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STARS, STONES AND ARCHITECTURE - AN EPISODE IN JOHN DEE'S NATURAL PHILOSOPHY

Brent M. Wagler School of Architecture, McGill University, Montréal. March 1995.

A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfilment of the requirements of the degree of Master of Architecture.

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Abstract

The work of John Dee (1527-1608) posits an approach to architecture based upon the concept of wonder. Sympathetic correspondences permeate Dee's disparate practical activities and architectural discourse. His contributions to astronomy, alchemy, cartography and navigation are grounded in the intersubjective cosmology of the Renaissance. It is in Dee's *Mathematicall Praeface* (1570), which promotes mathematics as a natural philosophy, that the architect's metier is aligned with the marvellous and established as an art encompassing numerous disciplines. Dee's syncretic formulation of architecture is distinctly attuned to the alchemical and magical discourses pervading the Renaissance and established in relation to his hieroglyphic "Monas" symbol. This emblematic device, discussed in the *Monas Hieroglyphica* (1564), exemplifies the link between architecture and writing. The Monas symbol permits the architect-as-alchemist to contemplate marvels and effect them in practice. In addition to positioning wonder in human activity, as a navigational beacon guiding the work of the architect. Dee signals the possibility of restoring conjuring – the dangerous and denigrated art of sixteenth century England – into architectural practice.

Abrégé

L'œuvre de John Dee présente une approche à l'architecture édifié sur le concept de l'émerveillement. Une affinité impreigne les activités pratiques disparates et le discours de Dee. Sa contribution à l'astronomie, l'alchimie, la cartographie et la navigation se base sur la cosmologie intersubjective de la Renaissance. C'est dans sa *Mathematicall Praeface* (1570) où les mathématiques sont présentées comme une philosophie naturelle, que le métier d'architecte équivaut le merveilleux et se veut un art englobant maintes disciplines. Sa formulation syncrétique de l'architecture s'accorde étroitement aux propos de magie et d'alchimie en vogue à l'époque, et s'établis en relation avec le symbole hieroglyphique appellé "Monas." Ce mécanisme emblèmatique, discuté dans *Monas Hieroglyphica* (1564) démontre le lien entre l'architecture et l'écriture. Le symbole Monas permet à l'alchimiste de contempler les merveilles et de les mettre en pratique. En plus d'introduire le merveilleux aux activités de l'homme, comme balise guidant le travail de l'architecte. Dee signale la possibilité de restaurer la conjuration – l'art dangereux et dénigré de l'Angleterre du seizième siècle – dans la pratique architecturale.

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Abbreviations

From time to time, references in the text or notes are in the form of (bracketed) abbreviations. These references are to the works by Dee, and the key to the abbreviations is as follows:

PA Propaedeumata aphoristica (London, 1558).

I have used John Dee on Astronomy: 'Propaedeumata aphoristica' (1558 and 1568), Latin and English, translated and edited by Wayne Shumaker (Berkeley: University of California Press, 1978). Citations are either to paired page numbers of the text and facing translation, or to the Roman numerals of the individual aphorisms.

MH Monas hieroglyphica (Antwerp, 1564).

I have used "A Translation of John Dee's 'Monas Hieroglyphica'," translated and with an introduction by C. H. Josten, Ambix, XII (June-October, 1964): 84-221. Citations are either to paired page numbers of the text and facing translation, or to the Roman numerals of the individual 'Theorems'.

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 MP Mathematicall Praeface (London, 1570).
I have used The Mathematicall Praeface to the Elements of Geometry of Euclid of Megara (1570), edited by Allen G. Debus (New York: Science History Press, 1975). Citations are to the signatures.

"For all men begin, as we said, by wondering that things are as they are, as they do about self-moving marionettes, or about the solstices or the incommensurability of the diagonal of a square with the side..."¹

The sense of wonder as the origin of questions is of primary importance to philosophical pursuits. It is because of wonder that human beings undertake any speculative task. The person said to be in a state of wonder is at a loss for an explanation, failing to grasp something. This is why the lover of stories is in a sense a philosopher, for stories are composed out of wonders. In writing, seeing, listening or making one's way through any story, the participant is provoked by the story's unfolding; details develop and reveal themselves, strangeries emerge, holding the participant's attention. The resulting amazement is coupled with thought and imagining. Wonder is the philosophical streak that marks meaningful human activity.

In ancient Greece the description of distant lands and of their characteristics disseminated by travel narratives contributed to creating an immense curiosity about "strange facts," " $\theta \alpha \nu \mu \alpha \tau \alpha$ " (*thaumata*) that run counter to common sense.² The appearance of the notion of " $\theta \alpha \nu \mu \alpha$ " (*thauma*), or wonder in Ionian literature, particularly in the writings of Herodotus, is followed by the description of fantastic facts through digressive writing. The peripatetics, from Aristotle to Theophrastus, combine the quest for the fantastic with the requirements of scientific investigation, recognizing that baffling phenomena exist and that they cannot be reduced to ordinary categorization. Also, for the Stoics, the "strange facts" that one can observe in nature reveal the presence of a divinity in the world.

¹Aristotle, Metaphysics, 983a 13-18.

²Christian Jacob traces the primary stages in wonder's development. In addition to "θαυματα" (thaumata) Jacob treats "παραδοξα" (paradoxa) facts and things that are out of the ordinary. See Christian Jacob, "The Greek Traveler's Areas of Knowledge: Myths and Other Discourses in Pausanias' 'Description of Greece'," Yale French Studies, 59 (1980): 65-85.

The meanings encompassed by the Greek " $\theta \alpha \nu \mu \alpha$ " (thauma) are shock. estrangement, to look, to learn, to understand.³ The relation between (thauma) wonder and looking, implies a connection between "seeing" and "immediacy." In the simplest sense, to see is to wonder. If a person pauses when looking at something strange, and thinks on it, reflects, is shocked by it, and ponders its origin or phenomenal aspect, that person would be in the state of questioning, or wonderment. The verb thaumazein (to wonder at, to marvel) and the noun thauma (a wonder, a marvel), are cognates of the noun théa (seeing, spectacle).⁴ The astonishment of seeing something strange can be taken as the beginning of theory, which is stated in the primary and original sense of the *theoros* to mean spectator, the one who stops to look and learn. Theoria had originally to do both with seeing and with the revelation of the divine.⁵

Wonder is the rivet in the pensive gaze, the moment of awe and uncertainty. Aristotle describes the relation between wonder and the origin of philosophy and says that "it is through wonder that men begin and originally began to philosophize."⁶ Plato explains this concept in relation to the observed activities of the juggler and the conjurer.⁷

This question of wonder, particularly immanent for the ancient Greeks, was also a significant germ in the sixteenth century imagination. In fact, the Renaissance revival of this classical notion generated numerous manifestations of it, frequently emerging in relation to magical and alchemical practice. Many books dealing with marvels and questions about mysterious phenomena also emerged during this period.⁸ It is interesting to note how the term "wonder" became embedded in English and Germanic cultures. Whitney refers us for the prefix *won+*, *wone+* to the Middle English nouns *wone*, *woon* (a dwelling, habitation); and the verbs of Middle English *wonien*, *wunien* (to abide, to remain), the Old High German *wonen*, and the German *wohnen* (to dwell) and gewohnen

³Ernesto Grassi traces the etymological lineage to the Greek god *Thaumas*, whose name means "the unusual" and "rich in wonders," Ernesto Grassi and Maristella Lotch, *Folly and Insanity in Renaissance Literature* (New York: University Center at Binghampton, 1986), 22-23.

⁴Indra Kagis McEwen, Socrates' Ancestor - An Essay in Architectural Beginnings (Cambridge, MA.: MIT Press, 1993), 20-21.

⁵[bid., 125.

⁶Aristotle, Metaphysics, 982 b12.

⁷Piato, Sophist, 235b; Republic, 602d.

⁸Bert, Hansen. "Science and Magic," in Science in the Middle Ages, edited by David C. Lindberg (Chicago: University of Chicago Press, 1978), 493-497.

(to be accustomed).⁹ It is within the problematic of the *thauma* (wonder) that I would like to situate the traveller, mathematician and alchemist of Elizabethan England, John Dee.

John Dee¹⁰ was born on July 13 1527, the son of Johanna Wild and Rowland Dee - a gentleman server to King Henry VIII. At age fifteen he began his formal education at St. John's College in Cambridge, where he earned his B.A. in 1546 and M.A. in 1548. While at Cambridge, Dee designed a flying scarab for a production of Aristophanes's Peace. Late in 1548, Dee enrolled at the University of Louvain and for two years studied with Gemma Frisius and Gerard Mercator, the leading geographers and astronomers in the Netherlands. In 1550, Dee lectured in Paris on Euclid and had the opportunity to exchange ideas with many other bright minds on the continent. A description of "the straunge Selfmouing" that Dee witnessed in 1551 at nearby St. Denis reveals his persistent fascination with mechanical machines. The events and discussions in Paris and Louvain piqued Dee's lifelong devotion to learning about mathematics. Shortly afterwards, he produced the first of a number of works dedicated to the teaching of mathematical subjects, including works on astronomy, and alchemy, the last being the Mathematicall Praeface of 1570 in which he articulates his most syncretic architectural theory. In the Mathematicall Praeface he describes "Thaumaturgike" as the art of making marvels by mechanical magic. As his description includes a passionate defense of himself from the charge of "conjuring," one may reasonably suppose that this thaumaturgic practice, perhaps in conjunction with a theatrical presentation, had been the source of his troubles with the law in 1555. The production of illusions with the aid of technical ingenuity was an acceptable activity, but also a dangerous one; even as late as 1605 he was still petitioning King James to have himself freed from suspicion of conjuring. Although his involvement with controversy never became life threatening, as it did for his spiritual medium Edward Kelley, doubts about Dee's conjuring persisted during the centuries following his death.

⁹The Century Dictionary: An Encyclopedic Lexicon of the English Language, edited by W. D. Whitney (New York: Century Co., 1899), 6815.

¹⁰For a summary of Dee's life-work see below "Appendix I - Chronology."

Major Secondary Sources

The act of interpretation, which has distilled facets of Dee's œuvre through a variety of hermeneutic filters, has produced numerous assessments. Their interpretations must be understood in relation to Dee's contradictory approaches to knowledge, frequently calibrated into the opposing camps of the occult and science, spiritualism and empiricism, or séance and experiment. Only when it is realized that the common bond uniting all these apparently unconnected strands is magic,¹¹ do Dee's multifarious interests begin to fall into place and create a consistent pattern. While few works articulate the relevance of Dee's syncretic approach to architectural endeavours, several works do merit consideration.

Eva Germaine R. Taylor significantly rehabilitates Dee's reputation from the pejorative assumptions about his conjuring activities. Her account of the history of English navigation in *Tudor Geography*, 1485-1583 unfolds primarily through a biographical treatment of Dee's practical exploits. While emphasizing his work and role as a teacher of practitioners in navigation and mathematics, Taylor explains Dee's geographical pursuits in relation to the kindred disciplines of surveying and measuring, perspective, astronomy, geometry, cosmography and architecture.¹²

Peter J. French's comprehensive study, John Dee - The World of an Elizabethan Magus encompasses not only Dee's works but argues for his importance in English culture through the influence of his Mathematicall Praeface on English "mechanicians," his work in navigation, and the influence of his philosophy on literature through his association with the "Sidney circle" and patrons at court.¹³ In treating the Neoplatonic elements and Hermetic tendencies in Dee's work, French places importance on the Monas Hieroglyphica of 1564 for a more profound understanding of Dee's practice and writing.¹⁴ His interpretation of Dee as an hermetic magus, initially iterated by Frances Yates, highlights

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¹¹The word "magic" is here used in the wide sense in which Renaissance writers employed the word *magia*. The latter was in no sense restricted to demonic magic, but embraced virtually all manifestations of Hermetism and occultism, being even extended to cover the workings of natural phenomena.

