The Scientific Revolution's Axiomatic Rejection of Magical Thinking: The Case of Astrology in England (1600 – 1700)

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ABSTRACT

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The research presented here will cover the changing perceptions of astrology over the course of the seventeenth century from the height of its popularity to its extinction, with special attention to the non-empirical motivations behind its dismissal by the scientific community. It is the main thesis of this paper that astrology was rejected by the scientific community of the seventeenth century on non-empirical grounds. This will be shown through an examination of the rhetoric of the leading members of the seventeenth-century English scientific community. It would appear from the rhetoric of the scientific elite, and from the historical record of scientific experimentation and correspondence, that astrology was dismissed on non-empirical grounds for two reasons that can be weighted equally in terms of significance. The first of these to be discussed, and the one that will be the main focus of this paper, is that the scientific community was able to take the final step of rejecting the magical paradigm based on a faith in the future potential of the mechanical paradigm to one day provide empirical evidence against the older paradigm. As a caveat it will be suggested that such a decision was made final by the fact that the tenets of astrology were essentially very difficult if not impossible to test by any means available in the seventeenth century.

CONTENTS

INTRODUCTION

The Scientific Revolution of the seventeenth century was undoubtedly one of the pivotal points in the history of Western civilization as it was responsible for the inauguration of popular consensus to the modern empirical approach to understanding the universe. With this achievement duly noted, however, it is also recognized that the leaders of the Scientific Revolution were not always motivated by empirical evidence in drawing many of the conclusions that they made about the natural universe. This becomes clear when, for example, recognition is given to the role played by religion in shaping the paradigms that directed the energies of many seventeenth-century empiricists. In light of the various religious beliefs held by these men, it may be more proper to view them as valiant in their advocacy of a strict empiricism, but not infallible in their attempt to adhere to it. Religion is just one example of non-empirically derived paradigms that guided research during this time however. From Bacon's Neoplatonism and Galileo's Catholicism, to Kepler's astrology and Newton's alchemy it is now widely recognized by historians that there was often much more to the worldviews of the seventeenth century's new breed of scientist than a pure notion of cold mechanization.[1] In turning specifically to England, as is the focus of this paper, it is recognized as well that

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[1] H. Butterfield, *The Origins of Modern Science: 1300-1800* (London: G. Bell & Sons, 1950), 105.; Richard Westfall, "The Role of Alchemy in Newton's Career," in *Reason, Experiment, and Mysticism in the Scientific Revolution*, eds. M.L.Righini. Bognelli & William R. Shea (New York: Science History Productions, 1975), 189-232.

following the Restoration in 1660 the reactions against the extremes of radical sectarianism that drove scientists to adopt caution and moderation in their approach and consensus agreement in their findings were often accompanied by perceptions of the Restoration as divine justification for the Royalist supporters and the Anglican Church, groups from which most of the scientific population was drawn. There were also more general feelings of divine sanctification for the new scientific pursuits as part of God's divine plan to reveal the splendor of his creations. Evidence of this is found in Thomas Sprat's *History of the Royal Society* (1667) where he writes,

> So that even the position of our climate, the air, the influence of the heaven, the composition of the English blood; as well as the embraces of the Ocean, seem to joyn with the labours of the *Royal Society*, to render our Country, a Land of *Experimental knowledge*. And it is a good sign, that Nature will reveal more of its secrets to the English than to others; because it has already furnish'd them with a Genius so well proportion'd, for the receiving, and retaining its mysteries.[2]

This writer, commissioned by England's largest scientific collective, furthermore, asserts that it is the duty of science to seek "a *rational Religion*;" rational yes, though a religion nonetheless. As historian Michael Hunter has noted,

> Sprat's case came together when he argued that since 'a *rational Religion*' was the 'universal Disposition' of the age, the philosophical attitudes and activities of the new science should properly be at the heart of the Anglican Church. He also emphasized that the scientist 'has always before his eys the *beauty, contrivance,* and *order* of *Gods Works*'.[3]

Faith and revelation are the antithesis of empirical validation. Faith can only exist without proof. Once proof is discovered, belief turns into knowledge. Religion, while it

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[2] Thomas Sprat, *History of the Royal Society,* eds. Jackson Cope & Harold Jones (St. Louis: Washington University Press, 1958; London: Routledge & Kegan Paul, 1966), 114-5.

[3] Michael Hunter, *Science and Society in Restoration England* (Cambridge University Press, 1981), 30.

may be quite rational, is nevertheless faith-based, and by definition non-empirical. When attention is given to the religious views of these early-modern scientists, and specifically their faith in the validity of particular cosmologies, it becomes clear that many of the paradigms that directed seventeenth-century scientific research were not entirely free from the charge of being, in part, built on non-empirical ground. It follows then that a history of early-modern science is incomplete if it is uninformed by the history of religion and if attention is not given to the scientists' a priori adherence to other non-empirically derived paradigms.

With this connection in mind, it is the purpose of this paper to shed light on the reasons for one particular conclusion reached by the English scientific community, namely, the intellectual dismissal of astrology. The research presented in this paper will cover the changing perceptions of astrology in England over the course of the seventeenth century from the height of its popularity to its extinction, with special attention given to the non-empirical motivations behind its dismissal by the scientific community. It is the main thesis of this paper that astrology was rejected by the scientific community of the seventeenth century – the very community that established empiricism as the only road to true knowledge – on non-empirical grounds. That astrology was dismissed for non-empirical reasons will be shown in an examination of the rhetoric of the leading members of the seventeenth-century English scientific community.

This paper will begin with a short historical synopsis of the European revival of astrology in the middle ages and its rise in popularity during the renaissance to provide a context and inform the reader about the intellectual and cultural place held by astrology as the seventeenth century began. Specific attention will be given to seventeenth-century

England for two reasons: not only because a large part of the scientific reform took place there, but also because by the seventeenth century astrology was already in decline on the continent due to Papal injunctions and the Inquisition, while in England it would soar to new heights of popularity during the Civil War years of the 1640s. An examination of the rhetoric of the scientific elite will then provide evidence for a general attitude toward astrology that contributed to its downfall. Specific focus will be given to leading members of the scientific community; prominent figures like Francis Bacon, Thomas Hobbes, John Locke, and the spokesman of the Royal Society, Thomas Sprat. Closer scrutiny of the writings of these men and others will not reveal the pure mechanistic thinking one might at first expect from the fathers of modern science, but rather a mixture of empiricism and various strains of religious conviction and contemporary prejudices that all work together to construct complex paradigms that guided their research. The scope of this paper will not allow a thorough, in-depth investigation of the belief systems of individual scientists, but it will allow us to see the complexity in their belief systems and the mixtures that they are. The non-empirical elements that guided these new scientists toward a dismissal of astrology will be examined in more detail, while attention will be given to the larger and more general trend of rejecting magical thinking altogether, within which the rejection of astrology was embedded.

The major reasons for the non-empirical dismissal of astrology will also be discussed. It would appear from the rhetoric of the scientific elite, and from the historical record of scientific experimentation and correspondence, that astrology was dismissed on non-empirical grounds for two reasons that can be weighted equally in terms of significance. The first of these to be discussed, and the one that will be the main focus of

this paper, is the decline in prestige that astrology began to experience about mid-century as a result of its prolific debasement and vulgarization by the popular masses. The second issue, namely, that the tenets of astrology were extremely difficult to test with the methods available to the seventeenth-century scientist, will be briefly discussed as a caveat to this.

With regard to the first issue, Keith Thomas, the prominent historian of early modern English history at Oxford University, has done a thorough job of recording in great detail the rise and fall in popularity astrology experienced during the seventeenth century in England, and such evidence as he has found will be cited here in such forms as records of astrologers' caseloads, almanac publication data, and the prevalence of ridicule and satire.[4] In discussing the conclusion that astrology's vulgarization contributed its downfall, Thomas has chosen not to focus on the negative effects of a massive vulgarization of astrology, but instead to discuss its decline in terms of a proactive attitude on the part of English society, specifically in the form of an excitement and hope for the future generated by the century of advancements and discovery. Thomas concludes that, in the final sense, the cause for astrology's decline was not due to any tangible empirical evidence, but resulted from a general faith in the scientific method, and in doing so he directly opposes Malinowski's theory that religion and magic need to be replaced by concrete and practical technology. He writes that "the change which occurred in the seventeenth century was thus not so much technological as mental. In many different spheres of life the period saw the emergence of a new faith in the

[4] Keith Thomas, *Religion and the Decline of Magic* (New York: Scribner, 1971).

potentialities of human initiative."[5] While he does suggest that new technologies may have contributed slightly to a decline in the use of magical remedies, he points out that for the most part the problems previously addressed with the help of love-potions or astrologers acting as detectives or meteorologists were not eliminated by new and improved cosmetics, police tactics, or methods of weather prediction, but by the hope that the same scientific methods that led to some improvement in these areas would one day devise final solutions to all such problems, and concludes that,

> We are, therefore, forced to the conclusion that men emancipated themselves from these magical beliefs without necessarily having devised any effective technology with which to replace them. In the seventeenth century they were able to take this step because magic was ceasing to be intellectually acceptable, and because their religion taught them to try self-help before invoking supernatural aid. But the ultimate origins of this faith in unaided human capacity remain mysterious.[6]

In simply choosing to report and describe the sequence of events that ended with a "faith in the potentialities of human initiative" as the last step in the decline of magic, Thomas is taking a decidedly phenomenological approach to the history of magic. He chooses to describe the decline of magic, and neglects to explore in depth the reasons as to why history followed this course. He suggests a couple of possibilities: that magic was "ceasing to be intellectually acceptable," and that contemporary religion advocated self-help, however, in the end he takes his leave of the argument saying only that "the origins of this faith…remain mysterious." The scope of his work permitted him only to describe the larger situation, and due its breadth he is forced to move on from there.

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[5] Ibid., 661.

[6] Ibid., 663.

The purpose of this research then is to pick up where Thomas has left off. In the course of this paper evidence will be brought to bear in order to show that Thomas was right in suggesting that society was able to take this final step – a leap of faith – to a belief in human potential as a result of the growing intellectual unacceptability of magic. The focus of this paper will be much narrower in scope, however, and will focus only on one aspect of the magical system – astrology. In keeping the focus on the scientific community, as opposed to the larger society, this paper will use a scaled down version of Thomas' phenomenological approach in order to describe the attitude of the English scientific community toward astrology throughout the course of the seventeenth century by examining their rhetoric, their experimental philosophies, and the various non-empirical elements in their worldviews. In the end, conclusions will be drawn about the reasons for the leap of faith taken from the sixteenth-century scientific esteem for astrology to the eighteenth-century indifference toward it. It will be mainly through the rhetoric of the scientific elite then that we will see that it was the case that the massive popular vulgarization of astrology reported by Thomas soured the scientific community's opinion of astrology to the point where it was not considered worth the effort to attempt any real empirical examination of it. Finally, as a caveat it will be suggested that such a decision was made final by the fact that the tenets of astrology were essentially very difficult if not impossible to test by any means available in the seventeenth century.

CHAPTER 1

THE EUROPEAN REVIVAL OF ASTROLOGY: 1100-1600

Medieval Acceptance: Aristotle, Augustine, & Aquinas

During the centuries between the end of the classical age and the onset of the high middle ages, astrology had become virtually extinct in Europe. This was due partly to the Christian condemnation of astrology through the Church Fathers. This early decline of astrology, however, also coincided with a general decline in learning in the West. After the fall of the Roman Empire, the translation of scholarly writings into Latin declined as well, and with them such works as Ptolemy's *Almagest*, and detailed astronomical tables and instructions that would have helped preserve the practice of astrology.

