated in previous chapters. Alchemists work from texts, like botanists or physicians. They read nature, like prognosticators, astronomers, and astrologers. And, perhaps the most well-known characteristic of an alchemist: they experiment. Usually this experimentation was in an effort to create gold from baser metal, or to create the Philosopher's Stone and thus gain immortality. Prospero's practice serves a different purpose. Whether Prospero is an alchemist or not, I take the view of Stephen Orgel: "Prospero's art is Baconian science and Neoplatonic philosophy, the empirical study of nature leading to the understanding and control of all its forces."[1]

Having already been in a position of money and power, Prospero does not seek to create wealth. His desire to build knowledge of the natural world is evident in his relationship to his books. He explains to Miranda that in his passion for "the bettering of [his] mind" (1.2.90) he closed himself off from the world. "My library/ Was dukedom enough" (1.2.109), he says, and later notes that the books he maintained in his exile were prized "above [his] dukedom" (1.2.168). Caliban believes Prospero's power is tied to his books, and later tells Stephano,

> … Remember

[1] William Shakespeare, *The Tempest,* ed. Stephen Orgel (Oxford: Oxford University Press, 1998), 23.

> First to possess his books; for without them
> He's but a sot, as I am, nor hath not
> One spirit to command (3.2.89-92).

Truly Prospero is a powerful "sorcerer" (as Caliban has named him (3.2.43)). He can command the elements to bring about shipwreck, cause sleep to come over others, command otherworldly creatures like Ariel and Caliban, and summon spirits. But Prospero cannot do any of these things without his books. Having seen how study in seclusion caused the blindness that allowed his brother's treason, he attempts to turn his study outward on the island, being more aware of his surroundings and taking control of his domain in a way he neglected in Milan.

While it is clear to the reader that Prospero relies on his books because he is engaged in active study and practice of his art, Caliban has trouble distinguishing the books from Prospero; the power and knowledge are in both. He claims that when parted from his books, Prospero is "but a sot" (3.2.91), as if it is the possession of the books that creates the power, and not the mastery of what is in them. Thus Prospero simultaneously projects to Caliban the role of one who is gifted with innate knowledge and power (because of his possession of his books), and to the reader (and himself) a student—one who has learned and continues to learn and practice—capable of only "rough magic" (5.1.50). Caliban should have more power or authority by virtue of his birth on the island than he does, but any native sovereignty he could claim is surpassed by Prospero's power derived from his art. Knowledge is truly power.

Like the allegorical alchemical texts and the symbolic images associated with them, Prospero's art is partly illusion and metaphor, but with a purpose of creating knowledge. John Dee called this *thaumaturgike*: "that art mathematical which gives certain order to make strange

works, of the senses to be perceived and of men greatly wondered at."[2] The shipwreck, the masque, and the trials through which Prospero forces the island's visitors are all of his own creation in order to bring about a change of heart, a reconciliation, and an education. Elizabeth Spiller believes Prospero's art is a rejection of Aristotelian science and a turning toward experimentation, which would come to define science in the seventeenth century: "[T]he end of Prospero's 'art' is knowledge and, if at the close of the play, Prospero suggests that what has occurred have only been 'happened accidents' (5.1.250), Shakespeare may be emphasizing precisely what it means in the new knowledge culture of early modern England to deliberately and artificially create an accident to simulate reality."[3] This is much like Hamlet's use of The Mousetrap to simulate the death of his father; by the end of which Hamlet hoped to have knowledge of the veracity of the Ghost's claims.

Unable to grow, unable to learn beyond memorization, Caliban remains on the outside of the art, "fixed in an older knowledge order."[4] His intellectual stagnation is mirrored in his inability to reproduce,[5] suggesting that while Prospero's knowledge will flourish in Miranda the old ways represented by Caliban will eventually die out. Spiller believes this difference is evident in the way Caliban talks of the island in Act 3, scene 2:

> Be not afeard. The isle is full of noises,
>
> Sounds and sweet airs, that give delight and hurt not.
>
> Sometimes a thousand twangling instruments
>
> Will hum about mine ears, and sometime voices

---

[2] Mickael Popelard, "Spectacular Science: A Comparison of Shakespeare's *The Tempest*, Marlowe's *Doctor Faustus*, and Bacon's *New Atlantis*," in *The Spectacular In and Around Shakespeare*, ed. Pascal Drouet (Newcastle Upon Tyne: Cambridge Scholars Publishing, 2005), 22.

[3] Elizabeth Spiller, "Shakespeare and the Making of Early Modern Science: Resituating Prospero's Art," *South Central Review* 28, no. 1-2 (2009): 26.

[4] Ibid., 33.

[5] Ibid.