¹²See Appendix II in Eva Germaine R. Taylor, Tudor Geography, 1485-1583 (London: Methuen, 1930), 193-243 which lists geographical and related works in Dee's library. For Dee on scientific instruments see Eva Germaine R. Taylor, The Mathematical Practitioners of Tudor and Stuart England (Cambridge: Cambridge University Press, 1954). Also, F. R. Johnson, Astronomical Thought in Renaissance England (Baltimore: Johns Hopkins Press, 1937).

¹³Peter J. French, John Dee - The World of an Elizabethan Magus (Boston: Routledge and Kegan Paul, 1972), ch. 6 and 7.

¹⁴Ibid., 62-88, 93-103.

Neoplatonic numerology, Hermetic religion and magic. kabbalah, alchemy, and astrology as important features in Dee's career.

The penetrating study, John Dee's Natural Philosophy - Between Science and Religion by Nicholas Clulee presents an interpretation of Dee as a mystical scientist.¹⁵ While describing Dee's divergent pursuits as all part of an expanded and shifting natural philosophy, he presumes that an undistorted picture of Dee's writings, and their intended meaning, may be reconstructed by attending carefully to the factual details of his scientific, philosophic, social and political interests. Clulee describes the extremely fluid situation that existed between the conceptions of magic and science prevalent in the competing religions of the time, and devotes himself to exposing Dee's idiosyncratic and eclectic blend of various sources – classical, medieval and Renaissance. Natural magic as a technology and spiritual-demonic magic as a means of spiritual enlightenment were, Clulee claims, both inspired frequently by the Neoplatonic and Hermetic sources recovered in the fifteenth century. In attempting to come to a materially derived understanding of Dee's natural philosophy, he dissociates Dee's philosophy of mathematics from magic, stating that only his spiritual magic owed anything to Renaissance Hermetic or Neoplatonic influences.

In another stream of thought, Frances Yates provides the interpretative fusion of distinct scientific-practical and occultist-magical currents in Dee's career. She suggests that the seemingly divergent activities and ideas of Dee can be understood as all belonging within the outlook of a *magus* inspired by the revived Hermetism and Neoplatonism during the Renaissance.¹⁶ Dee's role as an intellectual influence in the English Renaissance, according to Yates, is of pre-eminence. She points out in *Theatre of the World* the danger of "canalizing" Dee's work; she states that his contacts with the rising artisan and middle classes, the practice of writing scientific works in English to spread knowledge among those not learned in ancient tongues, are sides of Dee which differentiate him most strikingly from the learned Renaissance scholars of Italy, France or Spain.¹⁷

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¹⁵Nicholas H. Clulee, John Dee's Natural Philosophy - Between Science and Religion (New York: Routledge, 1988).

¹⁶Frances Yates, Giordano Bruno and the Hermetic Tradition (London: Routledge and Kegan, 1964), 150.

¹⁷Frances Yates, Theatre of the World (Chicago: University of Chicago Press, 1969), 18.

Dee's Published Works

For the purposes of this discussion of architecture, my study will be limited to Dee's three most spatially descriptive writings.¹⁸ Rather than search for a hypothetical adequation of the "whole," we must read these texts in order to discover their architectural essences and elucidate Dee's underlying attitude toward practice. In so doing, it is the intent of this exercise to glean coherent essences, or as the case may be, the irrational exigencies existing in Dec's treatment of a vast spectrum of subjects.

Dee's Propaedeumata Aphoristica (1558) and Monas Hieroglyphica (1564) are two complementary works that deal respectively with the movement of celestial bodies (astronomy)¹⁹ and its influence on terrestrial activity (alchemy).²⁰ In these works, a mathematical progression of aphorisms, theorems and symbols supposedly lead to a new method for the interpretation of the macrocosm and the microcosm.

The Propaedeumata Aphoristica is composed of one hundred and twenty aphorisms which Dee had been prompted to prepare after receiving a letter from the Flemish geographer Gerard Mercator on current disputes among astrologers. He proposes that the subject be approached mathematically, and on this basis, investigates the nature of astral influences and the theory of signatures. The cosmological framework of the *Propaedeumata Aphoristica* is the earth-centred universe, where devices of Ptolemaic astronomy regulate the motions of heavenly bodies. Dee's mathematical approach to astronomy is explained through a syncretic theory of geometrical optics. His thesis is that

¹⁸ Dec also wrote Parallatica commentationis praxeosque nucleus quidam (London, 1573), an astrological work inspired by the appearance of a supernova in 1572; he encouraged the economic and naval expansion of England in the General and Rare Memorials Pertayning to the Perfect Arte of Navigation (London, 1577); Dec edited with Federigo Commandino, Machometus Bagdedinus's mathematical work De superficierum divisionibus (Pesaro, 1570); and the work documenting his "angelic conferences" was compiled by Meric Casaubon, A True & Faithful Relation of What Passed for Many Yeers Between Dr. John Dee... and Some Spirits (London, 1659). Julian Roberts lists eight other published works attributed to Dee. (Julian Roberts, "John Dee," Dictionary of Literary Biography, 136 [1994]: 58-66). See also Appendix 1A in Taylor, Tudor Geography 1485-1583, 191-2; and Clulee, "John Dee's Writings," John Dee's Natural Philosophy, 302-309.

¹⁹Originally, astronomy included the observation of the stars and planets and their influence upon the tides, climate and other natural phenomena, together with the supposed influence of the stars and planets on human affairs. During the late 1400's a distinction developed between the scientific study of astronomy (called natural astronomy) and the philosophical study of human destiny (called judicial astronomy or astrology). The distinction became clearly established by the 1600's. Robert K. Barnhart, The Barnhart Dictionary of Etymology (New York: H. W. Wilson, 1988), 59.

²⁰Medieval chemistry combining the study of chemistry, philosophy and magic. Medieval latin alkimia was borrowed from Arabic al-kimiya (al the + Late Greek chymela) art of alloying metals; Greek chymela pouring, related to the mixing of plant juices. Barnhart, The Barnhart Dictionary of Etymology, 22.

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Frontispieces for John Dee's *Propaedenmata Aphoristica* (1558) and *Monas Hieroglyphica* (1564), both incorporating his inystical "Monas" symbol.

the influence of the stars is conveyed by certain rays which emanate from them, analogous to light: that the conjunction of these rays at a particular place and time is unique, and that they can be measured. Clulee has noted that like most of Dee's work, this one does not observe the accepted boundaries of sixteenth century science and that this fact is related to Dee's deliberate standing away from academic life.

The Monas Hieroglyphica (1564), dedicated to Maximilian of Habsburg (1527-1576), is Dee's most enigmatic work. It is a series of theorems expounding the Monas symbol which had first appeared in the *Propaedeumata Aphoristica* in 1558. This hieroglyphic symbol is used to explain and illustrate the *monas*, or primordial unity, of the universe. Dee bases his Monas symbol on the astronomical sign for Mercury, combining with it those of the other planets (those for the Sun and Moon being the most obvious), the cross (which could represent the four qualities of hot, cold, moist, and dry), and at the base, the sign of the Aries constellation. This alchemical symbol, stemming from a reformulation of the old doctrine of the four elements, applies to the sublunar world, and can be disassembled and reconfigured into a variety of zodiacal and numerical symbols. In the Monas, Dee has devised a symbol of enormous power, which is not only emblematic of

the alchemical process of transmutation of metals, but also the sublimation of the soul in its progress toward the divine.

In 1570, Dee published his "Mathematicall Praeface" to Henry Billingsley's English translation of Euclid's Elements of Geometrie. His statement of the dignity of the role of mathematics at the outset is strongly influenced by Neoplatonism, particularly that of the fifth century Greek philosopher Proclus. Mathematics. Dee proposes, is the key to knowledge.²¹ He also draws upon Aristotle for the main divisions of the mathematical arts, and cites the "incomparable Vitruvius" for their multiplication. These arts he gives a series of Greek-derived names, for example, "Chorographie." The significantly comprehensive art of "Architecture" is defined as "the storehouse of all workmanship." Dee's discussion of architecture encompasses many of the other related arts, quotes from Vitruvius and Alberti, culminating in an articulation of the classical theatre. The Mathematicall Praeface is also a statement in the vulgar tongue, of English rather than the scholarly language of Latin, and is devoted in a large part to setting out the importance of mathematical studies to those interested in a variety of arts and technologies. One of Dee's most controversial disciplines is named "thaumaturgike," literally "wonder-working," which he posits as a science for the effecting of marvels in the sublunar world. Although it is a distinct discipline concerned with mechanical magic, implicit in Dee's argument is that wonder-working should be the practical directive of any of the arts or sciences. Thus, the practice of Architecture, for example, should be oriented toward wonder.

The notion of wonder is an essential feature of Dee's writing. In the *Propaedeumata Aphoristica*, he marvels at the phenomenon of magnetism: "In the magnet, God has offered to the eyes of mortals for observation qualities which in other objects he has left for discovery to the subtler research of the mind" (*PA*. XXIIII). To behold, with wonder, the drawing of iron by a lodestone is, first and foremost, to be astonished by its mystery. In fact, to comprehend this sympathetic attraction one must assume the existence of an unseen link; there must be some reason for this miraculous breach in distance. While the eye of the observer in the late twentieth century may pause little to wonder at the lodestone, the Renaissance eye would linger with curiosity. Its invisible forces and their resultant motion would be cause for awe and conjecture, as when Giambattista della Porta

²¹The broad usage of the term is at least as old as Plato who in the *Republic* (VII, 521c-531c; also *Laws* 817c), includes astronomy, music, geometry and arithmetic in his classification of mathematical studies.

described magnetic interaction in "Of the Wonders of the Loadstone" as an erotic embrace in which neither the lodestone nor the iron will refuse to be drawn.²²

Beyond the philosophical and contemplative aspect of the Greek *thauma*, there rests an even more potent dimension to wonder. This dimension is beyond the observed marvels of everyday experience and carries with it certain dangerous possibilities of human behaviour, possibilities that transgress the limits of theoretical introspection. Drawing on Boethius, Dee states, "Your purpose is to know profound thynges: *and* to shew meruayles" in order to "Imitate the heaven" (*MP*, A.j.^v; italics mine). His reasoning follows a trajectory along the modes of speculative observation toward engaging in wonder, shifting from contemplation to participation. This shift can be understood as a distinction of the *theoros* from the *thaumaturge*. For instance, while the movement generated by the lodestone captures the attention of the *theoros* inspiring him to comprehend, reflect upon, and know the profound thing he sees, the *thaumaturge*, seeking to emulate this wonderful motion, will be compelled to imitate, to show its profundity in his own world. The *thaumaturge* performs the queer art of working wonders.

Wonderworking is the directive underlying Dee's fascination with a stone more loaded than the magnet: the practice of alchemy. In the *Monas Hieroglyphica* he legitimizes his pursuit of the philosopher's stone stating that the "soul will be able to work wonders tying, no doubt, with bonds that cannot be loosed, Venus and indeed Mars to the disk of the Moon (or at least to that of Mercury) and producing [...] the Sun of the philosophers" (*MH* XIII). In this instance the production of marvellous effects, or wonder, is double: both contemplative and participant. Dee's esoteric, theoretical pursuit of alchemical gold, which is purposefully directed toward achieving a transmutation of the soul, must be understood in relation to his practical, chemical experiments at Mortlake. The thought of transformation fuels the activity, but the activity returns to thought via observation. These aspects are inextricably connected: there is no separation of theory from thaumaturgy for Dee. This kinship reveals the dual nature of conjuring.