In the twelfth century astrology began to appear once again in the discourse of European intellectuals as part of the Spanish-Italian revival of classical learning brought about through the translation of Arabic literature. As Latin scholars began to encounter astrology in the classical writings, they were confronted with the inescapable dilemma of how to reconcile the more deterministic philosophies of the esteemed ancients with their own Christian metaphysics. The Christian cosmology, which necessitated beliefs in divine omnipotence, free will, and selective salvation was clearly at odds with the basic tenets of astrology. The root of the problem was that the basic components of the ancient philosophies had already been adapted by early Christian thinkers to fit with their views, for instance Aristotle's idea of a Prime Mover was easily identified with the Christian

model of God, however, the somewhat more marginal aspects of the ancient worldview, like astrology, now presented the medieval clergy with problems. Astrology was laced with difficult metaphysical implications, most notably a reduction of free will. The Aristotelian cosmology was a new and authoritative presentation of the universe that the Christian clergy could not ignore, however. The complete writings of Aristotle were made available to scholars by the early years of the thirteenth century. The arrival of Aristotelian philosophy made it clear to Christian theologians that a rational approach to understanding the natural world was possible, however, there were certain issues that needed to be addressed, or redressed as it were, in greater detail. Specifically, with regard to astrology a compromise needed to be made by Christians if they were ready to accept the authority and validity of Aristotle's ideas as a complete system, for astrology was so imbedded in the Aristotelian canon, even down to pragmatic and mundane issues like his physiology of the four bodily humors, that an outright rejection of astrology would have been impossible. At the same time, however, when applied to questions about individual human destiny, astrology naturally implied a certain degree of determinism, and from this time on it became a much more controversial belief system.

At the heart of the medieval debate was the issue of human free will. One of the most notable scholars to approach the subject was Thomas Aquinas. For help he turns to the established views of St. Augustine, who discussed astrology in his work *The City of God.*[7] Despite Augustine's strong polemics against predictions that imply a reduction of human free will, he can actually be seen to concede to astrology a valid working influence over certain aspects of the material world, including the weather, plants,

[7] Augustine, *The City of God*, trans. Marcus Dods (Edinburgh: T. & T. Clark, 1949), 5.6.

animals, and even the human body. In his *Summa Theologiae* then, Thomas Aquinas in turn adopts and elaborates on this distinction quite readily. He is also quick to draw the boundary of legitimate astrological predictions between sanctioned predictions pertaining to the mundane physical world, and heretical predictions implying any sort of fixed human destiny, which he condemns as the work of an evil intelligence.

> Nor can the stars cause free acts of reason and will; bodies cannot directly affect our mind and will, which are neither bodily nor functions of bodily organs. The stars can cause changes in human bodies, and so influence our sense-appetites, which are functions of bodily organs. So the stars can incline us to certain behaviour; but since, as Aristotle says, our sense-appetites obey reason, man still has a free will to act against the influences of the stars. To sum up then: trying to predict chance events or human behavior from an inspection of the stars is pointless, and leaves one open to the influence of demons; fortune-telling of this kind is superstitious and unlawful. This does not preclude prediction of things which are truly effects of the stars, like drought and rainfall and suchlike. The stars cause changes in our bodies and influence our emotions, and since most men follow their emotions without controlling them, astrologers often get things right, especially when predicting group behavior. But the demons also have a hand in it.[8]

As dubious as Aquinas was with regard to astrology as a whole, in light of Aristotle and on the authority of Augustine he accepted the validity of a correlation between the heavens and the material world, and as a result gave the ancient science a chance to weather the Latin middle ages as a practical guide to farmers, natural scientists, and physicians. Astrology subsequently became legitimized in the eyes of European politicians, and was increasingly practiced in royal courts from this time on, as is attested to by the proliferation of rulers' horoscopes on the continent during the fourteenth century.[9] Frequent examples of its use can also be observed throughout the Hundred

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[8] Thomas Aquinas, *Summa Theologica. English.* ed. Thomas Gilby (Garden City, NY: Image Books, 1969), 11.5; see also I.I.115.4.

[9] Peter Whitfield, *Astrology: A History* (London: The British Library, 2001), 128-130.

Years' War. The acceptance of astrology by great authorities such as Aristotle, Augustine, and Aquinas then, albeit with certain limitations, secured a place for astrology in the greater course of Western history. Though its revival in the high middle ages took place mainly within intellectual and political circles, its popularity among the general masses would begin to rise in time.

Renaissance Ambivalence: Neoplatonism & Pico della Mirandola

The study and practice of astrology became widespread across Europe among independent practitioners beginning in the late fifteenth century as a result of the Italian revival of classical philosophies such as Neoplatonism. In 1471 Marsilio Ficino, working in Florence at the request of Cosimo de Medici, finished his Latin translation of yet another highly esteemed and supposedly antiquated work, the *Hermetica*.[10] This body of mystical literature was attributed to Hermes Trismegistus, a legendary figure often recognized as the Egyptian wisdom god Thoth. Hermes was believed to have lived before Plato and to have predicted the coming of Jesus Christ. His wisdom writings espouse many of the same philosophical ideals as both men, and he began to be revered as a true sage because he was believed to have lived before either of them.[11] Due to the Renaissance proclivity for assigning the utmost prestige to works of ancient origin, the *Hermetica* came to be accepted as an authority of the highest regard, arguably on par with

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[10] Don Cameron Allen, *The Star-Crossed Renaissance: The Quarrel about Astrology and Its Influence in England* (Duke University Press, 1941; reprint, New York: Octagon Books, 1966), 3-4.

[11] Timothy Freke & Peter Gandy, *The Hermetica: The Lost Wisdom of the Pharaohs*, (New York: Peguin Putnam, 1997), 16.

the Bible in the eyes of some. As such, it is one example of the many Neoplatonic works praising astrology that became popular during the Renaissance. Neoplatonism, and its accompanying systems of Hermetic, Orphic, Zoroastrian, Neopythagorean, and Kabbalistic belief became the starting point from which waves of sixteenth-century intellectuals found themselves beginning their search for ultimate metaphysical truth. Because astrology was an integral part of the foundational metaphysics and cosmologies of these works it began to receive a great deal of attention from hoards of amateur intellectuals. It continued to be pursued by more prominent intellectuals and members of the clergy as well, all the while maintaining its place in the royal courts of Europe.

Eventually astrology came to be understood in two different ways, depending on whether it was applied to human destiny or not. Augustine and the medieval Church had tolerated what came to be called *natural astrology*, meaning astrology applied to the natural world, and used for weather prediction, farming, and the like. Human beings, however, were seen as having a more important metaphysical status than the material world and its plants and animals, mainly because they enjoyed free will. When astrology was used to determine human destiny it was given the name *judicial astrology*, because a certain degree of finality or judgement was inherent in predicting the future for individual human beings.

Because of the judicial elements of astrology then, and its tendency to raise controversial metaphysical questions, it continued to be seen as a threat to the cherished ideal of human free will, and as a result began to draw some new heavy criticism. The most comprehensive, and perhaps the most influential of such criticisms was the work of the young Italian scholar, Giovanni Pico della Mirandola (1463-1494), whose polemic,

Disputationes adversus astrologium, was published shortly after his death at age 31. The *Disputationes*, while maintaining a strong emphasis on human free will, was actually an emotionally motivated attack on astrology that, as a number of scholars have pointed out, stemmed from the Christian religious convictions of its author.[12] It is well known that in the years shortly before he died Pico had made his way to Florence and began to receive training from the charismatic Dominican friar, Giorlamo Savanorola (1452-1498), whose preaching at the Basilica San Marco in the early 1490's was inspired by desires to reform the Catholic Church and purge the Christian world of all extant heretical influences. It seems then that Pico, in his writing, set out to do just that. He had a plan to produce a series of seven books condemning the seven great enemy groups of the Christian faith, which for him were: unbelievers, pagans, Jews, Muslims, Laodiceans, heretics, and astrologers. Only the last book in this list was ever written, suggesting the possibility that astrologers were at the top of his list of heretics.[13]

The *Disputationes* can be seen through the eyes of modern scholarship as a comprehensive, but rambling and unorganized summary of traditional criticisms against astrology and astrologers. In keeping with the Renaissance tradition of veneration of the ancients, Pico begins by attempting to exonerate a number of highly esteemed authorities from accusations of believing in astrology, and these include among others, no lesser authorities than Pythagoras, Cicero, Plato, and Aristotle, all of whom were actually advocates of astrology except for Cicero. He also points to the writings of Church Fathers like Tertullian and Augustine as examples of authorities who condemned astrology as

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[12]Allen, 21.

[13] Ibid., 21.

heretical. He places God in direct control of events on earth, denying any indirect divine influence through the medium of heavenly bodies. Along with this appeal to authority, Pico contends that there is no consensus among astrologers with regard to important technical issues in astrology such as house systems, planetary exaltations, or their interpretations of planetary *aspects*, or angular relationships. He claims that astrology is irrational and that it is not based on reason or experimentation. He points to inconsistencies in the predictions of various astrologers about the weather and various historical events. He charges that astrologers are largely ignorant of the true motions of the heavens and that the records and tables they refer to are inaccurate. Pico also brings his own new criticisms to bear, suggesting for instance that the beginning of a human life occurs in the womb and not at the birth of the baby, and that as a result natal horoscopes are necessarily wrong. Likewise, he suggests that the birth of cities begins when people inhabit them and draw up a law code, not at the beginning of their construction. He further asserts that astrologers are wrong to cast horoscopes for kings at their crowning instead of the moment they are acclaimed. He also assumes that the signs of the zodiac and other components of astrology were derived from mythology, and so rejects any associations between the two as absurd. Finally, he proposes that the observed effects of the heavenly bodies on the material world are largely a result of their physical properties, which are nothing more than light, motion, and heat.[14]

Pico actually admits, however, in the course of this last argument, to some of the traditionally accepted 'natural' influences of the heavens, specifically in the areas of farming, navigation, meteorology, and medicine. Although he suggests that the effects

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[14] Ibid., 28.

observed in these cases are the result of the known physical properties of the planets and stars, namely light, motion, and heat. He goes on to deny the possibility that such properties can affect individual people because he claims that they are universal forces that affect everyone collectively who lives in a particular region or climate, just as these properties affect plants, animals, and the weather, and that nothing unknown or occult is at work in this.

Pico's polemical attacks are largely supported by his own anecdotes and testimony, and his work is thoroughly interlaced with satire. Despite the emotionally charged content and motivation behind the *Disputationes* though, the criticism itself seems to be mainly directed toward the actual mechanics and practice of astrology rather than its philosophical or theological implications. It was likely due to this largely pragmatic approach to criticizing astrology, along with the sheer size and breadth of his attack that it became the most common source of reference in the arsenal of critics of astrology for the next two centuries.

Religious Attack & Decline on the Continent

Although Pico's comprehensive attack was widely read, and comprised foundational material for the attacks of most opponents of astrology for centuries to come, it did virtually nothing to keep astrology from flourishing in Europe during the sixteenth century. The debate raged on with numerous well renowned intellectuals arguing for both sides. The major opponents of astrology in these years tended to argue from strong Western Christian perspectives, Catholic as well as Protestant, and employed them in conjunction with arguments drawn from Pico's work.

On the other side of the debate, two types of supporters of astrology have been recognized that were working against the opposition. The majority of these supporters of astrology were conservatives, whose stance was not far from astrology's opponents in that they denounced astrology in its more deterministic or judicial form, while maintaining a belief in natural astrology and in free will. These conservative supporters tended to advocate astrology's usefulness in the usual realms of farming, meteorology and the like.

Intensifying the debate were the less commonly found, moderate advocates of astrology who argued in support of judicial astrology and sought to apply it to social issues and to the lives of individuals.[15] During the Renaissance, though astrology was more popular than ever, just as in the middle ages it tended to be practiced mainly by the educated class, while the opponents of astrology more often than not did come from the less educated ranks of society. Astrology at this time was a professional pursuit, and as such astrologers were generally expected to have met high standards of education in order to be respected by their employers and colleagues. This usually meant proficiency in the sciences of astronomy, mathematics, and often in medicine as well, while according Allen, 'to be an opponent of astrology, one needed only enough Latin to read Pico and abridge his arguments.'[16]

Despite the range in levels of education exhibited by opponents of astrology during the sixteenth century though, there was a relatively high degree of organization among the opposition, which was orchestrated in large part by the Roman Catholic

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[15] Ibid., 99.

[16] Allen, 100; Thomas, 300.