That if I then had waked after long sleep

Will make me sleep again; and then in dreaming

The clouds methought would open and show riches

Ready to drop upon me, and when I waked

I cried to dream again. (138-146)

His deep awareness of the island, while expressed poetically, is indicative of an observer, whereas Prospero can command and manipulate it. "Prospero's art seeks a new order of knowledge, but whatever Caliban knows, he cannot translate his knowledge of the island into either knowledge or power. His curses fall on stony ground, and he creates nothing of his own."[6] When Prospero says of Caliban that he is a "born devil, on whose nature/ Nurture can never stick" (4.1.188-189), he is claiming that it is Caliban's birth—who he is—that prevents him from progression.

In Milan, Prospero was like Caliban; his focus on study and not practice made him vulnerable and weak. He was unable to foresee his brother's usurpation and was powerless to save himself and his daughter from the consequences. As Caliban has "read" his island, Prospero had spent his time reading his books, but did not move toward acting on what he had learned. His knowledge existed separately from his reality. Once on the island, he allows himself to practice what he has learned and to make theory into reality, much as the alchemists used their enigmatic texts to create physical changes in the real world. His knowledge becomes his power in a way that alchemists hoped theirs would.

And yet, when he comes to an accounting of the cost of his power, he finds the returns fall short:

[6] Ibid., 34.

> …I have bedimmed
> The noontide sun, called forth the mutinous winds,
> And ’twixt the green sea and the azured vault
> Set roaring war; to the dread rattling thunder
> Have I given fire, and rifted Jove’s stout oak
> With his own bolt; the strong-based promontory
> Have I made shake, and by the spurs plucked up
> The pine and cedar. Graves at my command
> Have waked their sleepers, oped, and let ’em forth
> By my so potent art. But this rough magic
> I here abjure; and when I have required
> Some heavenly music—which even now I do—
> To work mine end upon their senses that
> This airy charm is for, I’ll break my staff,
> Bury it certain fathoms in the earth,
> And deeper than did ever plummet sound
> I’ll drown my book. (5.1.41-57)

After such an impressive list of his skills, it is interesting that he refers to his art as “rough magic.” Of all the things he has accomplished through his study of his art, he has not been able to repair the wrongs of the past. It is not his practical art that will heal the human relationships, but rather the spiritual art of forgiveness.

The play begins with Prospero seeking revenge on his brother, and ends with forgiveness. And while it has been argued that though his brother does not respond to Prospero’s forgiveness,

thus creating perhaps a lingering tension depending on performance choices, the fact is that the act of forgiveness does not require a response. Prospero created a change in himself when he "pardoned the deceiver" (5.1.325). As John S. Mebane notes, the word "tempest" has an alchemical meaning: "it is a boiling process which removes impurities from base metal and facilitates its transmutation into gold."[7] The spiritual alchemical process has succeeded, and from the flawed person a purer form emerges. Likewise, Prospero's relationship with his brother has also gone through a transmutation, and a healing. Prospero does not kill his brother, as he could have done, but rather forces him (and his companions) into an alchemical tempest with all the inhabitants of the island—an experiment, at the end of which he not only forgives his brother, but also releases Ariel from their toxic relationship and leaves Caliban the island as his rightful inheritance.

The significance of Prospero drowning his books and breaking his staff suggests that knowledge—even ultimate knowledge that brings power over the elements and dominion over living things—is insignificant if one cannot also come to know the human spirit. This thesis has focused on Shakespeare's characters' attempts at knowledge creation through their use of various threads of contemporary scientific methods. Some of these threads are distinct, such as Prospero's book learning, Hamlet's experimentation on Claudius, or Friar Laurence's botanical knowledge. Others are subtler, like the undercurrent of disarrayed nature noted by characters in *Macbeth* and mirroring the actions of the Thane of Cawdor, or Ophelia's deranged preoccupation with flowers as she tries to cure her heartbreak. The science is there and in many more instances not mentioned in this thesis. But the science is merely a tool, not the driving force, behind these characters' actions. The driving force is a deep desire to understand—to know—their world, and

[7] John S. Mebane, *Renaissance Magic and the Return of the Golden Age: The Occult Tradition and Marlowe, Jonson, and Shakespeare* (Lincoln: University of Nebraska Press, 1989), 181.

thereby take control of their lives. In an attempt to find their footing in a sea of shifting ideas, these characters tragically often miss a fundamental anchor: an understanding of human nature, both in others and within themselves. Those who are able to connect with the humanity around them, such as Horatio, Mark Antony, or Prospero, survive. Those who focus on the external, the labels, and the proof, often do not. In a time of ever-changing reality with the exploration of new lands, the discovery of new celestial events, and a deeper knowledge of the workings of the human body, it is likely many people felt as Miranda did when she exclaimed, “O wonder!/ How many goodly creatures are there here!/ How beauteous mankind is! O brave new world…” (5.1.184-6).

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