"Thaumaturgike" is Dee's derivation of the classical art of effecting marvels which he defines in the *Mathematicall Praeface* as the art of making "straunge workes, of the

²²Giambattista Della Porta (1535-1615), Natural Magick (London, 1658), VII, xx, 201. The book was originally published as Magia naturalis libri XX in quibus scientiarum naturalium divitiae et deliciae demonstrantur (Naples, 1589).

sense to be perceived, and of men greatly to be wondered at" (*MP*, A.j.). It is in this passage that the marvellous observed in the cosmic world is distinguished from the marvellous in the world of invention and fabrication (*MP*, A.j.^v). This art thus consists in mechanical devices which produce effects that seem magical or supernatural. Some of these wonders, such as the machines of Ctesibius and Hero, are produced by pneumatic operations; others, including those that Plato²³ and Aristotle²⁴ mention, are accomplished by weights; and some rely upon tensile members or springs. The "Images of Mercurie: and the brasen hed, made by Albertus, which did seme to speake" depended upon other undisclosed devices. Here Dee refers to the speaking images of the kind generally supposed in the Renaissance to be magical, the brazen head described by "Mercurius Trismegistus" in the *Asclepius* which the Egyptian priests were supposed to animate by their religious magic. All such marvels are, Dee assures the reader, "Naturally, Mathematically and Mechanically, wrought and contrived" (*MP*, A.j.-j.^v).²⁵

The practice of thaumaturgy is the most controversial of Dee's mathematical arts. Included in his discussion of "Thaumaturgike" is "A Digression Apollegeticall" which is a lengthy retort against those who accused Dee of being a "conjurer" (MP. A.ij.). Here he legitimizes his interest and pursuit saying that the "wonderfull vertues" of this discipline are that they "glorifie" creation, allowing him to attain wisdom and virtue. In presenting "Thaumaturgike," derived from the Greek " $\theta \alpha \nu \mu \alpha$ " (*thauma*), Dee ushers into English consciousness a practical art that is rooted in theory – in the manifold sense of *theoria* and its associations with spectacle, in the sense of breaking with the ordinary and everyday, and the experience of the unexpected. In contesting his reputation as a "conjurer." Dee orients human activity with the experience of the festive, cautioning the English practitioner against an exclusively mechanistic approach toward practice. This interpretation of "conjuring" implies a rejection of the irrational and supernatural conceptions of the term which made it such a questionable practice during the Renaissance. Because thaumaturgy induces an extraordinary state of being – a mingling of shock, lingering affection and expectant speculation – "conjuring" is exposed as a transformative practice.

²³For Plato a thaumatopoión, "wonderworker" engaged in eidôloloiikên technên, "image-making art"; is capable of creating illusions in our minds. Plato, Sophist, 235b, 236c. See also Hugh Party, Thexlis - Magic and Imagination in Greek Myth and Poetry (New York: University of America Press, 1992), 179.

 ²⁴Aristotle describes the metaphysical aspect of these mechanical devices. Aristotle, Mechanica, 849 a2.
²⁵See also Yates, Theatre of the World, 29-30; French, John Dee - The World of an Elizabethan Magus, 109.

Dee's practice of thaumaturgy is linked with folly. Ernesto Grassi has noted the relation between wonder and the Germanic expression wahn (illusion or folly).²⁶ Wahn stems from the Middle High German wan (hope, expectation); the root uen (to strive for) is connected to gewohnen (to be accustomed), wonne (delight) and wunsch (wish, desire).

"Folly is the poet's power to see, to unveil reality, to open a stage upon its claim, to create a world by its metaphoric and metamorphic qualities. Its expression is poetic language through myth – a form of story which begins and ends out of nothing, with a vision which represents reality in its particular historicity: the poem as the original mirror of the historical reality of an era."²⁷

Dee's writings reveal his penchant for the marvellous, referring to the curiosities provoking the study and practice of many subjects current in England during the Renaissance. Wonder is the inherent underpinning of the astronomer's practice explained in the *Propaedeumata Aphoristica* through the observation and study of celestial movements and their influences in the natural world. In the *Monas Hieroglyphica*, Dee demonstrates how cosmic influences may be exercised and invoked in alchemical practice. He describes alchemy as a contemplative act of participation, explained in relation to the Monas symbol which can be playfully taken apart and assembled to generate a variety symbols. The *Mathematicall Praeface* is similarly emblematic of the many contained in the one. It spans classical, medieval and Renaissance subjects – virtually an encyclopedia of Dee's library collection – deemed suitable for English study and practice in the sixteenth century.

²⁶Grassi, Folly and Insanity in Renaissance Literature, 41. ²⁷Ibid., 109.

THE COSMOGRAPHER'S WORKSHOP

"Well, well, It is time for some to lay hold on wisdome, and to ludge truly of thinges: and not so to expound the Holy word, all by Allegories: as to Neglect the wisdome, power and Goodness of God, in, and by his Creatures, and Creation to be seen and learned... The whole Frame of Gods Creatures, (which is the whole world,) is to vs, a bright glasse: from which by reflexion, reboundeth to our knowledge and perceiuerance, Beames, and Radiations: representing the Image of his Infinite goodness, Omnipotency, and wisdome." (MP, b.ij.)

Sympathy

" 'Nothing happens to men without cosmic sympathy.' – as Thrice Great Hermes²⁸ has taught us." (PA, CXIX)

The most respected philosophical systems of antiquity postulated the existence of a primal matter (*prima materia* containing all matter potentially within it) which, when impressed with certain form or qualities (hot, cold, moist, dry), became the elements – either earth, water, air or fire. In the *Propaedeumata Aphoristica* Dee describes the elements as the "four separate great wombs" (*PA. XVIII*), each connected to a "humour" in



²⁸Hermetic magic appears to have played a major role in Dee's development. Hermes Trismegistus was the mythical magus who, during the Renaissance, was believed to be an ancient prophet of Christianity. His writings were translated by Marsilio Ficino from the Greek. This supposed prisca theologia, actually a collection of gnostic writings composed between about 100 and 300 A.D., contained magical treatises and recipes. Dee considered himself to be the messenger of Hermetic mysteries in England during the sixteenth century. See André J. Festugière, La Révélation d'Hermès Trismégiste, 4 vols. (Paris, 1950-1954): III, 1; Lynn Thorndike, A History of Magic and Experimental Science, in 8 volumes (New York: Macmillan, 1923-1958): II, 813; Wayne Shumaker, The Occult Sciences in the Renaissance: A Study in Intellectual Patterns (Berkeley: University of California Press, 1972); and Yates, Giordano Bruno and the Hermetic Tradition, ch. 1-3.

the human body.²⁹ These wombs or elements of "imaginative experience"³⁰ permit a physical correspondence between the microcosm and the macrocosm. The correspondence is perhaps best set out in a table.

Element	Humour	Essence	Common Quality	Chimerical being
earth	melancholy	salt	cold and dry	gnome
water	phiegm	mercury	cold and moist	undine
air	blood	sulphur	hot and moist	slyph
fire	choler	sulphur	hot and dry	salamander

A change in qualities would result in a change of substance, or transmutation.³¹ This alchemical conception of the elements, embedded in a web of associations, lies within the typical Neoplatonic cosmos; a relatively small world with all parts interconnected through a universal sympathy which stamps the earth with supernatural signs and permits man to learn of the great world about him. Sympathy originates in heavenly bodies and propagates through space as prescribed by the medieval theory of the multiplication of the species, which is the extension of many species, or things from a single source. This source, conceived of as being in motion, was known as the prime mover (*primum mobile*). When received on earth, the species or radiated sympathy gives rise to effects and correspondent "motion" on a terrestrial absorber.

According to this doctrine, celestial bodies are capable of imparting or infusing their respective powers into every kind of terrestrial matter: herbs, stones, flowers, liquids. Because of the influx of these celestial essences into terrestrial things, materials themselves acquire the same occult virtues passed on to them by the heavenly bodies and thus come to possess divine efficacy. Having a sympathetic conjunction with a particular planet or zodiacal sign, a stone, might then be used to influence the stars, either to neutralize hostile celestial combinations or to augment the beneficial effects of a favorable heavenly

²⁹Eustace M. W. Tillyard describes the elements as analogous to living creatures, perceptible bodies that are in "a constant flux of transformation." Eustace M. W. Tillyard, *The Elizabethan World Picture* (New York: Vintage, 1944), 63ff.

³⁰In explaining the "tetravalence of reverie," Gaston Bachelard has discussed the four elements as "tendencies" and "poetic exaltations." See Gaston Bachelard, *The Psychoanalysis of Fire*, translated by Alan C. M. Ross (Boston: Beach Press, 1964), 80-90.

³¹This four-element hypothesis had chemical implications which were not completely overthrown until the end of the 18th century. Elias Ashmole, editor, *Theatrum Chemicum Britannicum*... [London, 1652], introduction by Allen G. Debus (New York: Johnson Reprint-Sources of Science, 39, 1967), xiii.



Cosmic correspondences, by Dee (MH, f. 27, 215).

configuration. These influences were thought to be transmitted through the medium of a cosmic spirit (*quinta essentia*) that pervades the entire material universe.³²

Cosmography

Cosmography,³³ Dee states, is "the Description of the whole, and vniuersall frame of the world" (*MP*, c.iiij.), it is an art that exercises the sympathetic relation of the microcosm to the macrocosm. Dee's role as a cosmographer may be understood in relation to his study, teaching and practice of astronomy, geography and navigation.

³²John G. Burke, "Hermetism as a Renaissance World View," in The Darker Vision of the Reniassance: Beyond the Fields of Reason, edited by Robert S. Kinsman (Berkeley: University of California Press, 1974), 100-101.

³³Dee explains that the art of "Cosmographie" matches "Heaven and Earth, in one frame;" that is, it allows a mutual collation and an homology between the celestial ("heavenly") and the terrestrial ("geographical and hydrographical") globes (*MP*, b.iii.). Cosmography, applies the correspondent *parts* issuing from the heavens (æquinoctal circles, elliptic lines, colours, poles, stars) to a specific *position* situated in reference to an earthly horizon (in their true longitudes, latitudes, declinations, verticality) about a particular *motion* (in revolution on the earthly globe) (*MP*, b.iii).

During the years 1547-1551, the developments in geographic mathematics and scientific cartography culminated in Louvain.³⁴ While still studying at Cambridge, Dee crossed the channel in May 1547 to study at Louvain with the circle of mathematicians including Gerard Mercator, Gemma Frisius, Gaspard van der Heyden, and Antoine Gogava. After several months in the Netherlands, he returned to England, bringing with him astronomical instruments created by Frisius and globes constructed by Mercator. These two men had a pivotal influence on Dee's mathematical development.³⁵

Gemma Frisius (1508-55), a great Flemish mathematician, cosmographer. cartographer and inventor of globes, was the first to publish details of surveying by triangulation; he devised what was in effect an improved and elaborately graduated crossstaff, to be used for horizontal as well as vertical measurements. In 1529 at Antwerp, Frisius issued the first edition of the *Cosmographia* of Peter Apian and in 1530 his own *De principio astronomiæ et cosmographiæ*, which was notable for the description of finding longitudes by carrying a true timepiece from place to place.

The second geographer with whom Dee was linked was Gerard Mercator. Mercator was not only a globe-maker and a cosmographer, but a very skillful mechanician. designing and making astronomical and surveying instruments. Dee had in his library a number of instruments specially made for him by his friend, in addition to the two globes already mentioned.

Through his contacts in Louvain, Dee had the opportunity to exercise his training as a cosmographer. In 1547 he made astronomical and astrological observations: "observations (very many to the hour and minute) of the heavenly influences," leading to geodesic calculations for determining geographic coordinates; similar observations permitting the establishment of new ephemerids were documented in 1553.³⁶ At Louvain, Dee also had the opportunity to study the theories of exploration including the intriguing idea being discussed of a northeast or northwest route to Cathay and India.

³⁴Antoine de Smet, "John Dee et sa Place Dans L'Histoîre de la Cartographie," My Head is a Map. edited by Helen Wallis and Sarah Tyacke (London: Francis Edwards and Carta Press, 1973), 107.

³⁵Two other teachers significant to Dee's development, were Pedro Nuñez (1502-77) of Portugal, whom Dee met in Paris, Nuñez is significant because of discoveries made by the Portuguese and Spanish between the second half of the 15th and first half of the 16th century. Oronce Finé, Regius Professor of Mathematic at the Collège de France, is the fourth of Dee's teachers, author of *Cosmographia* (Paris, 1542), of which Dee owned two copies. Taylor, *Tudor Geography 1485-1583*, 75.