Church. As early as 1327 the Inquisition had begun to enforce the Church's anti-astrology policy by condemning the first victim of the heretical use of astrology to the stake. In Florence in that year Cecco d'Ascoli, a prolific author whose writings instructed practitioners in magical astrology, whereby one could supposedly harness the power of intelligent spirits that inhabited the planetary spheres if actions were taken at the proper times, was burned at the stake for his crimes.[17]

Over the course of the next three centuries the Church would actually fluctuate between policies of toleration and persecution of astrologers though, with some Church leaders even taking an avid interest in astrology. For instance, despite the widespread assault on witchcraft and magic brought about by the Protestant Reformation, and the strong anti-astrology stance taken by Protestant leaders like Luther, Calvin, and Zwingli, we have the example of Phillip Melancthon, who, as dedicated as he was to Luther's ideals for Church reform, never renounced his belief in a valid and divinely sanctioned science of astrology. He was able not only to maintain his devout faith in Christianity, but could combine it with a decidedly judicial view of astrology:

> What is true discipline except the ruling of life, but this is impossible if the distant causes are unknown. This divining art is manifestly necessary to the conduct of life, for it shows what one's natural inclinations are and allows one to exercise one's good qualities and bridle one's vicious instincts.[18]

Arguably though, the majority of representatives of the Christian faith tended to exhibit disdain, or at the very least uncertainty and distrust of astrology, especially in its judicial form. Evidence that the majority of the Church's followers held this attitude can

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[17] Theodore Otto Wedel, *The mediaeval attitude toward astrology, particularly in England* (Yale University Press, 1920; reprint, Hamden, CT: Archon Books, 1968), 75-76.

[18] Wedel, 64.

be plainly seen by noting two public injunctions against astrology produced by the Roman Church. In 1586 Pope Sixtus V issued bull *Coeli et Terrae* which specifically condemned judicial astrology and the casting of horoscopes, asserting that only God and the forces of evil could know the future and that those who claim such knowledge are aided by devils.[19] To add to the confusion though, even the Papacy itself was not wholly innocent of the charge of experimenting with astrology, however. In the early part of the seventeenth century, Pope Urban VIII enlisted the aid of no less an occultist than Tomasso Campanella, whose harmonizing of Christianity and Hermeticism led to his conclusions that Christ was a great magus, and that a utopian society was possible if brought about by a magical reform. The Pope himself was intensely curious about astrology and called on Campenella, after his release from prison for his heretical teachings, to use his magical abilities to protect the Pope from the ill effects of an eclipse that his enemies had predicted would signify his death.[20] Such apostasy on the part of the Pope was short-lived however, for he apparently reversed his views later on, and in 1633 he issued bull *Inscrutibalis*, which elaborated on the 1586 decree by specifically stating that it was now heretical to make astrological predictions concerning the institutions of the Church and the Papacy.[21] It is debatable whether Urban VIII truly renounced his beliefs though, and the obvious may be true: that he was merely protecting himself from forces he believed to be quite real. Indeed, the bull of 1586 even appears to grant validity to astrology in its natural form as well as its judicial form. It certainly did not condemn

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[19] Whitfield, 163.

[20] Ibid., 153.

[21] Ibid., 163.

the practice of using natural astrology as a guide to mundane activities like farming and meteorology, and while it did condemn predictions made about human destiny, it did not deny that they are possible.

The Church's formal condemnation though, backed by the fearful Inquisition, seriously curtailed the further growth of astrology by making an already suspicious science a heretical pursuit in all but its most mundane applications. While astrology had previously been tolerated in the universities as a topic for informal discussion and private study, even these practices came to be frowned upon, and professional astrologers who wished to continue their practices sought refuge elsewhere.[22] In the closing decades of the sixteenth century then, and particularly after the papal bull of 1586, the practice of astrology declined sharply on the continent.

Astrology's Rise in England: 1400 – 1600

The situation in England was the complete reverse of that on the continent. Although astrology was never taught formally in English universities either, and was also regarded with suspicion by the majority of the clergy, it nevertheless began to enjoy a popular reception there during the later half of the sixteenth century. This sixteenth-century renewal in England of interest in astrology, indeed to a level of interest that surpassed that of the middle ages, is attributed mainly to the mathematical revival brought about by the most famous Elizabethan astrologer John Dee (1527-1608), along with the help of Leonard Digges and his son Thomas, both astrologers and

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[22] Ibid., 163.

mathematicians as well.[23] Dee and the Digges's practiced and advocated rigorous mathematical calculations in the study of astronomy as it applied to astrology, and in doing so raised the standard for the English astrological community from that time on. John Dee was a long-time consultant of Queen Elizabeth I, and was commissioned for everything from the proper time for her coronation in 1559 to drawing an accurate map of the world in 1580.[24]

Although England had its fair share of astrologers during the middle ages, evidence for the practice of astrology in England during the fifteenth century and through the first half of the sixteenth century is scant.[25] This is probably due to a series of notable conflicts between the English monarchs and astrologers during these years that may have fostered a general reluctance on the part of those generations of intellectuals to get involved with it. Apart from the possession of a text here and there by a few rulers who were notably ambivalent toward it, and its use by their military and political strategists during the Hundred Years' War, astrology was virtually non-existent in England during the century or so before the reign of Henry VIII. The few scattered examples of astrologers who lived in England during the fifteenth century are of itinerant immigrants.[26] Henry VIII brought astrologers back into his court once again, and even protected them from clerical censorship.[27] However, virtually none of the general

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[23] Thomas, 288.

[24] Whitfield, 167.

[25] Thomas, 288.

[26] Whitfield, 130; Thomas, 288; Allen, 101.

[27] Thomas, 289.

population would become interested in astrology for some time. The study of astrology required a knowledge of Latin and other foreign and ancient languages until at least the mid-sixteenth century. Indeed, as late as 1560 William Fulke, an outspoken opponent of astrology, would still claim that most astrologers were also physicians, suggesting a class of educated men.[28] Apart from a few new vernacular publications during the reign of Elizabeth I then, the lay populace had little first-hand access to astrology writings until the Interregnum of the 1650s, during which time a veritable flood of vernacular publications inundated the land.[29] The revival of astrology in England then, began during the reign of Elizabeth I with Dee and the Digges's, but was practiced at first mainly among the upper classes, only slowly trickling down to the rest of society. Such was the state of astrology in England at the beginning of the seventeenth century.

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[28] Ibid., 300.

[29] Ibid., 288-9.

CHAPTER 2

AMBIVALENCE IN SEVENTEENTH-CENTURY ENGLAND

The Rise to Unprecedented Popularity

The early decades of the seventeenth century were a relatively peaceful time for English astrologers. Although much of the populace was as ambivalent as usual towards astrology, or at least wary of its status as a grey area of human knowledge, it was also generally accepted as a valid system for acquiring knowledge. There were of course counterfeits and pretenders, such as the notoriously controversial figure of Simon Forman (1552-1611), an uneducated opportunist and womanizer who profited from his career as a pseudo-physician/astrologer/alchemist and was routinely in trouble with both the Church and the College of Physicians for practicing medicine without a license.[30] For the most part though, astrology simply did not enjoy the widespread popularity outside of the ring of its learned professionals and their regular clients that it would during the Civil War and the Interregnum, nor was it the subject of intense controversy and ridicule that it would become throughout the later half of the seventeenth century. These early decades were a period of slow, steady growth for astrology during which its dedicated practitioners quietly prospered and continued to gradually reach out to an ever-widening circle of clientele. In those early decades of the seventeenth century then, astrology's popularity was clearly on the rise, and even dilettantes like Forman did quite well. Keith

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[30] Whitfield 171; Thomas, 305.

Thomas has estimated that between 1597 and 1601 Simon Forman was calculating over 1,000 astrology charts a year to answer various questions for clients.

By mid-century though the market had grown tremendously. The most famous of the English astrologers, William Lilly (1602-1681), recorded a caseload that nearly doubled that of Forman's, calculating close to 2,000 charts per year.[31] A further indication of the unprecedented growth of astrology during the Civil War years of the 1640s is the increasing number of almanacs that were published. Almanacs contained a great deal of information (e.g., recipes, maps, gardening tips) of which astronomical events and astrological prognostications or *forecasts*, were a large part. Some even included planetary *ephemerides*, or tables listing the daily positions of the planets in the zodiac, which made it possible for just about anyone to cast charts. Although foreign almanacs had been imported and circulated in England throughout the sixteenth century, these began to be replaced starting in 1545 with the first publication of an English almanac. Thomas has estimated that at the turn of the century there were close to 600 different almanacs in print in England, and that over the course of the seventeenth century nearly 2,000 almanacs had been published by about 200 different authors. William Lilly's almanac, *Merlinus Anglicus*, was by far the most popular, and it is estimated that in 1646 approximately 13,500 copies were printed. That number rose to 17,000 copies in one year. By 1648 around 18,500 copies were being circulated, and in the year following that Lilly had 30,000 copies printed. The total number of copies

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[31] Thomas, 307.

printed between 1646 and 1660 is estimated at between three and four million – a number of sales greater than the all-time number-one bestseller to that date – the Bible.[32]

This period also marks the advent of the publication of the first comprehensive instructional guides to astrology in the English vernacular.[33] It is quite likely that the anxieties brought about by the Civil War caused interest in astrology to increase due to the reassurance it brings through knowledge of the future. However, it is debatable whether it was the war or simply the sheer amount of information on astrology that had suddenly become available in the vernacular and written for the layman that contributed in the long run to astrology's continuing vogue throughout the second half of the century. Greater availability, of course, coincided with improvements in printing technology and a growing demand for published works in general. In either case, this surge of popularity to an unprecedented level is quite likely the reason for a new and extremely vigorous anti-astrology attitude and its accompanying satire that flourished in these years as well.

The Vulgarization of Astrology in England

Before approaching the subject of astrology's loss of prestige in the later half of the seventeenth century, it should be noted that hostility towards it had been a common feature of the English public mind since its rise to popularity in the Elizabethan period. Traditionally, of course, certain intellectuals had held anti-astrology attitudes since the time of the early Church Fathers. From the time of Elizabeth I however, satire and disdain had become a feature of the popular mind as well. From theatrical satire in

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[32] Ibid., 295.

[33] Ibid., 289.

Shakespearean plays,[34] to William Lilly's own lament during the height of his popularity in 1645 that "the citizens of London make small reckoning of astrology,"[35] it seems that a tradition of criticism had always accompanied any popularity it received. As a result, when its popularity rose to astronomical levels at mid-century, the tradition of criticism rose to new heights right along with it.

The root cause of astrology's loss of prestige in the seventeenth century had less to do with its critics than from the damage done to its reputation by opportunists and abusers. Criticism of astrology has historically been born out of a fearful reaction to a little understood system that threatened the human freedom of will, however, because its rise in popularity at mid-century was accompanied by the proliferation of this new breed of charlatan practitioners starting in Tudor England, criticism can also be seen as a symptom of its perceived vulgarity. Beginning in the Tudor period, astrology was no longer a science of learned, but became an open and unregulated profession. The growing range of ethics exhibited by practitioners of astrology in England following its Elizabethan renaissance is attested to in comments like those of Reginald Scot, who in his treatise *Discoverie of Witchcraft* (1584) wrote of astrologers that "though there be many of them learned and godlie, yet lurke there in corners of the same profession, a great number of counterfets and couseners."[36] And while Christopher Heydon in his *Defense of Iudicial Astrologie* (1603) pointed out that historically astrology had not "much conversed at any time with the mean and vulgar sort, but...hath been ever most familiar

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[34] William Shakespeare, *A Midsummer Night's Dream*, 3.1; *Henry IV*, 1; *King Henry VI*, 1.

[35] Thomas, 355.

[36] Reginald Scot, *Discoverie of Witchcraft* (London, 1584), 171.

with great personages, princes, kings and emperors," the famous astrologer Elias Ashmole would write a grievance in 1652 criticizing the "divers and illiterate professors" of astrology that discredited his science.[37] Keith Thomas, while noting that the majority of astrologers during the Tudor period were educated and sincere, also points to the presence of "a large, though indeterminate, number of low-level consultants scattered throughout the country," that he classifies as "village wizards," who were unable to read the formal instructional treatises on astrology.[38] There are even cases where the ethics of the highly placed and most trusted astrologers have been questioned. Historian D.C. Allen writes of the famous John Dee, confidant of Queen Elizabeth, that although he was "learned, unquestionably pious, and an experimenter of immense callidity, Dee was, nonetheless, ready to be fed by the great for labors that were distinctly of a swindling nature, and until a judicious account of him appears, he must be considered as more sincere but not too far above the lower order of prognosticators."[39] Allen also gives a good account of some of the more prominent charlatans that pretended to be professional astrologers during the Tudor period. He refers to the notorious Simon Forman for instance as an "astrological quack," and a "marvelous rogue" who was "the closest approximation to Don Juan that the Elizabethans knew."[40] Allen mentions astrologer John Lambe, who was arrested multiple times for "malpractices," and who succeeded in manipulating the Duke of Buckingham, eventually getting killed in a street fight. Lambe,

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[37] Thomas, 302-303.