³⁶de Smet, "John Dee et sa Place Dans L'Histoîre de la Cartographie,"107.



Frontispiece for Dee's General and Rare Memorials Pertayning to the Perfect Arte of Navigation, 1577 A Surveyor's Outlit, Cyprian Lucar, 1590

With Holland as his primary influence. Dee went on to contribute in large measure to the progress of European cartography. In the early 1550s, he invented the "paradoxal compass,"³⁷ an instrument for navigation in the polar regions, an accomplishment in which he prided himself. It is interesting to note the relation between the word "paradox" and Dee's invention. " $\Pi \alpha \rho \alpha \delta \delta \beta \alpha$ " (paradoxa) facts and things that are out of the ordinary, along with " $\theta \alpha u \mu \alpha \tau \alpha$ " (thaumata) wonders, were ideas that grew out of the encounters with extraordinary phenomena experienced by seafarers in ancient Greece.³⁸ Back in England. Dee would have particular influence as a technical instructor and navigational tutor. In 1551, he was recommended by John Cheke to Sir William Cecil who then introduced him to the English court; his courtly affiliations gave him the opportunity to contribute significantly in the development of British trade routes and cartography. With navigational globes, maps, and instruments in his possession. Dee advised Richard Chancellor on applied mathematics for navigation. Chancellor went on to establish in 1554 the Muscovy Company and in 1556, explored a passage between Great Britain and Russia with the aid of Dee's advice. This navigational route lead to the development of a pivotal

³⁷ Taylor, Tudor Geography 1485-1583, 88-91, 95-96, 263-265.

³⁸The infatuation with different manifestations of the marvellous became a veritable current of thought in Greece giving rise to a specialized literature, "paradoxography." Jacob, "The Greek Traveler's Areas of Knowledge Myths and Other Discourses in Paramias' Description of Greece'," 66ff.

trade relation with Russia and significantly enriched geographic documentation in England. Even more distant routes were realized in part by Dee's expertise. In 1579, the exploration of a northerly route to Cathay³⁹ had already excited the interest of Adrian Gilbert and John Davis, who eventually initiated several voyages in search of the Far East in the 1580s, based on technical advice given by Dee. Dee, however, did more than instruct these two marine pupils in the use of instruments, tables and the mathematics of navigating. During this time, he also interrogated angels in Gilbert's presence about their voyage planned to America – a voyage of considerable logistical mounting.

The role of Dee the practitioner, as surveyor and cartographer,⁴⁰ is not limited exclusively to the technical knowledge of measurement which he gained through the influential Louvain circle and which he applied in his instruction of pupils at the Tudor court. Nor is it limited to Dee's seminal role in the development of maps to record the new discoveries. It has been pointed out that for Dee, the search for a route to Cathay had not only geographic and commercial significance, but more so constituted the means of penetrating the secrets of occult science, those of Hermes Trismegistus and the hermeticism originating in the Orient.⁴¹ In drawing attention to this, de Smet indicates that the practical expansion of English seafarers toward Cathay, and for that matter to any other imagined destination beyond the horizon of the British isles, was in fact propelled by other more intellectual impulses than mere trade. English navigational practice contributed to a shift in the conception of knowledge of the macrocosm through the observation of unusual phenomena discovered in the world, marvels which are implanted in the mind of the traveller.

The cosmographer, then, defines pertinent traits which contribute to the specificity of one region in contrast to another: knowledge about the history of strange places and the r sterious philosophies of other cultures. For Dee, the *thaumata* present in places discovered beyond England endow the cosmographer with subject matter for innumerable observations as well as the hope of gaining knowledge of occult mysteries from the East. Dee and other philosophers like Guillaume Postel interpreted cosmography as a science of intellectual and geographical discovery; they thought Oriental wisdom might reveal a means

40 Ibid., ch. viii.

³⁹Taylor, Tudor Geography 1485-1583, ch. vii.

⁴¹de Smet, "John Dee et sa Place Dans L'Histoire de la Cartographie," 109-110.

of establishing a *concordia mundi* and a universal faith.⁴² As navigational practitioner, Dee promoted an expanded conception of the world in England which is explained by the travel narrative prevailing in the North, a narrative characterized by mystery and the unveiling of secrets. Underpinning these voyages was the belief that the discovery of Cathay, New Guinea, Asia, Atlantis, or Hochelaga (the hidden corners of the world) would reveal their philosophies, cultures and lands, as well as their strangeries and paradoxes to the curiosity of the English imagination.

A practical concern of cosmography, and architecture, is measuring - an activity concerned with marking a position in time and space. Measurement in the sixteenth century, is rooted in Ptolemaic cosmology; in Book 1, of Ptolemy's Geometry, the fundamental principle of geography is defined as the accurate fixing of position on the earth. However, the contemplative intentions of Ptolemy are transformed and adapted, for Dee, into the possibilities of active measurement. In the Mathematicall Praeface he claims that "Geographie" teaches ways by which "the Situation on Cities, Townes... may be described and designed, in commensurations Analogicall to Nature and Veritie"; for the application of this art "Mappes, Chartes, & Geographicall Globes" may be used (MP, aliij.). The transformation of the Ptolemaic contemplation of place in the cosmos into the active concern with measure may be illustrated further by pausing briefly to consider books dealing with cosmography from which Dee drew many of his sources; works dealing not only with astronomy and natural philosophy, but also navigation and survey, mathematical geography, and voyages and travels. The influence of contemporary published works which dealt with cosmographic measurement⁴³ and related geographical disciplines in Dee's Mathematicall Praeface are thoroughly discussed by Taylor.44 The impact of the Mathematicall Praeface and the influence of Dee's discussion of the family of disciplines that detail the science of measurement is expounded by Yates in discussing the

⁴²Works inspired by voyages of exploration emerged throughout the sixteenth century. For example, Dee's friend Guillaume Postel, (1505-1581), traveller and Hebrew-Arabic scholar, wrote Des Merveilles des Indes et du Nouveau Monde, où est demonstré le lieu du Paradis terrestre (Paris, 1553).

⁴³Noteworthy among Dee's collection of measuring and mensuration books are: Abel Foullon, Description et usage de l'Holometre (Paris, 1555), explains the holometre, an instrument adapted for any type of measurement; Johannes Taisnier, De Annulo Sphaerico (Antwerp, 1560); Jacques Besson, Le Cosmolabe (Basel, 1561), deals with the construction and use of a universal measuring instrument; Girolamo Cataneo, Dell' arte del misurare (Brescia, 1572); Silvio Belli, Quattro libri geometrici... il primo del misurare con la vista (Venice, 1566), treats the ocular estimation of size distance, and proportion, and teaches the virtue of mental geometry; and of course Marcus V. Pollio Vitruvius, De Architectura edited by Daniele Barbaro (Venice, 1567), book IX deals with sundials.

⁴⁴Taylor, Tudor Geography 1485-1583, especially Appendix II.

Mathematicall Praeface in relation to Robert Fludd's illustrations in the Utruisque cosmi historia... [The History of the Microcosm and the Macrocosm] (Oppenheim, 1617), and Pantometria [Geometrical Practice] (London, 1571), a book dealing with practical measurements of all kinds, written by Dee's friend and disciple Thomas Digges.⁴⁵

As evinced by Dee's navigational and geographical practice the cosmographer pursues knowledge about the world in which he lives – observing and encountering the universe and relating it back to himself. Measuring instruments, such as Dee's "paradoxal compass," orient the cosmographer toward the *thaumata* and *paradoxa* existing in the external world. In measuring celestial and terrestrial magnitudes human activity is positioned in the physical world. Our discussion of earthly measure may now be steered from the macrocosmic to the microcosmic aspect of the cosmographer's practice.

The Library and the Laboratory

Dee's attitude toward practice is characterized by the confluence of distinct thought processes – experimental, mathematical, and philosophical. The multiplicity and connectedness of these currents can be studied by examining where Dee's practical activities took place – in his library and laboratory.

The contents of Dee's library have played an important role in most interpretations of his approach to knowledge.⁴⁶ It was one of the most remarkable for his time in England, containing more than 2000 printed works and 198 manuscript codices.⁴⁷ Many of the works came from dissolved religous houses and the libraries of Oxford and Cambridge. Dee acquired books and manuscripts throughout his life, frequently handcopying works when a printed edition was not available. The discussion of Roberts and Watson in John Dee's Library Catalogue orbits around the facsimile reproductions of the

⁴⁵In the discussion of *Pantometria* (Geometrical Practice) Digges describes the use of a "topographical instrument" (sailing compass), used to ascertain distances from a map made by triangulation. For the art of surveying and other modes of measure see Yates. *Theatre of the World*, ch. iii, iv.

⁴⁶French, John Dee - The World of an Elizabethan Magus, ch. 3; Yates, Theatre of the World, ch. 1-2; Taylor, Tudor Geography 1485-1583, 191-243.

⁴⁷Clulee, John Dee's Natural Philosophy, 12-13.

1583 list of books in Dee's library.⁴⁸ Their analysis demonstrates that Dee's heavily annotated collection, especially those works he owned in manuscript form, were used mostly as working tools, and not antiquarian objects. Dee often amended books, adding diagrams and corollaries to works he studied, suggesting his attitude toward learning was active, in progress. Roberts and Watson also remark that Dee's study of Hebrew works facilitated his practice of kabbalah. For reference, the extensive division of Dee's library collection into categories such as art, measuring or architecture is perhaps valuable in that it puts the study of Dee's sources on a secure footing, but it offers little insight into the relation of these works to each other, nor indicates which volumes were most significant to Dee.

Dee's library was more universal in scope than any other in Elizabethan England. Nevertheless, it may be regarded as emblematic of the northern intellectual currents of the sixteenth century,

"The whole Renaissance was in this library. Or rather it is the Renaissance as interpreted by Ficino and Pico della Mirandola, with its slant towards philosophy, science, and magic, rather than towards purely grammarian humanist studies. It is a Renaissance without doctrinal ferocity, either Reformation or Counter Reformation, but with very strong mystical and magical leanings, a Renaissance which prefers to read of the hierarchies of angels with Pseudo-Dionysius... rather than the works of Calvin. And it is a Renaissance situated in England, with its characteristic development of popular science with a strong practical bent, with an outlook towards navigation and the sea, and new lands beyond the sea,... a Renaissance which values poetry, ancient and modern, Greek and Latin, Italian and French."⁴⁹

If Dee's library may be understood as an emblem of scholastic, written knowledge (apprehended by study), then similarly his laboratory may be thought of as an emblem of experimental knowledge (understood through experience). Both workshops, were set up on a family property at Mortlake in Surrey. Dee's move from London in the later 1560s to Mortlake provided the space for the library, housed at one time in five rooms. The property was also adjacent the river Thames enabling him to set up an elaborate alchemical

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⁴⁸Julian Roberts and Andrew G. Watson, editors, John Dee's Library Catalogue (London: The Bibliographical Society, 1990). Their study includes detailed chronological documentation of Dee's travels, activities, and acquisition and copying of works for his library.

⁴⁹ Yates, Theatre of the World, 12.

workshop, the largest private laboratory in England at the time. By 1583 he had built three workshops with a substantial number of apparata in several buildings on the property. Alchemical experiments in the sixteenth century pursued not just the separation of metals but were measured by the belief in the philosopher's stone and the elixir of transmutation. Transubstantiation through *scientia naturalis* (natural magic)⁵⁰ was probably Dee's ultimate concern in the laboratory, also one of his main concerns in his "angelic conversations." In addition to the laboratory experiments performed at Mortlake, Dee conducted magical exercises with Edward Kelley as his spiritual medium. The concurrence of Dee's exoteric physical experiments with his esoteric angelic exercises evinces the correlation of his alchemical and magical pursuits. The intentions of crystal-gazing and experimental science blur, mysteries of matter and spirit are thoroughly explored but retained as mysteries.

The library and laboratory at Mortlake may be regarded as emblems of Dee's activities. The way Dee marked his library collection, using books and manuscripts as working tools, overlaps scholarly introspection with openness and vitality. Similarly, the game of experimental science played out in the laboratory is marked by episodes of interference, effects without cause. The activity of one workshop corresponds with the other. Book and apparatus are inseparable vehicles of knowledge, the integrated crucibles of the practitioner's work.

In this connection, as an example of reciprocity, the library and laboratory are useful to designate the relationship between thought and action during the sixteenth century. The theoretical was in Dee's mind inseparable from the practical: they are necessary aspects of life directed toward the ordering of human activity. This is not a modern relationship between theory and practice. The post-Renaissance fascination with the free will would identify the practical with autonomy and self-determination. Nevertheless, for Dee, there is no division of ends; there remains a connection between watching and doing, reading and making. By analogy, architectural practice may be understood in relation to the intertwining of speculative and practical modes implied by the Mortlake workshops. Thus, architectural practice can be positioned where thinking and action dissolve into unity.

⁵⁰On the relation between science and magic during the Renaissance Wayne Shumaker points out that, "the department of inquiry designated for us by 'physical science' was then referred to as fatural magic,' the phrase deriving from the fact that causes that lay behind surprising effects remained hidden...What was then called scientia, or 'knowledge,' included what was thought to be solid in all branches of learning." Wayne Shumaker, Renaissance Curiosa (New York: University Center at Binghampton, 1982), 176.

The Discourse of Alchemy

According to alchemical lore in England during the sixteenth century, all of nature was conceived as a vast chemical laboratory. Paracelsus (1493-1541) and his followers, including Dee.⁵¹ considered Creation itself to have been a divine chemical separation and felt that the cosmos continued to operate in chemical terms. The four elements were perceived, by Paracelsus, in their cosmic sense as imperceptible elemental bodies or matrices. In the alchemical scheme of things, the macrocosm is explained in terms of chemistry; life forces, or archei, operated as internal alchemists in the body, the blood flow was described as a series of distillations.⁵² Dee's interest in alchemical medicine led him in 1562 to Zürich where he discussed Paracelsus with Conrad Gesner (1516-65), renowned naturalist and polyhistor. It is interesting to note that Gesner's Thesaurus de remediis secritis (1555), which deals with distillation and alchemical furnaces, was of particular interest to Dee.53

Dee's interest in metallurgy and chemical experiments all fall into the generally held principles⁵⁴ of alchemy during the Renaissance: namely, that earthly stuff was the issue of the macro-to-microcosmic union of astral beams and earth force.55 It was believed that the alchemist could alter the proportions of mercury in base metal. By subjecting base metal to a number of alchemical processes,⁵⁶ a transmuted, philosophical stone, high in mercurial content, would emerge. Although alchemy is concerned with earthly stuff, it is an activity

⁵¹The influence of Paracelsus on Dee is substantial, ninety-two editions of Paracelsian works in 157 copies were catalogued in Dee's library. Roberts and Watson, John Dee's Library Catalogue, 11.

⁵² Ashmole, Theatrum Chemicum Britannicum... [London, 1652], introduction, xvi.

⁵³See Conrad Gesner, *Thesaurus de remediis secritis* (Zürich: Froschover, 1555). This alchemical record contains marginal drawings of vessels and apparatus, and includes the methods of getting virtues out of plants,

animals, minerals and their use in effecting cures. Dee's copy is copiously annotated throughout, particularly in the sections dealing with distillation.

⁵⁴Dee maintains that the "three distinct parts" (PA, XVIII) of alchemy, the principles he borrows from Paracelsus, include: sulphur (principle of combustibility, substance and structure), salt (solidity and colour), and mercury (vaporous quality).

⁵⁵See Allen G. Debus, The Chemical Dream of the Renaissance (New York: Heffer, 1968); and Allen G. Debus, The Chemical Philosophy: Paracelsian Science and Medicine in the Sixteenth and Seventeenth Centuries (New York: Harper Row, 1977).

⁵⁶Dee lists seven(7) purgative operations of seven(7) planets under Aphorism 77 (PA, LXXVII). These are included in the twelve fundamental processes of the alchemist's work, which George Ripley calls the "Twelve Gates": they are: calcination, solution, separation, conjunction, putrefaction, congelation, cibation, sublimation, fermentation, exaltation, multiplication, and projection. See George Ripley's Compound of Alchymie (1471, pub. 1591) included with a collection of alchemical poems in Elias Ashmole's Theatrum ંટ

⁻ Chemicum Britannicum... (London, 1652).

1957 CONTOUR VEHIELS, WORKNHOP



Pacumatic apparata from Robert Boyle's New Experiments Physico-Mechanical Touching the Spring of the Air and its Effects, 3660). "Sublimatorium" from Andrea Labavius's Die Alchemie, 1597.

focused on the purification of the alchemist. In fact, alchemy's essential function was to transmute human spirit through gnosis. It establishes a cathartic morphosis, the dialectical sublimation of alchemist via the transformation of base metal into divine stone.

The position on alchemy, eschewed by Dec in the *Monas Hieroglyphica*, is that those labouring only in the transmutation of metals are denounced; man, not metal is the subject of alchemical transmutation, if rightly received. The alchemical quest is also not exclusive to the spiritual field – the transmuted human will be able to produce philosopher's stone in the external world (*MH*, XVIII). Here, Dee clearly identifies the human capacity for action in the physical world. The implications for architecture lie in identifying that both the architect and alchemist are in pursuit of the sublimation of human spirit through practice. The practitioner exercises a form of magic that is both subjective and transitive, working toward the alteration of the alchemist-architect (microcosm) and the transformation of his surroundings (macrocosm).

Simultaneous with Dee's first mention of the Architect in the *Mathematicall Praeface* is the acknowledgement not just of the geographical, but also the alchemical "lines" that describe a particular place. "Chorographie" is "an vnderling, and twig, of Geographie"



The "Temple of Four Castles" by Edward Kelley from A True and Fouthful Relation 11, 1659. The "crosse of graduation," for the grading and measurement of compound elemental qualities (MP, 2013).

(MP, aliii), the art whereby architectural beginnings are inscribed on the highly alchemical ground of the northern Renaissance. It teaches by analogy to describe a "circuite...in the territory or parcell of ground which it taketh in hand to make description, it leaveth out (or vndescribed) no notable, or odde thing, above the ground visible," (MP, anii). As the art concerned with the geometric demarcation of forces on the skin of the earth, "Chorographie" describes a place or situation in relation to the cosmos and the elements. Here, Dee introduces the Elizabethan reader to the idea of *chora*, the legendary first place appearing in the myth of Daedalus. One of Daedalus's principal commissions was the design of a chora or dance platform at Knossos.57 Echoes of the Greeo-Roman chora may be detected in Dee's discussion, but his manifestation is different. "Chorographie" is also, and this is the distinguishing feature of Dee's articulation, the means by which things below ground may be described: "Yea and sometimes, of things vnderground, geneth some peculier marke: or warning: as of Metall mines, Cole pittes, Stone quarries. & c" (MP. a.iiij.). This statement about things underground reveals Dee's practical interest in mining and metallurgy, practices involving the excavation of earthly stuff. It also signals Dee's interest in the alchemical pursuit of the philosopher's stone. "Chorographie" is a two-sided

⁵⁷ Alberto Pérez-Gómez, "The Myth of Daedalus," AA Files, 10 (1985): 51.

art. It is, on the one hand, a method for inscribing an architectural ground, apprehended in relation to its topographic and cosmic features, drawn or inscribed on the earth's surface. On the other, "Chorographie" makes perceptible the alchemical dimension of practice; embedded beneath the surface lies the base metal of the architect's work. Thus, Dee roots the genesis of architecture to the practice of alchemy.

ARCHITECTURE AND THE "MATHEMATICALL ARTES"

"The Mathematicall minde, [can] deale speculatively in his own Arte: and by good meanes. Mount above the cloudes and sterres: And thirdly, he can, by order, Descend, to frame Naturall thinges, to wonderfull uses: and when he list, retire home into his own centre: and there, prepare more Meanes, to Ascend or Descend by: and, all, to the glory of God, and our honest delectation in earth." (MP. *.i^V)

Mathematical⁵⁸ Understanding

Perhaps the most comprehensive single work written by Dee is his *Mathematicall Praeface* prepared for the translation of Euclid's *Elements of Geometrie*. Dee's discussion of the spectrum of mathematics, ranging from the study of optical perspective and mechanics to mysticism and land surveying, reveals the broad-ranging levels of his natural philosophy. Even a cursory reading of this piece will reveal that mathematics resists any simple attempt at definition. Similarly, the confluence of currents from the distinct traditions that flow into the *Mathematicall Praeface* is not easily extricable.⁵⁹ For this reason, some background relating to the the late medieval and Renaissance mathematical themes (a combination of Pythagorean, Neoplatonic and Hermetic magical influences) inherited by Dee will help us understand his *Mathematicall Praeface*.

In the search for wisdom, Renaissance thinkers sought to return to the undiluted and original sources of that wisdom. It was through the revival of mathematic schema stemming from the Greeks which inspired Dee's conception of mathematics. Classical philosophy saw mathematics as key. Pythagoras was one of the *prisci theologi* and *prisci*

⁵⁸Mathemata in the original sense of knowledge consists in what is learnable and how "the mathematical" unfolds its essence. Martin Heidegger, "Modern Science, Metaphysics and Mathematics," in Basic Writings, edited by David F. Krell (San Francisco: Harper, 1977), 243-282.

⁵⁹Clulee (John Dee's Natural Philosophy, 152-8) argues that the treatment and presentation of the mathematical arts in the Mathematicall Praeface is explicitly based on Proclus. French (John Dee - The World of an Elizabethan Magus, 108) claims that the Mathematicall Praeface is modelled on Agrippa's recommendation that the magician know arithmetic, music, geometry, optics, astronomy, science of weights, and mechanical sciences derived from these. Yates (Theatre of the World, 20-41) contends that the Mathematicall Praeface is based on the subjects Vitruvius urges the architect to know. See also Allen G. Debus, "Introduction" to Dee's Mathematicall Praeface, 8-12.

magi, so esteemed in the Renaissance because he saw in number the root of all truth and the constituent principle of all things. In Plato's *Timaeus*, the demiurge constructs the body of the world according to geometric proportions and forms the world-soul according to harmonic proportions.⁶⁰ These facets of the classical conceptions of mathematics entered the Renaissance through the renewed interest in Pythagorean and Neopiatonic philosophy.

Hermetic magical philosophy, Yates and French claim, provides a more specific impulse behind the active appreciation of the value of mathematics for the study of nature.⁶¹ They contend that mathematics was an aspect of the essential reality behind the appearances of natural phenomena. And, since mathematics was an essential element of nature, the study and manipulation of nature involved a concrete and practical application of mathematics in addition to the more obvious mystical and numerological interpretations of nature associated with Pythagorean Platonism and Neoplatonism.⁶²

An important source in the Renaissance for the Platonic epistemology of mathematics was the *Commentary of the First Book of Euclid Elements* of Proclus (410/12-485), which Dee studied carefully. Proclus's concept of mathematical knowledge is derived directly from the intermediate place of mathematics in Plato's scale of knowledge. Between knowledge of perceptible things that is limited to belief and conjecture, and the purely rational knowledge of intelligible ideas or forms, stands the knowledge of the understanding that uses images from lower forms of knowledge and, by means of assumptions, proceeds to conclusions.⁶³ Since *mathesis*,⁶⁴ or learning, is the recollection of eternal ideas in the soul, the study that most particularly arouses innate human knowledge and stirs the intellect is called mathematics.⁶⁵ Proclus attributes to

⁶⁰Plato, Timaeus, 31b-32a, 35a-36b.

⁶¹Frances Yates, The Occult Philosophy in the Elizabethan Age (London: Routledge and Kegan, 1969), 75, 80-2; Yates, Theatre of the World, 30-2; French, John Dee - The World of an Elizabethan Magus, 90-1.