[38] Ibid., 300-303.

[39] Allen, 105.

[40] Ibid., 105.

he notes, was later made infamous in popular ballads and in "the literature of roguery."[41]

Without going into further detail, Allen writes that,

> Far below them [i.e., the notorious charlatans] in both wit and foul dealing was a great mass of petty rascals, predaceous off-scourings who patrolled the by-lanes and holed in the alleys. The names by which they were known – Edward Alavantrevor, David Upan, John Uprobert – have all the characteristics of an alias, and one suspects that they were no better than they sound or than the English opponents of astrology say that they were.[42]

Clearly then the reputation of astrology as a profession and astrologers as respectable citizens had been difficult for the honest professionals of Tudor England to maintain in the face of competition from charlatans and opportunists who abused the science for their own ends. With the rise in popularity in the 1640s evidenced by the growing caseloads and increase in almanac publications, the laments of learned astrologers like Elias Ashmole and William Lilly who complained respectively of the proliferation of "divers and illiterate professors" and of the "small reckoning of astrology" can be taken quite seriously.[43]

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[41] Ibid., 105.

[42] Ibid., 105.

[43] Thomas, 302-303; 355.

CHAPTER 3

THE ATTITUDE, BACKGROUND, AND ROLE OF THE SCIENTIFIC ELITE

Due to the rise in prevalence of this lower order of astrologers, a distinctly negative bias toward astrology was adopted by a significant percentage of the English population by mid-century. The question then becomes whether such an attitude could be adopted by early-modern scientists as well, and the possibility of such a bias is an important and highly relevant question in light of the exuberant esteem for the merits of empiricism that defined the Scientific Revolution. It is the main thesis of this paper that a negative bias was present in the minds of leading thinkers of the Scientific Revolution, that an a priori rejection of astrology and magical thinking in general was a necessitated by their adherence to a larger paradigm, and that evidence of this is found in their rhetoric. It may be surprising to some that such a contradiction existed in the minds of men who claimed to be leading a revolution that was founded upon a shift to the need for empirical evidence in decision making, however, two things should be kept in mind as we approach the issue of such a contradiction.

The Defense of a Paradigm Shift

First of all, the scientists of the seventeenth century believed that magical-associational thinking was the direct antithesis of empiricism. The term magical-associational thinking refers to the worldview that allowed for sympathetic magic, and it

assigned connections between things based on observed similarities in their aesthetic characteristics. For example, gold was associated with the sun because they both share a yellow color. Associational thinking was both the most common and most traditional form of viewing the universe until the Scientific Revolution, and it is true that its standards were less than empirical, in that it demanded little consensus or sterile experimentation. It is also true that historically, association-making has often been used unscrupulously by opportunists who knew full well they did not have a valid understanding of the system but pretended to have authority in order to make coin. Hence, it is no surprise that astrology was often regarded by seventeenth-century empiricists as arbitrary and whimsical. The empiricists saw it as an out-dated competitor of the mechanical paradigm, and due to its prevalence and imbeddedness there was an emotional component involved in the scientific disdain for it whereby the scientists, who were a small minority of the population – indeed, a minority even within the intellectual community – naturally felt defensive of their new approach in the face of this tradition. This is quite apparent in the notable seventeenth-century defenses of science to the scholastics and occultists that were written like Joseph Glanvill's *The Vanity of Dogmatizing* (1661), and *Plus Ultra* (1668), and Thomas Sprat's *History of the Royal Society* (1667). These were works of propaganda for science. This was a period of revolution, and these scientists were battling for a cause they believed in to the end. Not only was society saturated with occult beliefs, but the majority of the learned at this time were actually opposed to science, favoring tradition, Aristotle, and scholastic reasoning.[44]

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[44] Martha Ornstein, *The Role of Scientific Societies in the Seventeenth Century*, 3rd ed. (Chicago: University of Chicago, 1938; reprint, London: Archon Books, 1963), 131.

The full title to Glanvill's 1668 work says more: *Plus ultra; or, the Progress and Advancement of Knowledge since the days of Aristotle. In an Account of some of the most remarkable late improvements of Practical, Useful Learning: To Encourage Philosophical Endeavours. Occasioned by a Conference with one of the Notional Way.*[45] This work was an elaboration on Sprat's defense of the Royal Society in his *History*, which had been published a year earlier. Sprat devoted the entire first third of his book to defending the merits of the Royal Society to the scholastics and occultists, which is summarized in the "compass of design":

> Their purpose is, in short, to make faithful *Records*, of all the Works of *Nature*, or *Art*, which can come within their reach: that so the present Age, and posterity, may be able to put a mark on the Errors, which have been strengthened by long prescription: to restore the Truths, that have lain neglected: to push on those, which are already known, to more various uses: and to make the way more passable, to what remains unreveal'd. This is the compass of their Design. And to accomplish this, they have indeaver'd, to separate the devices of *Fancy*, or the delightful deceit of *Fables*. They have labor'd to inlarge it, from being confin'd to the custody of a few; or from servitude to private interests. They have striven to preserve it from being over-pres'd by a confus'd heap of vain, and useless particulars; or from being straitned and bounded too much up by General Doctrines.[46]

Such criticism of traditional knowledge drew virulent attacks from members of the learned establishment, one notable example being the attack of Dr. Henry Stubbe, a physician who titled his book, *A censure upon certain passages contained in the History of the Royal Society as being destructive of the established Religion and Church of England.*[47] Glanvill responded to Stubbe in turn in 1671.[48] Arguments in this sort of tit-

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[45] Ornstein, 275.

[46] Sprat, 61-62.

[47] Ornstein, 132.

for-tat fashion were common between the scientists and the traditionalists in the established system of education. It should be noted here too that these defenses of science also include criticism of the unorganized, independent practitioners of occult sciences who rarely responded in like fashion, if indeed they were ever even aware that this new growing establishment was attacking them. The scientists were fighting a battle against two enemies then, revolting against both the traditional scholastic system which was "bounded too much up by General Doctrines," and the tradition of independent practitioners involved in occult association-making, a system in which "devices of *Fancy*," and the "deceit of *Fables*," were under the "custody of the few," and served "private interests." In short, the Scientific Revolution was just that, a revolution, and due to the minority status of its proponents, it can be seen as taking a decidedly defensive stance that was often quite emotionally charged. That such emotion was left unchecked is understandable in light of the second component in their revolutionary psychology.

The second thing to consider as we approach the possibility of an *a priori* rejection of magical thinking by the empiricists is that we should view the Scientific Revolution as a formative time in a period of dialectical shift during which magical thought was only slowly being replaced by a relatively new system of thought. René Descartes (1596-1650), was instrumental in popularizing the idea of the mechanical universe, which soon became the foundational paradigm for modern science. The Cosmic Vortex Theory proposed by Descartes, whereby cosmic vortexes, or "whirls of water" pull and shift everything in the cosmos from the planets and stars to light and heat, was accepted by both amateur scientific virtuosi as well as prominent scientists quite readily,

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[48] Ornstein, 275.

and was even adopted into university curriculums with relative ease compared to Kepler's complex laws for instance, which took considerably more time to gain approval.[49] The mechanized functioning of the universe applied to all terrestrial phenomena as well, right down to the human being. His treatise, *l'Homme* (withheld from publication after Galileo was condemned), is considered the first modern physiology text. The relatively swift acceptance of Descartes' idea of a completely mechanical universe by the European scientific community of the seventeenth century is actually quite surprising, because his method for determining such truths was wholly deductive. Descartes proposed no mathematical data, observations, or measurements whatsoever to back up his theory. It came to be regarded as scientific dogma based on its appealing plausibility.

It can be observed then that empiricism had not yet been stretched and applied to every aspect of decision-making, and in particular no scrutiny was made of the foundational mechanical paradigm from within which the ideals of empiricism were being applied to the outer world. Paradigms invariably contain a great deal of metaphysical assumptions that cannot be tested. Often, in order to have any foundation at all a scientist must extrapolate beyond that which can be observed in order for research to move forward. Problems arise, however, when assumptions that can be tested are not, and are instead adopted unconsciously. This is particularly common with the appearance of revolutionary paradigms that are so astounding that they are adopted whole-heartedly without scrutinizing the minutia, particularly when the minutia seem to be blatant and obviously true. In the case of the Scientific Revolution, the scientists felt they owned the

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[49] Ornstein, 47-48.

truth and that the occultists were wrong simply because their was no mechanical explanation for their beliefs. This was a case of paradigm shift, and many components of new paradigms are not examined before being adopted can be shown in the following way.

Thomas Kuhn, in *The Structure of Scientific Revolutions* defines paradigms as being unshakable in their core assumptions, allowing only "further articulation" of that one fixed foundation. He writes,

> To see how this can be so, we must recognize how very limited in both scope and precision a paradigm can be at the time of its first appearance. Paradigms gain their status because they are more successful than their competitors in solving a few problems that the group of practitioners has come to recognize as acute. To be more successful is not, however, to be either completely successful with a single problem or notably successful with any large number. The success of a paradigm – whether Aristotle's analysis of motion, Ptolemy's computations of planetary position, Lavoisier's application of the balance, or Maxwell's mathematization of the electromagnetic field – is at the start largely a promise of success discoverable in selected and still incomplete examples. Normal science consists in the actualization of that promise, an actualization achieved by extending the knowledge of those facts that the paradigm displays as particularly revealing, by increasing the extent of the match between those facts and the paradigm's predictions, and by further articulation of the paradigm itself.[50]

By "normal science" Kuhn is referring to what he says constitutes the majority of scientific research today as well as historically, and that indeed these "mopping-up operations are what engage most scientists throughout their careers."[51]

> Closely examined, whether historically or in the contemporary laboratory, that enterprise seems an attempt to force nature into the preformed and relatively inflexible box that the paradigm supplies. No part of the aim of normal science is to call forth new sorts of phenomena; indeed those that will not fit the box are often not seen at all. Nor do scientists normally aim to invent new theories, and

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[50] Thomas Kuhn, *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press, 1962), 23-24.

[51] Ibid., 24.

> they are often intolerant of those invented by others. Instead, normal-scientific research is directed at the articulation of those phenomena and theories that the paradigm already supplies.[52]

Kuhn's observations were made from the time of the Scientific Revolution forward, beginning with the replacement of the Ptolemaic, geocentric universe by the Copernican heliocentric one. His analysis however, of the common features of paradigm shifts, is based on observations of what occurs when one scientific paradigm is replaced by another scientific paradigm. In order to apply Kuhn's theory to *the* Scientific Revolution's replacement of magic with mechanics in the seventeenth century, it must be shown that the widespread adoption of the mechanical paradigm was also a shift from one scientific paradigm to another. In other words, it must be shown that there was in fact a general scientific paradigm of some sort in place before the advent of empiricism. That this was so becomes clearer if we closely observe the actual traditional occult practices that fell into disfavor at this time. Strictly speaking the occult practices can be seen as sciences, in that their fundamental principles had been based on observations, however unsystematic, of natural phenomena. It can be shown too that the empiricists themselves regarded these practices as sciences, albeit rudimentary sciences that were arguably invalid. Francis Bacon, the eminent Father of Empiricism, referred to magic, alchemy, and astrology as "sciences," and wrote that while their ends are "noble," they are also "full of error."[53] Now, in order to say that the occult sciences formed an actual, unique paradigm of their own it must be shown that they were linked somehow, and particularly in some way that was at odds or distinct from the empirical paradigm. That this plethora

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[52] Ibid., 24.

[53] Francis Bacon, *Of the Advancement of Learning,* ed. G. W. Kitchin (London: J.M. Dent & Sons, *n.d.*), 1.3.11; 29.

of occult sciences constituted a paradigm is less obvious because of the sheer variety of different pursuits and unaffiliated individual practitioners, and the general lack of consensus agreement, even *within* a particular field like astrology. If we focus however, on the common belief in a *sympathetic universe* that is found across all occult sciences, then we can start to see the paradigm that was replaced by empiricism. If we look closely at the theories and tenets of practices like magic, alchemy, and astrology, we can see in each of these a fundamental belief in the existence of *sympathy* on a cosmological scale, whether it is an association between rituals and the cosmos, chemicals and the cosmos, or the cosmos and humanity.