⁶²Yates, Giordano Bruno and the Hermetic Tradition, 146-50. Neoplatonic works are present in large numbers in Dee's library – particularly Proclus, Porphyry, lamblichus and the Christian Pseudo-Dionysus. The library also shows Dee's interest in the Italian revival of Neoplatonism by Pico della Mirandola and Marsilio Ficino in their discovery of the Hermetic corpus. Roberts and Watson, John Dee's Library Catalogue, 28.

⁶³Nicholas H. Clulee, "John Dee's Mathematics and the Grading of Compound Qualities," in Ambix, 18 (1971): 201.

 ⁶⁴During the thirteenth century Roger Bacon identified mathesis, (meaning knowledge) with its sibling mathesi, (meaning divination). Bacon is quoted in Debus, "Introduction" to Dee's Mathematicall Praeface, 9-10, n.
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⁶⁵For Proclus, the *understanding*, as the intermediate between *intellect* and *sense*, traverses and unfolds the measureless content of the "*Nous*" by articulating its concentrated intellectual insight, which the *understanding* then gathers together and refers back to the "*Nous*." See Proclus, A Commentary on the First

"mathematical being" an intermediate ground between the indivisible realities of the intelligible realm and the divisible things of the sense world.⁶⁶

This particular understanding of mathematics is what makes it akin to erotic knowledge. According to the spiritual magic of Florentine Neoplatonist Marsilio Ficino (1433-1499), messages can be transmitted between the world of the intellect and the perceptible world. Ficinian magic is built on the principle of universal pneumatic sympathy and is comprised of three components: the upper world of living stars, the animate lower world, and between them the world of demons, or pneumatic beings. These demons, or "gifts" permit the *magus* to tap into currents which establish relations between the world's parts.⁶⁷ Ficino's pneumatic magic is based on Plato, who names magic as one of the "demonic" arts. It is interesting to note that Plato, in his *Symposium*, calls love a "daimôn," and "the demonic ('ta daimonion') is between god and mortal."⁶⁸ Moreover, demonic love is the source of all skills that mediate between earth and heaven.⁶⁹

There is also evidence of Heinrich C. Agrippa's occult influence on Dee's understanding of mathematics. In *De occulta philosophia* (1531), a work that Dee knew well, Agrippa expounds a tripartite conception of mathematical magic.⁷⁰ Agrippa divides the universe into the three worlds of the kabbalists: the natural or elemental world, where the *magus* operates with natural magic, the middle celestial world where he operates with mathematical magic, and the supercelestial world where he operates with numerical conjurations.⁷¹ Dee's concentration on mathematics, following Agrippa, as the key to all arts includes operating with number in mathematical science and operating with number to conjure angels.

661bid., 3-4.

⁶⁹Ibid., 202 c.

Book of Euclid's Elements, translated by Genn R. Morrow (Princeton: Princeton University Press, 1970), 9-10.

⁶⁷For a summary of Ficino's magic see Ioan P. Couliano, Eros and Magic in the Renaissance, tranlated by Margaret Cook (Chicago: University of Chicago Press, 1987), especially ch. 2 and 6; and D. P. Walker, Spiritual and Demonic Magic from Ficino to Campanella (Notre Dame, Ind.: University of Notre Dame Press, 1975).

⁶⁸Plato, Symposium, 202 d-c; 203 d.

⁷⁰In addition to the several copies of De occulta philosophia [The Occult Philosophy], Agrippa's famous work on spiritual magic, Dec also owned De incertitudine et vanitate scientiarum et artium atque excellencia verbi Dei declamatio [The Declamation on the Uncertainty, vanity and abuses of the Sciences and the Arts] (Antwerp, 1530). Roberts and Watson, John Dee's Library Catalogue, 28.

⁷¹For an outline of Agrippa's thought see Yates, Giordano Bruno and the Hermetic Tradition, 130-43; French, John Dee - The World of an Elizabethan Magus, 30ff.

Dee's Mathematicall Praeface opens with a Neoplatonically inspired discussion of number in the three worlds, but he concentrates on the operation of number in the middle world, the world of "Thynges Mathematicall." He stresses the fact, however, that mathematics also provides a means of operating in the divine (supercelestial) and in the elemental (natural) worlds (MP. *i.ff). His conception of mathematics is closely related to Agrippa's conception of mathematical magic, and because mathematics is the only discipline that participates in all three worlds, it also acts as the sort of demonic gift which traverses Ficino's magical schema.

Structure of The Mathematicall Praeface

In the statement of intent, Dee writes "a certaine forewarnying and Preface, whose content shalbe, that mighty, most pleasaunt, and frutefull *Mathematicall Tree*, with his armes and second (grifted) branches" (MP, *.i^v); this Dee has meticulously illustrated in the "Groundplat." This fold-out diagram signals the detail and conjunction of issues in front of Euclidean geometry. Dee's mathematical tree denotes the tension between a rational exactitude and a kind of insufficient attempt to delineate the openness and network of relations implicit in the mathematical spectrum.

The complex limbs of mathematics are carefully explained, beginning with a consideration of the "Thynges Mathematicall," number and magnitude. Number is a sum of units or monads which are not numbers themselves, but ideal indivisible entities, "numbering" being the mental union of many a *unit* into an idea of quantity. The absolute conception of number is described as an exercise of the rude imagination as it overlooks number's corporal and mystical aspects. Magnitude, the complement of number, is a notion according to which things may be thought of as long, broad or thick. Issuing from a *point*, magnitude is rendered as a geometric line. Such a *line* is a breadthless length, infinitely divisible in points. Points themselves are, like units, ideal indivisible entities, but also having position and capable of *motion* (MP. *.j^v-*.ij, a_j^v -a.ij).

Hinged to Dee's discussion are arithmetic (involving number) and geometry (involving magnitude). Arithmetic, having to do with the rule of things, makes use of the skill of *algebra*, an applied arithmetic based on the symbolic representation of mathematic entities. Geometry is essential to the "mechanician" in his sciences of

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Frontispiece to Dee's Mathematicall Praeface, 1570. Dee's "Groundplat" for the Elements of Geometrie..., 1570.

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measuring.⁷² Derived from both arithmetic and geometry are numerous "vulgar" arts and sciences. For example, derived from Geometry is "vulgar" geometry, including "geodesie" (surveying), "geographie" and "chorographie" (measure of place), "hydrographie" (the study of oceans), and "hypogeiodei" (subterreanean measure).

Dee distinguishes as separate arts rather narrow uses of mathematics to which he frequently assigns names of his own coinage from Greek roots. Along with the more familiar geography, perspective, astronomy, music, astrology, statics, and navigation, are technical sciences such as "trochilike" (properties of circular motion.) "heliosophie" (properties of spiral lines), "menandrie" (enhancement of power), "horometrie" (measurement of time), "stratatrithmetrie" (ordering military forces), "pncumatithmie" (pneumatics), and "hydragogie" (aqueducts). Others such as "zographie" (drawing, scene painting), "thaumaturgike" (natural marvels), "archemastrie," and architecture are less

⁷²Geometry so concerned Dee that he chose to rename its dual aspects. Geometria, or "Land measuring" is concerned with practical measurement and surveying, which Dee differentiates from pure geometry. The contemplation of geometry's metaphysical aspect, called *Megethologia*, is more appropriate, he claims, to the general and abstract science of magnitude (MP, a.ij).

sciences than arts in which the fusion of principles from several different disciplines is evident.

In presenting such an encompassing breakdown of mathematically derived subjects. Dee has presented the world, and knowledge of things as a kind of "open encyclopedia."⁷³ Mathematical knowledge is like a web radiating out; things, Dee suggests, are to be "openly, of the world perceived" (MP, *.iiij^V). His structuring is at once the attempt to rigorously encircle the ever-expanding universe of mathematical beings inscribed on the field of geometrical study, and a diagrammatic mapping of something that otherwise refuses closure, demonstrated by the multiplication of many derivative arts and sciences. Though Dee describes these distinct disciplines separately, the mathematical world he attempts to explain spirals ever outward, mathematical understanding simultaneously restores itself through a writing of the physical universe.

By naming and discussing each art, Dee carefully separates the issues at hand; however, in order to describe one he frequently calls on others. Mathematics, therefore, functions as a kind of magical nexus connecting the divine world with the created world and linking humanity to both through mathematical understanding. As a mathematical art, "Architecture" can be considered as the place where multiple disciplines, currents and relationships coalesce. Architecture is the mother of all the arts and sciences and the one which includes them all, for the education of a true architect must include some acquaintance with every branch of the whole encyclopedia of knowledge.⁷⁴ The inextricable complexity, or to put it better, the simultaneous presence of even the most disparate elements-in the compound mathematical art of "Architecture"– converge to determine an event.

As a work in the "vulgar" tongue, the Mathematicall Praeface signals the infiltration of the Greek, Latin and Hermetic traditions into England; Dee's "chiefest cause" was bringing forward this legacy, for in it may be found the "inventions of straunge and wonderfull thinges" (MP. .ij.). Dee's intent "to excite and stirre up" popular interest in

⁷³Italo Calvino, "Multiplicity," in Six Memos for the Next Millenium (Cambridge, MA.: Harvard University Press, 1988), 116. In identifying the encyclopedic aspect of "understanding" Calvino claims, "knowledge as multiplicity is the thread that binds together major works of what is called modernism and of what goes by the term postmodernism...today we can no longer think in terms of a totality that is not potential, conjectural and manifold."

⁷⁴ Yates, Theatre of the World, 25.

classical subjects among English practitioners was made possible by assigning to them Vitruvian classifications (MP. .ij.). The Mathematicall Praeface then, is a weaving together of the diverse branches of knowledge into a manifold and multifaceted vision of the world. The study of these arts was the foundation upon which solid geometrical inquiries could be made; this Dee made clear by planting the study of Euclid in the loarn of the Mathematicall Praeface. And reciprocally, the knowledge of the "artes mathematicall" are conceptually adherred to the instruction of "the principles, groundes and Elements of Geometrie" (MP. .ii.). Dee also aided the comprehension of the Elements by preparing annotations, corollaries, alternate proofs and new diagrams where he saw fit to do so.

Mathaumata

Mathematical arts and sciences are to be learned; the method of teaching, however, is not limited to the arts and sciences themselves.

A significant passage dealing with Dee's approach to mathematical learning is in the section on "Archemastrie." The term Archemastrie, meaning "full of mastery." stems from Thomas Norton's *Order of Alchimy*, a text which conceives of knowledge in alchemical terms. *Arche*, the prefix of the term has a double meaning: that from which something emerges, and that which governs over what emerges.⁷⁵ Dee defines Archemastrie as both magical and practical. In the crucial passage, Dee says.

"And bycause it procedeth by *Experiences*: and searcheth forth the causes of Conclusions, by *Experiences*: and also putteth the Conclusions them selues, in *Experience*, it is named of some *Scientia Experimentalis*. The *Experimentall Science*." (MP. A.iij^v)

In Dee's usage, "experimental science" retains its traditional broad meaning of experiential knowledge resulting from some sort of practical trial. In fact, experiment, understood as practical experience, had a wide currency in sixteenth-century English magical literature, where the term experiment is used for a variety of magical practices, including crystal-gazing and raising spirits.

⁷⁵Heidegger, "Modern Science, Metaphysics and Mathematics," 260.



In addition to pointing out the value of experimental science in the passage on Archemastrie, Dee posits magic, albeit indirectly, as an approach to knowledge. Clulee claims that Dee's obscure references to *alnirangiat* and the *ars sintrillia*, both explicitly magical subjects, must be understood as the complement to "experimental science."⁷⁶ Dee's use of their original Arabic and Latin names may have been to deliberately conceal the references.