Returning to Kuhn's theory of paradigm shift then, we can see that he makes two important points regarding paradigm shifts. First of all, he emphasizes the importance of anomalies or 'crises' that arise that cannot be explained by the older paradigm, and cause it to be seen as inadequate. Thus he says that failures and shortcomings of the older paradigm are necessary preconditions for a paradigm shift to take place. These failures force the search for a new, more adequate paradigm. The second point he makes is that once a new paradigm has been constructed that does a better job of explaining things, it is virtually always necessary to adopt the new paradigm wholeheartedly, even if it also has shortcomings. The key to understanding this is that there is rarely, if ever, complete perfection on the grand scale at the level of the working paradigm, and so it is usually necessary to choose the *best* paradigm to work within. Once again, it is helpful to review Kuhn's observations.

> Paradigms gain their status because they are more successful than their competitors in solving a few problems that the group of practitioners has come to recognize as acute. To be more successful is not, however, to be either completely successful with a single problem or notably successful with any large number.

> The success of a paradigm...is at the start largely a promise of success discoverable in selected and still incomplete examples.

Turning then to the issue of the empirical sciences replacing the sympathetic sciences, we can now see that while one does indeed have to assume that there were shortcomings with the pre-mechanical, occult approach to understanding the natural world, it does not necessarily have to be the case that those shortcomings had anything to do with a failure or invalidation of occult beliefs themselves – perhaps the problem was with what they did not address. In other words, if the "few problems" that the intellectual community had "come to recognize as acute" had nothing to do with the problems astrology addressed for instance, and required an entirely different approach to measure, then astrology, or its paradigm could be rejected, not because it was invalid, but simply because it could not be applied to this new acute problem. In the seventeenth century, precise information about the natural world was sought - the concrete, the tangible, the observable. The systematic collection of this type of information about the natural world was seen as practical knowledge to the empirical scientists, and practical was desirable. These were the areas of interest outlined in Bacon's program for a scientific utopia called the "House of Salomon," which called for the study of all things mechanical, or observable through the senses:

> ...refrigeration, insulation, motion, infusions, grafting and inoculating, heat, lights and radiations, magnitudes, motions, helps for the sight, spectacles and glasses, relflexions, refractions, fossils, sounds, harmonies, perfume houses, smells, practices of taste, engines, ordnance and instruments of war, flights, ships and boats, clocks, geometry, astronomy...[54]

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[54] Francis Bacon, "House of Salomon," Appendix to *The Role of Scientific Societies in the Seventeenth Century*, Ornstein, 264-270.

The mechanical paradigm was highly successful in providing the scientific community with an understanding of these types of things. The occult's sympathetic paradigm was not helpful. Therefore it is theoretically possible that the sympathetic paradigm could have been replaced for its failure to solve certain problems, even if it had been seen to fall short of its own claims of destiny, personality, and the like – those were simply unverifiable.

So then, if it was decided that the universe was mechanical, *and* that traditional occult associations such as correlations between planetary positions and personality could not be articulated or explained within the mechanical paradigm, the rejection of them became axiomatic. The certainty that an empirical exploration of a mechanical universe was the better paradigm, with the added elements of the scientific community's minority status and their significant competition with what they saw as a decidedly vulgar worldview, led to the scientific community's axiomatic rejection of magical thinking. This entailed the rejection of all occult associations made before the onset of empiricism without testing them. Such concepts were axiomatically false by default, and were ignored altogether. In historical terms all of this suggests that such a reaction was quite likely often an emotionally charged reaction in that associational thinking was not only seen as vulgar, being practiced by quacks in the back alleys of London and in a slightly different form in the ivory towers of Cambridge and Oxford by the stalwart scholastics, but it was widespread and dominant, and as such was in direct competition with the mechanical paradigm.

There is evidence for a highly confident, and emotionally defensive reaction of the empiricists to the idea of a valid but unobserved, untested, and seemingly unrelated

co-relationships in the natural world. This attitude manifested itself in their written polemics against this type of thinking. What we will see in the writings of early modern scientists are frequent examples of arguments that adopt an editorial style with a persuasive end. Before we turn to the rhetoric of the scientific community, however, it is first necessary to understand a little about the social background of that community in terms of its context and roles, and most importantly, the people who constituted the community, who they were, and where they came from.

The Demographics of the Scientific Community: Social Background & Education

In order to get a feel for the general demographics of the post-Restoration scientific community, Michael Hunter examined representative samples of late seventeenth century scientists and calculated the percentages of the various social backgrounds from which they originated.[55] These calculations reveal, in descending order by social status, that 40 percent of late seventeenth-century scientists – the majority – were from aristocratic, land-owning families, while 23 percent were second-generation clergy, and 5 percent were other types of professionals. Another 12 percent were from the merchant class, and artisans made up the lowest 14 percent. Finally, 6 percent were of unknown origin. This reflects the economic disparity of the times, in that the 63 percent majority representing the aristocracy and clergy in turn represent less than 6 percent of the population. The education tended to be rather uniform as well, with 75 percent of

[55] Hunter, 60.

these men having attended either Cambridge or Oxford universities, while only 6 percent were trained at other institutions.[56]

The Role of the Royal Society & the Universities

The cutting-edge scientific community in post-Restoration England was mainly centered around the newly formed, London-based Royal Society, which was essentially a scientific club for interested gentlemen that arose from the informal gatherings of a group of men at Oxford University in the 1650's.[57] While the advances and discoveries that characterized the Scientific Revolution were usually based on the achievements of individual scientists acting on their own, the intellectual body that was the consensus for sanctioning those discoveries were the members of the Royal Society. The university faculties tended to focus on pedagogy and maintained the status quo in their curriculums. That is not to say that individual professors were not responsible for revolutionary advances, certainly Newton, Boyle, and others, were employed at universities. However, when great discoveries were made, whether in a university laboratory or in the scientist's own home – where Newton for instance discovered the spectrum of light – they were first brought to the attention of the Royal Society rather than the university faculties, who despite the occasional exception, were generally seen

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[56] Ibid., 60-61.

[57] Margery Purver, *The Royal Society: Concept and Creation* (London: Routledge and Kegan Paul, 1967), xi-xvii.

as bastions of traditional Aristotelian and scholastic philosophies. In any event, the university was mainly an institution of education, while the Royal Society was dedicated to information dissemination and scientific correspondence. Two years after its official establishment in 1662 the Society began to publish its own monthly scientific journal, *The Philosophical Transactions*, as an ongoing summary of important discoveries and discussions. New discoveries were eventually incorporated into university curriculums after being first established by the Royal Society as valid, but this took time. Prior to the establishment of the Royal Society though, university curriculums tended to focus only on Aristotelian ethics, politics, economics, logic, physics, and metaphysics, along with Latin, Greek, and Hebrew. Following the inception of the Royal Society in the 1660's, however, these curriculums began to include chemistry, mathematics, astronomy, botany, and anatomy.[58]

[58] Ornstein, 248.

CHAPTER 4

THE RHETORIC OF THE SCIENTIFIC ELITE: FRANCIS BACON, THOMAS HOBBES, JOHN LOCKE, AND THE ROYAL SOCIETY

Francis Bacon: The Father of Empiricism

The most influential force in the shift from the use of magical-associational reasoning to the use of experimentation in early modern science was Francis Bacon (1561-1621), writing in the early decades of the seventeenth century. Previous advances, such as the telescopic discoveries of Galileo in 1609, undoubtedly had a hand in instilling a mechanistic worldview on the popular mind, however, it was Bacon who called for an outright revolution in our direct attempts to measure and understand nature. In his own words he called for "a total reconstruction of sciences, arts, and all human knowledge, raised upon the proper foundations."[59] This call was for the advent of empiricism, or the use of the controlled, observable, and replicable measurement when gathering information about the natural universe.

Prior to the adoption of a mechanistic worldview and rigorous empirical methods in scientific exploration, humanity sought correlations in nature and assigned a deep significance to observed similarities in the accidental qualities of objects or events. This is the type of associational thinking that characterizes sympathetic magic. Correlations were often posited without the observance of any concrete, physical connection.

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[59] Francis Bacon, "The Great Instauration: Proemium,"in *European Science in the Seventeenth Century*, ed. John Redwood (London: David & Charles, 1977), 19.

Heavenly phenomena and historical events, for instance, were correlated with each other based on similarities in their accidental characteristics, and many of these co-relationships between celestial events and mundane events had achieved a strong traditional and authoritative status by the seventeenth century, and stood without any concrete record of evidence. This is how the sciences of alchemy and astrology functioned. In astrology for example, if the moon were passing through a particular zodiac sign, for instance the fire sign of Aries – a name shared with the ancient god of war, the celestial event would signify the manifestation of earthly events associated with that sign and its fiery, warlike nature. The moon, historically, as well as in astrology, represented the constructs of femininity, receptivity and emotion. Astrology saw it as something like a barometer for a kind of emotional weather that affected everyone. When passing through the sign of Aries such an event was interpreted as signifying a period of fiery, energetic self-assertion as a temperament for the general populace. The psychologist Carl Jung would later call such phenomena, clusters of archetypal events that have an acausal (i.e., non-causal) co-relation. Whether or not such traditional associations may actually have been built on rudimentary forms of observation over the course of astrology's history is irrelevant here though. By early modern times the basic premise that correlations could be deduced by observing similarities in accidental qualities was such a certainty that observations were not being conducted in any systematic fashion, and new associations were being drawn whimsically. This is exactly the kind of associational thinking that Francis Bacon sought to eradicate in his *Novum Organum* or *Instauratio Magna* (The Great Instauration; 1620) when he wrote that,

> The primary notions of things which the mind readily and passively imbibes, stores up, and accumulates (and it is from them that all the rest flow) are false,

> confused and overhastily abstracted from the facts; nor are the secondary and subsequent notions less arbitrary and inconstant; whence it follows that the entire fabric of human reason which we employ in the inquisition of nature, is badly put together and built up, and like some magnificent structure without any foundation.[60]

Again, in a more direct attack on this type of magical thinking in *The Advancement of Learning* (1605), Bacon wrote that,

> The sciences themselves, which have had better intelligence and confederacy with the imagination of man than with his reason, are three in number; astrology, natural magic, and alchemy: of which sciences, nevertheless, the ends or pretences are noble...but the derivations and prosecutions to these ends, both in the theories and in the practices, are full of error and vanity.[61]

These are strong words. They directly reject the validity of the prevailing associational type of deductive reasoning in Bacon's day, and they are principled – not based on empirical evidence. That any direct formal experimentation was yet to be done by Bacon's community on such sciences as astrology is evident in Bacon's call for future examination, and what he a priori believed would be a subsequent reduction, or "purification" of astrology. He in fact believed that there was some validity to natural astrology, though he expected empirical examination to prune away anything in astrology that was directed toward individuals or that limited free will. In the *Advancement of Learning* he wrote:

> As for astrology, it is so full of superstition that scarce anything sound can be discovered in it. Notwithstanding, I would rather have it purified than altogether rejected. I do not hesitate, to reject as idle superstition the doctrine of horoscopes and the distribution of houses, which is the very delight of astrology...the doctrine of nativities, elections, inquiries and the like frivolities, have in my judgement for the most part nothing sure or solid, and are plainly refuted and convicted by physical reason.[62]

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[60] Ibid., 18-19.

[61] Bacon, *Advancement*, 1.3.11; 29.

[62] Whitfield, 167-168.

There is a fundamental contradiction here with Bacon's insistence on empirical methods in conclusion making. That the judicial elements, or "frivolities" of astrology are "plainly refuted" by reason is an argument from an a priori belief, or a deduction. Reason in this sense means common sense or logic, and in this case Bacon's own 'judgment,' which is exactly the opposite of what he so strongly argued for, namely, *induction*, or strictly empirical observation. Bacon contradicts himself by dismissing the judicial elements of astrology on principle, with plain reasoning alone. He uses the term "physical reason" but this cannot mean physical evidence, for the tenets of astrology – and especially judicial astrology – were never subjected to empirical scrutiny in the seventeenth century. Where is the empirical evidence for the inefficacy of these systems of association that Bacon insists is "the proper foundation" for drawing conclusions about the natural world? Apparently it was so "plainly" obvious that judicial astrology lacked validity that empirical evidence was not needed before a conclusion was drawn. Bacon obviously had an a priori idea of what is real and what is not before he made this call for purification, because in it he actually suggests specific areas of nature that it is worthwhile to observe. What happened to the inductive method of allowing nature to tell us what is valid and what is fruitless to explore? Indeed, if induction was the most dearly held principle that Bacon avowed than there must have been a very powerful motivation for the father of empiricism to reject a general paradigm before observation. We get a glimpse of a possible motivation when we examine another set of his statements regarding the more general Neoplatonic idea of the human being as a microcosmic reflection of the macrocosmic universe.

> The ancient opinion that man was *microcosmus*, an abstract or model of the world, hath been fantastically strained by Paracelsus and the alchemists, as if there were to be found in man's body certain correspondences and parallels, which should have respect to all varieties of things, as stars, planets, minerals, which are extant in the great world. But thus much is evidently true, that of all substances which nature hath produced, man's body is the most extremely compounded.[63]

Bacon goes on to argue at length that the macrocosm-microcosm theory is too simple to account for the complexities of human anatomy, and that that the complexity of human anatomy is evidence in itself that there could be no correlations between the human body and the universe. Bacon again uses deductive reasoning to arrive at this, and it would also seem from another statement on the same topic that he had religious convictions that systematically ruled out the possibility of any correspondence between the macrocosm and the microcosm.

> For as all works do show forth the power and skill of the workman, and not his image; so it is of the works of God, which do show the omnipotency and wisdom of the Maker, but not his image: and therefore therein the heathen opinion differeth from the sacred truth; for they supposed the world to be the image of God, and man to be an exact or compendious image of the world, but the Scriptures never vouchsafe to attribute to the world that honour, as to be the image of God, but only the *work of His hands*...[64]

Bacon's complete religious belief system is far too complex to be discussed in detail here. Nevertheless, it becomes obvious from this statement that it was quite influential as a non-empirically established paradigm that guided his judgment. Finally, we get an overall idea of his specific position on astrology, not only from the preceding statements, but by observing exactly which elements of astrology he ultimately rejects and which ones he suggests are fruitful to explore, and we can note that these decisions

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[63] Bacon, *Advancement,* 2, 109.

[64] Ibid., 2, 88.

were made not after inductive empirical testing, but purely from his plain reason. Ultimately, he advocates an exploration and refinement of the effects of the 'greater revolutions', or the astrological influences that affect the masses as a whole – as astrologers observe in studying the histories of civilizations. At the same time he rejects outright any influence of the 'smaller revolutions', or those that affect only individuals. In final support of this argument he simply reiterated what Pico della Mirandola argued – that like the other properties of the planets, such as heat and light, any influential effects would affect only the masses and could not possibly single out individuals – a logical deduction. There is no empirical argument given for his general rejection of influences that could impede free will. He simply concludes with the age-old blanket statement, "the stars incline, but do not compel"[65] – a statement that given his frequent outright rejection of correlations between celestial events and human behavior is philosophically difficult to understand.

The Royal Society as Baconian

Though the Royal Society was a somewhat diverse group of gentlemen who held a wide range of belief systems, it was nevertheless a group, and as such was made cohesive by an agreement on the proper approach to scientific exploration and decision-making. The Royal Society idolized Bacon and his revolutionary ideals. Thomas Sprat praises Bacon all throughout the pages of his *History*, and this exuberance is testified to in statements like the following:

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[65] Whitfield, 167-9.

> The *Third* sort of *new philosophers*, have been those, who have not onely disagreed from the *Ancients*, but have also propos'd to themselves the right course of flow, and sure *Experimenting*: and have prosecuted it as far, as the shortness of their own Lives, or the multiplicity of their other affairs, or the narrowness of the Fortunes, have given them leave. Such as these, we are to expect to be but few: for they must devest themselves of many vain conceptions, and overcome a thousand false Images, which lye like Monsters in their way, before they can get as far as this. And of these, I shall onely mention one great Man, who had the true Imagination of the whole extent of the Enterprize, as it is now set on foot; and that is, the *Lord Bacon*. In whose Books there are every where scattered the best arguments, that can be produc'd for the defense of Experimental Philosophy; and the best directions, that are needful to promote it. All which he has already adorn'd with so much Art; that if my desires could have prevailed with some excellent friends of mine who engaged me in this work, there should have been no other preface to the *History* of the *Royal Society,* but some of his Writings.[66]

Bacon's image is graven on the frontispiece of the *History of the Royal Society*, right along with its first president, Lord William Brouncker, and King Charles II himself, royal patron of the Society. Perhaps the most striking praise for Bacon, however, is found in the poem by Abraham Cowley that actually was used as the preface for the *History*. In poetic verse Cowley expresses the debt of gratitude and esteem held for Bacon's dedication to the establishment of empiricism, which was regarded as both revolutionary and liberating to the early-modern scientist. The poem begins by describing how philosophy, meaning in this case truth or knowledge in a general sense, or the true approach to acquiring knowledge of the world, was kept hidden from humanity by unscrupulous scholastic schoolmen until the arrival of Bacon.

(Philosophy, I say, and call it, He,
For whatsoe're the Painters Fancy be,
It a Male Virtu seems to me)
Has still bin kept in Nonage till of late,
Nor manag'd or enjoy'd his vast Estate:

But, oh, the Guardians and the Tutors then,

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[66] Sprat, 35-36.

(some negligent, and some ambitious men)
Would ne're consent to set him Free,
Or his own Natural Powers to let him see,
Lest that should put an end to their Autoritie.

But 'twas Rebellion call'd to fight
For such a long oppressed Right.
Bacon at last, a mighty Man, arose,
Whom a wise King and Nature chose
Lord Chancellour of both their Laws,
And boldly undertook the injur'd Pupils caus.[67]

The poem goes on to describe the old way of thinking – which seems to include anything that was traditionally taught in the universities – in the form of a "Monstrous God" who dominated the "orchard" of knowledge, and rather than teach the truth, "made Children and superstitious Men afraid," by instilling "Ridiculous and senceless Terrors." Bacon is viewed as a revolutionary individual who overthrows the false system of traditional knowledge and leads humanity to the truth. The 'He' in this passage refers to Bacon, that "mighty Man."

With the plain Magique of tru Reasons Light,
He chac'd out of our sight,
Nor suffer'd Living Men to be misled
By the vain shadows of the Dead:

The orchards open now, and free;
Bacon has broke that scar-crow Deitie;
Come, enter, all that will,
Behold the rip'ned Fruit, come gather now your Fill.[68]

From this prefatory poem it is obvious that Bacon's program was accepted as the only true path to knowledge, and it also seems clear that Bacon the man had achieved a rather

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[67] Abraham Cowley, "To the Royal Society," preface to *History of the Royal Society,* by Thomas Sprat, eds. Jackson Cope & Harold Jones (St. Louis: Washington University Press, 1958; London: Routledge & Kegan Paul, 1966).

[68] Ibid., emphasis in original.

glorified status for his work. Interestingly, from a philosophical perspective, though it is not surprising in the historical context, it would seem that despite all the praise and glory given to the ideal of letting the inductive experiment suggest the conclusions, it was deductive reasoning that ushered in the new paradigm of empiricism to replace the associational paradigm. It was reason that allowed empiricism to reject the magical-associational system. It was reason, indeed, "the plain Magique of tru Resaons Light," that invalidated magical thinking as a whole, and even regarded it as something not worth exploring.

John Locke: Continuing Bacon's tradition

The empiricists of early modern England seem to have fought the occult sciences for two reasons. Most obviously they were attacking the widespread practice of asserting the existence of correlations in nature based on aesthetic qualities. As we have seen in the rhetoric examined so far, renowned spokesmen for empiricism often began with the general premise that all such traditional associations, save perhaps the tenets of natural astrology, are simply absurd, which was a necessary condition of their adoption of a new paradigm. There is another element to their disdain for magical thinking as well however, beyond the challenge it presented to their a priori beliefs about the universe. These men were concerned with association making because it tended to be a solitary enterprise in which conclusions were set forth without a consensus agreement. Practices like astrology were largely artistic by the early modern period (and they arguably have always been so) such that individual practitioners would frequently give very subjective interpretations of

celestial phenomena drawn from their own personal experiences, and then tailor those interpretations to the lives of individual clients.

Now, it is quite possible that some consensus could have existed within the astrology community at that time that might have provided standardized interpretations to give to clients. There were, for example, authoritative texts on the subject and even a London-based Society of Astrologers (1649-1658).[69] The astrology community's lack consensus on basic issues was not the real problem. Sets of necessary and sufficient criteria for certain types of conclusions had in fact been established by observation throughout astrology's supra-millennial history, so that there was in fact consensus on the meanings of major planetary configurations. If a client asked, for instance, whether he should wait to confess an ill deed to his father or not, any astrologer noting that the moon was currently in the water sign of Pisces and that it would be moving into the fire sign of Aries the next day, all else being equal, would advise their client to confess with all speed while the emotional weather forecast called for empathy, compassion, and sensitivity today, and egoism, confrontation, and conflict tomorrow.

The real problem arose because astrologers were known to answer questions that were far too specific and exceeded the limits of any possible community consensus. Such questions were addressed, and are recorded in the casebooks of astrologers. Examples of these are the female weaver who asked William Lilly "if her friend loved her as he should love her," or the gentlewoman who inquired whether her gentleman "were vexed at the receipt of a letter."[70] Other examples of such questions include the request for help from

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[69] Thomas, 304.

[70] Ibid., 315.

Elias Ashmole by "the two who digged for treasure," or the request for Lilly's prediction about the winning horse whether it be "the chestnut, the dapple grey," or "the iron grey."[71] It was the kind of independent association-making, on the part of individual practitioners acting apart from any community consensus that incised the emerging empiricists. This is a controversial aspect of magic that is indeed plagued it for a very long time. Conflict between communities that value consensus and independent magical practitioners has been common ever since Rome attempted to monopolize the legitimization of religion, as Gustavo Benavides has pointed out.[72]

> Forms of illegitimacy such as the magic that eluded political or ecclesiastical control, along with *superstitio*, heresy, syncretism, and certain 'mystical' doctrines and practices, have a long history. *Superstitio*, interpreted by Benveniste as "*don de présence*," had become already in Roman times a term of opprobrium. A *superstitiosus*, one endowed with the virtue of *superstitio* and able to see what had happened in the past as if he had been present, was regarded as someone engaged in dangerous practices of foreign origin. In the later Empire those who consulted soothsayers, astrologers or diviners to inquire about the future were considered *malefici* and therefore guilty of engaging in *maleficium*. The reasons then, for the eventual illegitimate status of *superstitio* and the opposition between *religio* and *superstitio* had to do with the distinction between the public and official, on the one hand, and what is private and in principle beyond control, on the other.[73]

In late antiquity the conflict was between the established ecclesiastical community and practitioners of the occult. In early modern England that conflict existed, though at this time there was the additional attack on the occult from the emerging community of scientists.

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[71] Ibid., 318, 312.

[72] Gustavo Benavides, "Magic, Religion, Materiality," *Reflections/Reflexions Historiques* 23, 3 (1997): 310.

[73] Ibid., 310.

Just as we observed condemnations of this random association-making in Bacon's writing from the beginning of the seventeenth century, so too we see it in the writings of John Locke (1632-1704) toward the end of the century in his *Essay Concerning Human Understanding* (1688).

> Independent ideas, of no alliance to one another, are by education, custom, and the constant din of their party, so coupled in their minds that they always appear there together, and they can no more separate them in their thoughts, than if they were but one idea, and they operate as if they were so. This gives sense to jargon, demonstration to absurdities, and consistency to nonsense, and is the foundation of the greatest, I had said of all the errors in the world ; or if it does not reach so far as it obtains, it hinders men from seeing and examining.[74]

In saying that such ideas have "no alliance to one another," Locke means that there is no mechanical explanation for their connection. Locke defines the associational thinking of his day as the generation of "fantastical ideas" which are not validated by observation. They are contrasted with "real ideas" which are supported by observations made of them in nature.

> By *real ideas*, I mean such as have a foundation in nature; such as have a conformity with the real being and existence of things, or with their archetypes. *Fantastical* or *chimerical*, I shall call such as have no foundation in nature, nor have any conformity with that reality of being to which they are tacitly referred as to their archetypes. [T]hose [ideas] are fantastical which are made up of such collections of simple ideas as were really never united, never were found together in any substance ; v.g., a rational creature, consisting of a horse's head, joined to a body of human shape, or such as the centaurs are described.[75]

Locke had very definite ideas about what is real in the world and what is not. He, like Bacon and the scientists of the Royal Society, believed that the mechanical paradigm was the perfect answer to what is real and what is not, and that if something could be

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[74] John Locke, *An Essay Concerning Human Understanding,* ed. A. S. Pringle-Pattison (Oxford University Press, 1978; reprint, Sussex: Harvester Press, 1978), *2*.33.18; 221.