Archemastrie implies that the mathematical arts can be extended by the introduction of principles from outside their conventional boundaries. One of the refreshing features of the *Mathematicall Praeface* is the freedom and flexibility with which Dee encourages the development of existing arts and sciences. They are elaborated and enhanced through the interaction of several distinct approaches to knowledge – confused in the experience of the mathematical, the magical and the experimental. It is the archemaster who "steppeth in and leadeth forth on, the *Experiences*, by order of his doctrine *Experimentall*, to the chief and final power of Naturall and Mathematicall Artes" (*MP*, A.ij.^V). Archemastrie, then, is less a distinct art with its own subject matter and principles than a catch-all term for the

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⁷⁶Almrangiat was an odd Arabic term used to refer to various kinds of magic ranging from tricks to talismans and conjuring. It is defined as the magic att that joins together the virtues of earthly things to produce strange and extraordinary effects. Thus, it is a form of natural magic for the manipulation of the hidden virtues of things. Ars sintrifue involves a magic much less "natural" and even more obscure than almirangiat which is similarly derived from medieval and arcane magical practices. Clulee, John Dee's Natural Philosophy, 166-170

experiential methods that can be applied in all arts. It is also a sanction for giving consideration to the diffuse body of magical lore reporting natural effects and secrets that had no place in the discussion of the more established mathematical sciences.

If knowledge of things, according to Archemastrie, is attainable via natural magic (*scientia naturalis*), then the instruction of architecture in reference to Euclidean geometry could be enhanced with mathematical magic – something which benefits the student's comprehension of mathematics, in the order of wonder. The apprehension of mathematical knowledge according to experience appears to be Dee's concern in the use of *mathaumata*.⁷⁷

Included in the eleventh book (11) of Dee's original 1570 edition of Euclid's *Elements*⁷⁸ are more than 60 paper fold-outs, some with strings, intended to benefit mathematical learning.⁷⁹ The effect of these devices for the reader is clearly beyond that of mathematical demonstration. Had the issue been about illustrating Euclidean geometry or making difficult problems simple, Dee could easily have devised fold-outs for more complex geometrical propositions than those which he selected. In fact, many of the *mathaumata* in Book 11 demonstrate very pure geometries, or the most elementary of mathematical concepts, notions and forms which are profound in their simplicity. It appears doubtful that the impression of these things, these mathematical beings could escape the surprise and contemplation of the reader.

The profundity of these paper fold-outs is undeniable. They are aligned with Archemastrie because they reveal experience as magical. By occupying the middle zone between two worlds, between the vulgar world of geometrical exercises and the upper world of contemplation, they are no longer flat images of ideas. These devices demonstrate not only the place of mathematics, but of the practitioner in the world: they are intermediary and vertical. The very first of the paper fold-outs in Book 11 is a singular tab which

⁷⁷I am indebted to Louis Brillant who pointed out the significance of these fold-out diagrams in the 1570 edition of Euclid.

⁷⁸Euclid, The Elements of Geometrie of Euclid of Megara, translated by H. Billingsley, including "Mathematicall Praeface" by John Dee (London: John Daye, 1570).

⁷⁹Similar diagrams, though rare, appeared throughout the 16th and 17th centuries, particularly in books dealing with astronomy and medicine where multi-dimensional relationships and compound ideas are represented and demonstrated. One particularly compelling example is Ottavio Pisani's Astrologia seu motus, et loca siderum (Antwerp: R. Bruncau, 1613), a work that includes large engraved diagrams with revolving dials and pointers to assist the comprehension of astronomical proportion and motion.



Diagrammatic mathaumata from Book 14 of Euclid's Elements of Geometrie..., 1570

demonstrates very simply the vertical erection of a horizontal line. From the earthly horizon, the two-dimensional surface of the page, the *mathaumata* transfigures mathematics into a perceptible, spatial construction. To clarify the significance of these paper tabs, we should point out that they are representative of many other things which Dee discusses in the *Mathematicall Praeface*; they cast shadows, they conjure up images of sundials, compasses, even architectural forms.

Proposition eleven (11) of the eleventh (11) book of Euclid contains a marginal note added by Dee which cuts graphically into the text of the *Elements*. Dee points out the importance of contemplating wonderful things, either in the case when one is, "Mathematically imagining, or Mechanically practicing."^{NO} In this brief line, Dee identifies the two inseparable elements of human work: imagination and practice. By analogy, architectural practice may be informed, the architect as "mathematician" and "mechanician" is capable of effecting marvels. In placing his digression here, at the doubling of the eleven (11). Dee has identified a peculiar moment, not only the instant of marriage of imagination and practice, but a moment of symbolic and numerological significance. Eleven (11) is a numeral composed of two parallel lines that stand vertically; it is a doorway, a temple

⁸⁰Euclid, The Elements of Geometrie..., Book 11, Proposition 11, 328⁹.

opening. It is interesting to note that one of the marks of ownership which Dee frequently used to identify books in his collection was a "ladder" symbol, made of two vertical lines joined by three horizontal rungs.^{\$1}

It should also be noted that in Book 11 there are images borrowed from Fra Luca Pacioli and Albrecht Durer. Images of the five regular bodies – which were built before they could be drawn – are taken from Pacioli's *De divina proportione* (1509); they are included among the leaves containing the *mathaumata*.³² Also present are images for the construction of the five bodies, borrowed from Durer's *De symmetria humani corporis* (1534), which may be assembled in three dimensions from flat engravings.⁸³

⁸³Ibid., Book 11, 340^vff.

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⁸¹The "ladder" mark has frequently been found in conjunction with Dee's name. Roberts, John Dee's Library Catalogue, 24.

⁸²Engravings of the cube, tetrahedron, octahedron, dodecahedron, and icosahedron are found in Euclid, The Elements of Geometrie..., Book 11, 318^v-391^v.

Thaumaturgy and Practice

"[S]ing, together with me, to the praise and honour of that phoenix, from the wings whose charity alone we have extracted, with [feelings of] fear and love, all those *speculative feathers*,⁸⁴ [as protection] against the nakedness brought down on us by Adam, so that with their aid we might much more cheerfully resist certain raw colds of ignorance and will striving after honest Truth, might hide the shame of [our] mistakes from the philosophers' eyes." (*MH*, f. 8, 139)

It may be argued that the *Mathematical Praeface* is essentially practical in nature; that its purpose is to instruct and apply established mathematical knowledge. Dee frames his talk to English mechanicians "who well can, (and also will,) vse their vtward senses, to the glory of God, the benefit of their Countrey, and their owne secret contentation, or honest preferment, on this earthly Scaffold" (*MP*, a.iij). The *Mathematicall Praeface* did serve to diffuse and redistribute established information and techniques in England and, in the process, stimulated a familiarity with mathematics to a large audience. Dee himself assumed, in part, the role of mathematical practitioner, exemplified by his tutoring in a variety of mathematical subjects and by his work as a navigational and astrological consultant. Yet, what is at the root of the important work of the "mechanician," so stressed by Dee, as a work that involves the use of mathematics? (*MP*, a.iij) How is the work of the "mechanician" informed by the marvels of the "conjurer" and what is the relation of this practitioner dialectic to architectural practice?

It is in Dee's articulation of the mathematical disciplines as "Methodicall Artes" that he places an emphasis on usefulness. Mathematical arts and sciences are defined as distinct in their principle subject matter from geometry, even though they "vse the greate ayde, direction, and Method" of geometry (*MP*. b.j). A number of the "methodical" arts which Dee recommends for technical work deal with specific aspects of mechanics that lend themselves to application in a variety of activities, among which he mentions mills, mining, pumps, cranes, bellows, gunnery, engines of war, and mechanical clocks. Such practical technologies were founded in theory upon mathematical understanding, which served to reduce the magical stigma attached to the more unusual aspects of technology inherited by the Renaissance. Stories of Archytas's flying wooden dove, the brazen head of Bacon and

⁸⁴In the original Latin text this phrase appears as "Theoreticas Plumas." Dec is probably alluding here to Mercury's or Icarus' wings.



Simple machines from Robert Fludd's Utrusque cosmi. Austoria, 1617: pulley, builder's machine, music machine,

other automata, including the statues of the Hermetic *Asclepius*, were popular during the sixteenth century. Demonstrations of ingenuity with optical effects, such as burning mirrors and visual illusions of people walking in air were also detailed, often in association with the names of Archimedes⁸⁵ and Roger Bacon (*MP*, d.j, A.j). For Dee, there is on these technological marvels an overlapping of the "operational" aspect that is actualized by their mechanical means and the "poetic" dimension revealed in the profundity of their working.

Dee paid particular attention to the technological marvels from classical sources. He draws attention to the Greeks – Hero, Philo, Archimedes and especially Ctesibius – in the discussions of pneumatics, horometry, hydragogy, statics, and architecture. Vitruvius is Dee's source for both Philo and Ctesibius. Ctesibius of Alexandria (third century BC) wrote the first book on pneumatics in antiquity. In addition to the renowned inventions activated by fluid mechanics, notably the Ctesibian pump, water organ and clocks.⁸⁰ he

85Archimedes was considered to have been one of the two foremost figures of antiquity in the field of mechanics. During the Renaissance mechanics, dioptrics, and pneumatics were classified as *magia naturalis* and were therfore not considered to be as suspect as some other forms of *magia*. A good source for Archimedes is E.J. Dijksterhuis, *Archimedes*, translated by C. Dikshoorn (Princeton: Princeton University Press, 1987).

⁸⁶The chief source for these marvels is Vitruvius' *The Ten Books on Architecture*: water driven pump (X, vii), water organ (X, viii) and time keeping instruments – anaphoric clock (IX, viii, 10-15) and zodiac clock (IX, viii, 10-15).



Pneumatic automaton from 1693 edition of Philo of Byzantium. Automatic singing birds from Heron's *Pneumatics*.

also devised numerous singing, drinking and moving " $\alpha v \tau o \mu \alpha \tau \alpha$ " (automata).⁸⁷ Philo of Byzantium, teacher of pneumatics and technical science, wrote on hydraulic, mechanical, static and pyrotechnical demonstrations.⁸⁸ In the introduction to Book X (the book on motion and machines), Vitruvius states that it is a branch of the architect's business to plan seating and machinery for public shows and plays on the stage.⁸⁹ In ushering into England the marvellous feats from the past, was Dee concerned solely with the mechanical aspect of these technologies? Had he wished merely to expose the efficiency with which the mathematical sciences could be applied in the sixteenth century, surely there would have been more mechanically sound references to cite than the techniques of ancient Greece. Although the many *automata* are explained by physics, pneumatics or hydraulics, Dee's fascination with them lies in the realm of marvels, of " $\theta \alpha v \mu \alpha \tau \alpha$ " (*thaumata*); they are

⁸⁷See A. G. Drachmann, *Ktesibios, Philon and Heron: A Study in Ancient Pneumatics* (Copenhagen: Bianco Luno, 1948) for the works of Ctesibius (pump, water organ, water-clocks), 1-36; of Philo (pneumatics, hydraulics), 41-126; of Heron (automata, magic vessels, fountains), 127-161. See also, Jean-Claude Beaune, "The Classical Age of Automata: An Impressionistic Survey from the Sixteenth to the Nineteenth Century," in *Fragments for a History of the Human Body*, vol. 1, edited by Michel Feher (New York: Urzone, 1989), 430-480.

⁸⁸ Ludwig Reichert discusses the Philonian influence on the architectural imaginations of Villard de Honnecourt, Giambattista della Porta, and Athanasius Kircher. See Dr. Ludwig Reichert, editor, Philo of Byzantium – Pneumatica (Göttingen: Hubert & Co., 1974), 26-30.

⁸⁹Vitruvius, The Ten Books on Architecture, X. "Introduction." iii.

emblems of a mathematic-magical thought which rely on the devices of mechanical knowledge unsurpassed in sophistication and complexity.