[75] Ibid., 2.30.1, 5; 208-209.

explained as having a mechanical cause, or at least a possible mechanical explanation it could qualify for the "real" status. If, however, the mechanical paradigm could not provide any explanation or theory for the existence of a phenomenon, then it was regarded as fantastical.

> As to the truth and falsehood of our ideas, in reference to the real existence of things, when that is made the standard of their truth, none of them can be termed false...Upon the whole matter, I think, that our ideas....may very fitly be called right or wrong ideas, according as they agree or disagree to those patterns to which they are referred.[76]

By saying that "real existence" should be the standard for truth, Locke essentially means that if something cannot be observed as having a mechanical functioning, it is does not exist.

Such adherence to a paradigm to the point where phenomena that cannot be explained are rejected outright is actually not all that surprising. Thomas Kuhn has noted that explanations, not just evidence, are necessary in order for phenomena to be accepted as real. Even concrete evidence, if not supported by any explanation, is quite often rejected or ignored altogether.[77] It is theoretically possible then that the adherents of the mechanical paradigm could have been capable of denying the validity of even concrete observations made with regards to astrology or any other phenomena if they could not be explained within their paradigm.

Likewise, when possible explanations can be given to explain observed phenomena that make them fit within a paradigm, however remote or improbable those explanations may be, they will usually be adopted, for the only alternative is to change

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[76] Ibid., 2.31.26; 216.

[77] Kuhn, 39.

the paradigm. Locke, in defining the legitimate boundaries of human understanding, gives his explanation for the existence and practice of associational thinking. He explains the magical-associational thought process as a symptom of an innate shallowness of thought in human beings, whereby any thoughts and ideas people had that could not be observed with seventeenth-century techniques and given a mechanical explanation were the result of a lazy adherence to "custom," or tradition, rather than rational thinking and 'true' observation.

> That there are such associations of them made by custom in the minds of most men, I think nobody will question who has well considered himself or others; and to this, perhaps, might be justly attributed most of the sympathies and antipathies observable in men, which work as strongly, and produce as regular effects, as if they were natural, and are therefore called so, though they at first had no other original but the accidental connexion of two ideas which either the strength of the first impression, or future indulgence so united, that they always afterwards kept company in that man's mind, as if they were but one idea. [78]

At this point in his treatise Locke distinguishes these false ideas derived from custom, or "acquired antipathies," as he calls them, from pathologies that arise from genetics or biology, which he calls "natural antipathies." Interestingly, the issue he addresses here in connection with "acquired antipathies," is actually a digression he takes from his usual task of describing phenomena, in order to focus for a moment on what he personally sees as a major crisis stemming from these false "acquired" associations.

> I mention this not out of any great necessity there is, in this present argument, to distinguish nicely between natural and acquired antipathies ; but I take notice of it for another purpose, viz., that those who have children, or the charge of their education, would think it worth their while diligently to watch, and carefully to prevent the undue connexion of ideas in the minds of young people. This wrong connexion in our minds of ideas, in themselves loose and independent one of another, is of so great force to set us awry in our actions, as well moral as natural, passions, reasonings, and notions themselves, that perhaps there is not any one thing that deserves more to be looked after. The ideas of goblins and sprites have

[78] Locke, *Essay, 2*.33.7; 218.

> really no more to do with darkness than light ; yet let but a foolish maid inculcate these often on the mind of a child, and raise them there together, possibly he shall never be able to separate them as long as he lives.[79]

Locke's desire to inculcate empirical thinking and exhort the merits of the mechanical paradigm were noble, however, his rejection of the associational thinking of his day was less than empirical; it was a principled rejection. From his point of view there was no reason to empirically test the tenets of any science that viewed the universe in associational terms because acausal associations could not be explained with in the mechanical paradigm, and rather than change the paradigm, they were labeled "fantastical."

Thomas Hobbes: A Place for Deduction and Astrology as a Science

Turning back to a closer contemporary of Bacon's, we can see that Thomas Hobbes (1588-1679) employed the same axiomatic rejection of associational thinking in *Leviathan* (1651). In a passage criticizing philosophy, Hobbes lists seven causes for "absurd assertions" made by philosophers whom he says suffer from a lack of consistency in "the definitions, or explanations of the names they are to use."[80] The second of these causes of absurd assertions that he lists is telling of his views on associational thinking.

> The second cause of absurd assertions, I ascribe to the giving of names of bodies to accidents; or of accidents to bodies; as they do, that say, faith is infused, or inspired; when nothing can be poured, or breathed into anything, but body; and that, extension is body; that phantasms are spirits, &c.

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[79] Locke, *Essay,* 2.33.8-10; 219.

[80] Thomas Hobbes, "Leviathan:Of Reason and Science," in *European Science in the Seventeenth Century*, ed. John Redwood (London: David & Charles, 1977), 36.

And later, in describing the sixth cause he writes,

> The sixth [cause of absurd assertions is attributed], to the use of metaphors, tropes, and other rhetorical figures, instead of words proper. For though it be lawful to say, for example, in common speech, the way goeth, or leadeth hither, or thither; the proverb says this or that, whereas ways cannot go, nor proverbs speak; yet in reckoning and seeking of truth, such speeches are not to be admitted.[81]

Hobbes is taking issue here with the practice of using metaphorical language in general. The fact that takes metaphorical language so seriously suggests that he would be vehemently opposed to the belief in correlations between things based on mere similarities in accidental qualities such as color. It would seem likely that he would have no qualms about asserting that it is absurd to assert for instance that, as the receptive, feminine counterpart to the sun, the moon in the sign of warlike Aries is correlated with an assertive emotional temperament in people because of some kind of acausal connection. However, the opposite is actually evident in *Leviathan.* Like Bacon, he assigns truth to induction, or observation of nature, and calls it history. However, as a philosopher, and one who was keenly interested in adapting the rigorous and consistent logic of mathematics to the study of human behavior, particularly in politics, Hobbes accepted the validity of logical deduction, and called it science.

> There are knowledge of two kinds; whereof one is knowledge of fact: the other of the consequence of one affirmation to another. The former is nothing else, but sense and memory, and is absolute knowledge; as when we see a fact doing, or remember it done; and this is the knowledge required in a witness. The latter is called science; and is conditional; as when we know, that, if the figure shown be a circle, then any straight line through the centre shall divide it into two equal parts. And this is the knowledge required in a philosopher...The register of knowledge of fact is called history...the registers of science, are such books as contain the demonstration of consequences of one affirmation, to another; and are commonly called books of philosophy.[82]

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[81] Ibid., 37.

[82] Ibid., 39.

Hobbes' acceptance of deductive reasoning, albeit in a decidedly rigorous and mathematical sense, allows him to assign a place for astrology in his table of the "registers of science."[83] In this table he places astrology right alongside ethics and logic, giving it the definition: "Consequences from the *influences* of the stars."[84]

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[83] Thomas Hobbes, "Leviathan: Of the several subjects of knowledge," in *European Science in the Seventeenth Century,* ed. John Redwood (London: David & Charles, 1977), 39.

[84] Ibid., 41; italics in original.

CONCLUSION

Scientists Rejecting Sciences

That this "plain Magique," of Bacon's reason sanctioned empiricism as a replacement paradigm for the traditional paradigm of magical thinking seems quite apparent, yet when we take a closer look at what exactly that system of magical thinking entailed it becomes quite surprising as well. What we have here was not simply science replacing magic, but in actuality it was the reasoning of early modern scientists that caused them to reject a whole set of other sciences. A closer look at the sciences of astrology, alchemy, and even ritual magic will reveal that although their conclusions are drawn from accidental associations, and that those associations were justified by the premise that similarities in accidental qualities actually reveal a correlation – the premise that such correlations exist is itself based on observation from the very beginning, and hence is a form of science. Bacon admits this much when he refers to "astrology, natural magic, and alchemy" in *The Advancement of Learning*, saying that as "sciences, nevertheless, the ends and pretences are noble."[85]

The original procedure of observation and retention or rejection that astrology was built upon may have gone unrecognized because the major correlations that astrology proposed as true had been established in ancient times. Such propositions were naturally suspect because there were no rigorous scientific standards in ancient times. In fact, any

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[85] Bacon, *Advancement*, 1.3.11; 29.

propositions about nature made before the Scientific Revolution was thought to be suspect and the world needed to be explored again with new eyes. To make matters worse for astrology, the early modern practitioners of all of these, what came to be called "arts", seem to have been simply working within the larger, perverted premise that *any* accidental associations that the mind can construe are valid, and little or no consensus was needed. This is what the early modern scientific reformers were railing against, but in doing so it appears that they failed to recognize the original, albeit subjective, observation that had built sciences like astrology in ancient times, and did not set out to re-examine it. However, Bacon did recognize these arts as sciences, and even called for astrology to be "purified" rather than "altogether rejected." So why was it not explored? Alchemy is a good example of an ancient science that actually was empirically invalidated by years of extensive research and experimentation. Isaac Newton spent thirty years of his career experimenting with alchemy. He moved from the study of chemistry to alchemy in the late 1660s, produced a flood of alchemical writings between 1675 and 1687, and his work climaxed in the early 1690s with his *Index Chemicus*, which in over 100 pages, with 879 headings, and nearly 5000 references Newton summed up centuries of Alchemical experimentation and tied it together with thirty years of his own research in an attempt to explicate the one great work that he saw as the ultimate object all alchemy – the discovery of *"Materia Prima*...that which has been stripped of every form by putrification."[86] King's College holds the largest collection of Newton's alchemical papers, and its staff is forced to allow only the study of them on microfilm due to an

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[86] Richard Westfall, "The Role of Alchemy in Newton's Career," in *Reason, Experiment, and Mysticism in the Scientific Revolution,* eds. M. L. Righini Bonelli & William R. Shea (New York: Science History Publications, 1975), 203.

enormous volume of contemporary researchers who wish to explore them firsthand.[87] Nothing of the sort exists for the science of astrology. No records of formal research conducted on it have ever been found. In retrospect it is quite understandable why this should be the case, aside from the fact that it was generally thought to be a fruitless pursuit.

For all practical purposes, astrology was virtually impossible to test, not because its tenets cannot be operationalized - modern psychology has methods, for example, that are perfectly suited to put many concrete predictions made by astrology to the test. The tenets of astrology were not subjected to testing during the Scientific Revolution, however, because they could not be operationalized by the scientists of the seventeenth century. This was because most of astrology's most fundamental, and most easily observable predictions are made with regards to human personality, and methods for exploring the human personality, such as personality inventories, had not be conceived of yet. A categorization of fixed personality traits and their correspondence to astrological predictions are arguably the only truly testable data that seventeenth-century astrology could have offered, for astrology made many sweeping and general predictions about things like general fortune in terms of love, money, career, politics, and the weather, yet any reports or observations about these types of events would be extremely circumstantial and anecdotal. Imagine for instance a researcher trying to collect data on the validity of astrological predictions about love affairs. Isolating as many variables as possible, one might start with the case-book of one astrologer, like the renowned William Lilly, and proceed to go around London and check with the thousands of clients who received love

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[87] Westfall, 189-190.

predictions to see if those predictions did indeed come true. The researcher might for example, inquire of a client as to whether she did indeed 'marry a stingy but successful entrepreneur' as predicted, and the typical answer might be that the husband was indeed successful as a middle-class merchant, doing better or worse from year to year, who was at times very frugal with his money, buying only enough wine and chocolate as the times allowed. Predictions of this kind are impossible to operationalize, even by today's standards.

Astrological predictions were not all so vague, however, despite what some skeptics might think. There was a certain degree of consensus, especially on astrology's basic tenets. It was true even in the seventeenth century that all astrologers understood for example that the fiery sign of Aries to contain properties that were completely antithetical to the watery sign of Pisces. A look at Pythagoras' *Tetrabiblos* written as far back as the second century will show that people born when the sun was in Aries, all else being equal, would have among other things, a distinctly forthright, assertive temperament, and would be characterized by a self-centered approach to life, while those born under Pisces would be completely different – observably different – exhibiting a decidedly passive approach to interactions and a penchant to be self-sacrificing. The real trick would be to randomize any other influential variables so that 'all else' could be equal. However, techniques like variable randomization had not be conceived of in behavior research yet, let alone behavior research itself, or instruments like self-report personality inventories that could gather data objectively or statistical techniques like analyses of variance to interpret the data quantitatively. Techniques for exploring individual differences in personality across large samples were not developed until centuries after astrology had

died. The science of psychology was still in its infant philosophical stage in the seventeenth century. Scientists, most notably John Locke, were just beginning to realize that human psychology was a viable pursuit. Those who devoted at least some of their time to considering the nature of the psyche were more concerned with determining that there was such a thing, and what its possible limits and boundaries were. They were merely trying to show that the study of commonly observed human behavior actually had a rightful place in the mechanical world, and the study of individual differences, or differences *between* people was hardly a consideration at all.

Finally too, aside from both the general rejection of associational thinking and the difficulties inherent in testing astrology, there are other, more general factors that contributed to the decline of astrology in England at this time, and these will be discussed briefly here. When historians discuss the intellectual dismissal of astrology it is interesting to note that they invariably refer to indirect causes that contributed to a loss of interest in the subject, not to any evidence that directly refuted its specific tenets. It was not empirical invalidation that caused scientists to lose interest in astrology, but the refutation of larger ideas about the universe in which it was embedded that caused it to lose its credibility.

The Fall of Neoplatonism

In the seventeenth century, astrology was wedded to the larger paradigm of Neoplatonism. Neoplatonism viewed the material world as a microcosm, or mirror image of the perfect spiritual world. The material world was regarded as imperfect, and the most noble duty of humanity was to aspire to ascend to spiritual perfection. In 1614, however,

Isaac Casaubon produced convincing textual criticism that showed the *Hermetica* to be a work of later origin than had been long thought.[88] From this point on Hermeticism, a strong link in the Neoplatonic chain, was beginning to be seen as the creation of Hellenistic scholars in the second century of the common era, much later than either Plato or Jesus. The wisdom of the ancient Egyptian sage Hermes was torn down from its sacred pedestal, and with it, a great deal of respect for the ancient systems of wisdom that had been associated with it, like astrology. The overthrow of Neoplatonic philosophy was one aspect of the larger intellectual revolution that took place that affected astrology. Historically, astrology had been adopted by Neoplatonists as a detailed map of macrocosm-microcosm paradigm. The overthrow of Neoplatonism, however, was probably not all that significant for English astrology though. The decline of Neoplatonism came about rather easily in seventeenth-century Britain due to the fact that it had never quite reached the heights of popularity there that it had on the continent. It has been pointed out that Neoplatonism, as an all-encompassing worldview, was only really advocated with any enthusiasm in early modern England by smaller minority groups such as the Cambridge Platonists.[89] Astrology's popularity had gone far beyond the circle of intellectuals who could discuss reality in such terms.

The Heliocentric Revolution

Historians of science often point to Galileo's popularization of the Copernican theory of heliocentricity as the beginning of the end for astrology and the magical

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[88] Freke & Gandy, *Hermetica*, 16.

[89] R.T. Wallis, *Neoplatonism* (London: Duckworth, 1972), 173.

worldview in general. Although Copernicus had published *De revolutionibus orbium coelestium* (On the Revolutions of the Celestial Orbs) as early as 1543, his theory was not widely known or respected until Galileo's work nearly a century later. Galileo is now often recognized as the first modern scientist. Along with his experiments with falling bodies and his work in mathematics, Galileo is credited with being the first person to turn the telescope to the sky. His scientific work culminated in 1632 with his publication of *Dialogo sopra i due massime sistemi del mondo* (Dialogue on the Two Chief Systems of the World). Published in Italian vernacular, an unusual choice for a scientific work at that time but done in order to reach the larger public, the *Dialogo* directly challenged the Aristotelian and Ptolemaic cosmologies of a finite universe that consisted of pure ethereal spheres that carried the flawlessly smooth planets around the center of the universe (i.e., Earth). Galileo's telescopic observations as early as 1609 had revealed such challenges to the idea of a perfect universe as lunar craters and the moons of Jupiter, both of which suggested a physical composition of the planets, and that the heavens were imperfect and changeable. For if the moon could have imperfections, and if Jupiter could have moons, they were not so different from the earth. When this revelation was combined with Galileo's mathematical and logical arguments in support of Copernican heliocentricity, the universe became infinite in its expanse, and the earth just another small rock caught in the orbit of the sun like everything else. When the perfect, geocentric universe began to crumble, astrology began to lose its mystique as well.

Despite the seemingly insurmountable challenge that the Copernican-Galilean revolution brought to the older, Aristotelian cosmology, astrology itself was actually losing its credibility only with those who knew very little about it. For astrology,

although it had been using Ptolemy's geocentric configuration of the universe for centuries, has always been in the end nothing more than a system of *relative* correspondences. Astrology is a system of prediction based on the relative positions of the planets to each other, and ultimately to the earth. In fact modern astrologers still take the actual, heliocentric solar system and transpose it into geocentric terms for the purpose of interpreting the relative position of the planets to the latitude and longitude of the place where a person was born. They keep the relative positions of the planets intact, while choosing to shift the focus to the earth because the idea is to decide how the planets are influencing the lives of people. It was quite reasonable then for the astrology apologist, Sir Christopher Heydon, to write in 1603 that, "whether (as Copernicus saith) the sun be the centre of the world, the astrologer careth not."[90] It is interesting to note too that as early as 1556, Robert Recorde's astrology textbook, *The Castle of Knowledge,* contained the earliest English reference to the Copernican theory. It is also interesting to note that Thomas Digges (d.1595), a second-generation astrologer-mathematician, and the pupil of the famous Tudor astrologer, John Dee, has been acknowledged as being the first writer to interpret the Copernican theory of heliocentricity as implying that there is no Celestial Sphere and that the fixed stars are actually spread throughout an infinite universe.[91] Astrology has never been inherently tied to a geocentric universe, but many people in the seventeenth century thought that it was, and so it lost more credibility because of the Copernican revolution as well.

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[90] Thomas, 349.

[91] Whitfield, 167.

Astrology Never Empirically Invalidated

If the typical scientific revolution is, as Thomas Kuhn describes it, a process in which one paradigm is rejected only when it can be replaced by another, then the rejection of the magical paradigm was atypical. The conclusion drawn by Keith Thomas is that astrology, along with the magical worldview in general, was not replaced with a more suitable paradigm but with a hope that the new empirical approach to understanding reality would one day lead humanity to the answers astrologers were previously sought for. This conclusion presupposes something. If astrology was replaced by a *faith*, then it was not rejected by empirical means. It was simply replaced by a hope – arguably an utter certainty – that it would be one day be refuted.

Unlike the other sciences such as medicine, biology, chemistry, and astronomy, the tenets of astrology were never tested and either refined or rejected. There are two major reasons for this, and both factors were influential. First of all, it is true that in the seventeenth century astrology was essentially not testable. This was due partly to the fact that there was a significant lack of consensus within the astrological community with regards to interpretations of astronomical phenomena and their manifestations on earth. This certainly presented a difficulty for researchers who would have sought to refine or refute astrology as a whole. However, this does not excuse the scientific community from neglecting to test at least *some* tenets of astrology, such as those held by a majority of astrologers, or perhaps by the leading astrologers of the time. Such a failure to conduct any experiments on astrological tenets at all was due instead to their axiomatic rejection of the possibility of its validity.

To be skeptical that such a blatant negative bias could have existed would be a mistake, for indeed, a strong negative bias against astrology has even been empirically verified in the modern scientific community of our own time. In a contemporary study evaluating the negative bias contemporary psychologists have toward astrology, Goodstein and Brazis (1970) mailed fictitious abstracts of an empirical research study on astrology to 1,000 psychologists selected at random from the 1968 American Psychological Association Membership Register. One group received abstracts reporting positive correlations between planetary configurations at the time of subjects' births and their choice of careers. The abstracts the other group of psychologists received reported no significant findings. A letter was attached asking for the psychologists' assistance in evaluating the abstract they each received, and a form was included for them to record their judgement of study. Statistical analyses revealed that those scientists who received the report of no correlation between astrology and career rated the study as being better designed, as having more validity, and as having more adequate conclusions than the other group did. The group that received the positive findings was more likely to rate the study as being not well designed, lacking validity, and in need of additional research. A quote from the authors regarding the responses they received from those who were mailed the positive findings reveals the controversy that research on astrology engenders, even in our time.

> The returned forms contained many emphatic and emotionally charged spontaneous comments, many of which attacked the investigators on personal and professional grounds. There were statistical criticisms, criticisms about the limitations in the completeness of the data, and generalized attacks on astrology. Many respondents wrote rather lengthy comments, including several full-page letters. Three *S*s indicated a clear awareness of the underlying process of the

> study, while many more indicated their annoyance at being asked to participate in such "foolishness," often at great length. [92]

These modern scientists were able to justify an outright rejection of the possibility of astrology's validity because they assumed that it has been refuted by modern empirical data. The scientists of the seventeenth century could make no such claim, however. Their rejection of it and the magical paradigm as a whole was purely axiomatic. This reaction was justified in their eyes by the fact that the mechanical paradigm could provide no possible explanation for the correlations that occult sciences like astrology proposed. This decision to reject the possibility of such correlations on principle was made all the more easy by the fact that there were no instruments or methods available in the toolbox of the seventeenth-century scientist that could be used to test them, even if they had wanted to. Finally then, as suggested by Thomas, the main reason that the tenets of astrology were never empirically tested, was because astrology had lost its intellectual integrity due to the vulgarity it accrued as it soared to new heights of popularity at the exact time that the emerging empiricists were desperately fighting to inaugurate a new age founded on paradigm that could not include old fantasies.

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[92] L. D. Goodstein & K. L. Brazis, "Psychology of Scientist: XXX. Credibility of psychologists: An empirical study," *Psychological Reports* 27, (1970): 835-838.

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APPENDIX

To the *Royal Society.*[93]

I.

PHILOSOPHY the great and only Heir
Of all that Human Knowledge which has bin
Unforfeited by Mans rebellious Sin,
Thought full of years He do appear,
(Philosophy, I say, and call it, He,
For whatsoe're the Painters Fancy be,
It a Male Virtu seems to me)
Has still bin kept in Nonage till of late,
Nor manag'd or enjoy'd his vast Estate:
Three or four thousand years one would have thought,
To ripness and perfection might have brought
A Science so well bred and nurst,
And of such hopeful parts too at the first.
But, oh, the Guardians and the Tutors then,
(some negligent, and some ambitious men)
Would ne're consent to set him Free,
Or his own Natural Powers to let him see,
Lest that should put an end to their Autoritie.

II.

That his own business he might quite forgit,
They amus'd him with the sports of wanton Wit,
With the Desserts of Poetry they fed him,
Instead of solid meats t'encrease his force;
Instead of vigorous exercise, they led him
Into the pleasant Labyr nths of ever-fresh Discours:
Instead of carrying him to see
The Riches which doe hoorded for him lye
In Naures endless Treasurie,
They chose his Eye to entertain
(His curious but not covetous Eye)

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[93] Abraham Cowley, "To the Royal Society," preface to the *History of the Royal Society,* ed. Thomas Sprat (1667; reprint, St. Louis: Washington University Press, 1966).

With painted scenes, and Pageants of the Brain.
Some few exalted Spirits this latter Age has shown,
That labour'd to assert the Liberty
(From Guardians, who were now Usurpers grown)
Of this Old *Minor* still, Captiv'd Philosophy;
But 'twas Rebellion call'd to fight
For such a long oppressed Right.
Bacon at last, a mighty Man, arose,
Whom a wise King and Nature chose
Lord Chancellour of both their Laws,
And boldly undertook the injur'd Pupils caus.

III.

Autority, which did a Body boast,
Though 'twas but Air condens'd, and stalk'd about,
Like some old Giants more Gigantic Ghost,
To terrifie the Learned Rout
With the plain Magique of tru Reasons Light,
He chac'd out of our sight,
Nor suffer'd Living Men to be misled
By the vain shadows of the Dead: (fled;
To Graves, from whence it rose, the conquer'd Phantome
He broke that Monstrous God which stood
In midst of the Orchard, and the whole did claim,
Which with a useless Sith of Wood,
And something else not worth a name,
(Both vast for shew, yet neither fit
Or to Defend, or to Beget;
Ridiculous and senceless Terrors!) made
Children and superstitious Men afraid.
The orchards open now, and free;
Bacon has broke that scar-crow Deitie;
Come, enter, all that will,
Behold the rip'ned Fruit, come gather now your Fill.