During the sixteenth century, theatrical magic (thaumaturgy) and scientific magic (technology) were blended and interrelated activities.⁹⁰ In both the scholastic and the Hermetic traditions of the Renaissance, mechanical things were firmly linked in people's minds with magic. It is hardly suprising, then, that while at St John's College Dee's design of a mechanical scarab enabling an actor to fly above the stage for Aristophanes's *Peace* and his famous mirror that created the illusion of a life-size image of the viewer in front of a mirror earned him the reputation of "conjurer" (*MP*, b.j^v). Though fully recognized as being within the natural world, the practice of conjuring was controversial because it was considered contrary to nature, using mechanical magic or geometric optics to produce astonishing, unnatural effects. Although such practices were associated with negative stigma during Dee's time, they became more accepted in England by the next century. In 1648, for example, John Wilkins published *Mathematical Magic*, a book dealing with applied mechanics, simple machines and their uses.⁹¹

In discussing practice in relation to both the "mechanician" and the "conjurer," in the *Mathematicall Praeface* Dee cautions against the ensuing slippage between magical and mechanistic modes of thought. A quantitative and mechanistic approach to practice would eventually establish a metaphysics which did not leave room for animism or sympathy, thus making magic something "unreal" or "supernatural" in the modern sense. This transition was brought on in part by technical developments of the period: mining, military technology and navigation blossomed in the sixteenth century. Nevertheless, Dee clearly attempts to steer the practitioner beyond the goals of facility and efficacy by including references to theatrical magic. In defending himself as a conjurer, Dee maintains that conjuring is integral to practice. The intention of practice should not merely be concerned with the application of mechanical technology to the service of humankind – it must effect

⁹⁰ Yates. Theatre of the World, 79.

⁹¹ The full title reads: Mathematical Magic: or, the Wonders that may be performed by Mechanical Geometry. In two books [Bk. 1] Archimedes, or Mechanical Powers. [Bk. 2] Daedalus, or Mechanical Motions. Being the most easy, pleasant, useful (and yet most neglected Part) of the Mathematics. Not treated before in this language. See also, Alex Keller, "Mathematical Technologies and the Growth of the Idea of Technical Progress in the Sixteenth Century," in Science, Medicine and Society in the Renaissance, edited by Allen G. Debus, 1: 11-27, which includes examples of magical devices; and Bert Hansen, "Science and Magic," Science in the Middle Ages, edited by David C. Lindberg (Chicago: University of Chicago Press, 1978), 483-506.



Images with text from Lebbeus Woods's *The New City*, 1992; "If machines are grown, what might be the work they do?" (p 70), "Tools for the hand are instruments for the mind: their purpose is therfore uncertain" (p 68), "Knowledge is the certainty of the question, rather that the expediency of an answer" (p 58).

wonder in the world. The practice of architecture, then, must aspire toward things which the architect can only attain as *both* "mechanician" and "conjurer."

Thaumaturgy is the fruit of the *magus* whose work is closely allied with artistic expression. Thaumaturgy acknowledges the artificial and the marvellous: Dee's flying scarab is both a mechanical device and a fantasy invention capable of facilitating human flight. Here, the intentional trajectory of the scarab is analogous to architecture: both share the principle of working wonders. Thus, Dee prepares architecture to soar from the state of becoming to the incredible lightness of being itself.

Architecture

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John Dee did not practice architecture: his direct writing about the subject covers only a handful of pages in the *Mathematicall Praeface (MP. d.iij. - d.iiij^v)*.

Dee draws on Italian precedents for his brief description of "Architecture," quoting from the "Heavenly Archemaster" Marcus Vitruvius from classical Rome, and Leon Battista Alberti, the fifteenth-century Florentine. The influence of Vitruvius on Dee's understanding is undeniable;⁹² the lavish provision of Vitruvius in Dee's library, compared with the absence of Andrea Palladio's *I quattro libri dell'architecttura* confirms that Dee's interest in architecture was theoretical. Also, there was no copy of Sebastian Serlio's hermetically bent *De architectura libri quinque*, with its emphasis on perspective scenes in the theatre although, Serlio's tragic, comic and satiric scences are reproduced in Jean Martin's French translation of Vitruvius, which was in Dee's collection. The passages from Vitruvius's *De architectura* listed under "Architecture" provide Dee with the definition of an architect, references to the theatre, and the basis for his classification of mathematical arts and sciences. Quoting from Vitruvius, Dee claims,

"An Architect (sayth he) ought to vnderstand Languages, to be skilfull of Painting, well instructed in Geometrie, not ignorant of Perspective, furnished with Arithemetike, haue knowledge of many histories, and diligently haue heard the Philosophers, haue skill of Musike, not ignorant of Physike, know the aunsweres of Lawyers, and haue Astronomie, and the courses Cælestiall, in good knowledge. He geueth reason, orderly wherefore all these Artes, Doctrines, and Instructions, are requisite in an excellent Architect. (MP, diij-diij.^V)

Yates has demonstrated that Dee's discussion of Architecture, indeed of all the mathematical arts, is firmly rooted in Vitruvius.⁹³ Her detailed analysis reveals that the transference of Vitruvianism in England was due essentially to Dee. Interestingly, Vitruvius was not published in English until centuries after Dee's time; were it not for the references to Vitruvius included in the *Mathematicall Praeface*, the only architectural treatise

⁹²The first edition of De architectura was printed in 1486 at Rome, there were at least twenty-five editions before 1575. Dee owned five editions of this famous architectural treatise. Roberts and Watson, John Dee's Library Catalogue, 37.

⁹³ Yates, "John Dee and Vitruvius," Theatre of the World, ch. 2.

in antiquity would have remained virtually unknown in England. Also, of note is the fact that the English literary Renaissance was not matched by an architectural Renaissance.

A significant reference to Vitruvius is in Dee's passage on "Anthropographie" where he transcribes the Vitruvian concept of anthropomorphism.⁹⁴ Dee identifies man with the macrocosm, the being for whom all else was made, who "participates with spirits and angels" and is made "in the image and similitude of God." Anthropography, Dee claims, is "the description of the Number, Measure, Waight, figure, Situation, and colour of euery diuerse thing, conteyned in the perfect body of MAN: with certain knowledge of the Symmetrie, figure, waight, Characterization, and due locall motion" (*MP*, c.iiij.). To this harmonious and microcosmic constitution of man, all the arts are related, especially zography (painting and sculpture) and architecture. Dee draws the reader's attention specifically to Vitruvius's third book of *De architectura.*⁹⁵ Vitruvius uses the proportions of the human body to illustrate his concept of architectural symmetria. He states that man's body with arms and legs fully extended fits into a square and a circle.

Dee gives two other references for the geometry of the square and the circle as the basis of proportion. Durer's *De symmetria humani corporis* and Agrippa's *De occulta philosophia* deal with the proportion of the human body in relation to the occult lines of force inscribed within these simple geometries. In the twenty-seventh chapter of Agrippa's work, the extended body of man is illustrated within a square and a circle, which are marked with the characters of the signs of the zodiac and of the planets. The following chapter is on the composition and harmony of the human soul and on the effects of music in harmonizing it with the universe. In Agrippa, the fusion of the Vitruvian man and the cosmological man is complete, seasoned with a strong admixture of magic.

Dee's references to Vitruvius, Durer and Agrippa concerning the correspondence of cosmic harmony and the terrestrial world of man with the signatures of astrological and magical influence are connected to Dee's interest in the ancient problem of "Squaring the

⁹⁴The stress on anthropomorphism during the Renaissance is hinged to the Hermetic nature of architecture. For instance, the orthagonal plan of the Escorial, completed in 1586, was conceived such that it could be inscribed within a circle. See René Taylor, "Architecture and Magic – Considerations on the *Idea* of the Escorial," in *Essays in the History of Architecture*, edited by Douglas Fraser and others (London: Phaidon Press, 1967), 81-109.

⁹⁵The reference in the margin is to "Lib. 3. Cap. 1" (MP, c. iiij).



Vitruvian figures in a cosmic setting, from Heinrich C. Agrippa's De occulta philosophia, 1533.

Circle."⁹⁶ The reconciliation of the circle with the square is, for Dee, an exercise of technical and philosophical proportion, an act of bridging opposing worlds.⁹⁷ For example, as described by Ramon Lull, the circle (symbol of the heavens) and square (symbol of the four elements) are geometrical emblems of the cosmos. The Circle, defended by Aries and Saturn, was thought of as the figure most like to God, having no beginning and no end. Her brother the Square, however, maintains that it is he who is most like to God in the four elements.⁹⁸ In this relation, the union of the square and circle, then, would be the reconciliation of distinct magnitudes, an act which takes measurement to its zenith, collapsing the sacred emblems of roundness and orthogonality in a moment of

⁹⁶In his discussion of "Statike...or the Experiments of Balance"(MP, b.iii).^V) Dee outlines several exercises dealing with solid magnitudes and volumes, such as doubling the cube, comparing the volumetric ratio of a cube and a sphere, and the symmetrical reproduction of solids about an axis (MP, c.j.-c.iij). For Dee the most fascinating among these ancient unresolved problems is the problem of determining the proportion of a circle to a square.

⁹⁷As Robert Lawlor has noted, "the Squaring of the Circle is of great importance to the geometer-cosmologist because for him the circle represents pure, unmanifest spirit-space, while the square represents the manifest and comprehensible world. When a near-equality is drawn between the circle and square, the infinite is able to express its dimensions or qualities through the infinite." See Robert Lawlor, "The Squaring of the Circle." in Sacred Geometry (London: Thames Hudson, 1982), 74.

⁹⁸Lull also explains the Triangle (symbol of divinity) as nearer to the soul and to God the Trinity than the Square and Circle. See Frances Yates, *The Art of Memory* (Chicago: University of Chicago Press, 1966), 182-83. It is also interesting to note that Dee frequently used the Greek letter "A," notably in the dialogue reproducing • his words in the "angelic conferences."

coincidence. Squaring the circle – a technical paradox that signals the liquification of opposites, a unity of two beings – clearly demonstrates that for Dee the geometry of Euclid is a geometry of profound significance, the circle and the square are not objects for manipulation, they are elements of desire.

The passages from Vitruvius⁹⁹ that Dee transcribes in the *Mathematicall Praeface* (*MP*. d.iij.- d.iij.') synthesize: i) Architecture as the ample science which "is garnished, beautified and stored with so many and sundry skils and knowledges"¹⁰⁰; ii) the metaphysical construction of Architecture as the process of "framing" and "reasoning": iii) the dialectical notion of the signifier and signified; and iv) the criteria for the architect's education: one fostered in "many Languages and Artes," such that he might attain the "high Tabernacle of Architecture." In summarizing Vitruvius, Dee states that Architecture,

"is Geometrie, Arithmetike, Astronomie, Musike, Anthropographie, Hydragogie, Horometrie & c. and to conclude the Storehouse of all workmanship." (MP. d.iij.)

The passages from Alberti which Dee incorporates in the Mathematicall Praeface deal with: i) the exercise of the imaginative faculty in the Architect's work; he who "hathe the skill, (by a certaine and meruailous meanes and way,) both in minde and Imagination to determine and also in worke to finish what workes so euer, by motion of waight, and cuppling and framyng together of bodyes may most aptly be Commodius for the worthiest vses of Man." (MP, diiij.); and ii) the application of Albertian lineamenti. "Lineaments," Dee states, are "The Immaterialitie of perfect Architecture" (MP, diiij.); they are for Dee "the certaine and constant prescribyng, conceived in mynde: made in lines and angles: and finished with a learned minde and wyt" (MP, diiij.).

⁹⁹In Dee's copy of the 1567 edition of Vitruvius, with commentary by Daniele Barbaro, there are no annotations in book V (on theatre) but copious notes elsewhere attest to his interest in such diverse matters as the names of woods, in writers on architecture, on the water-organ and in hydragogy (water power). Roberts and Watson, John Dee's Library Catalogue, 82-83.

^{100&}quot;Garnish," taken from the Latin, ornata, i.e. ornament; and "Beauty" taken the Latin, venustas. In addition to Ornament and Beauty borrowed from Vitruvius, Dec declares the "storehouse" as Architecture's third aspect.

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Dee emphasizes the distinction of the mechanical from the mathematical in his description of the Architect – he calls the discipline a "mathematicall arte." The mathematical aspect can be understood as architecture's alignment with *mathemata*, that which is learnable and knowable in the metaphysical sense. Whereas the architectural practitioner in the strict sense deals with the "thynges mathematicall" and their inherent properties, besides dealing "Speculatiuely in his own Arte," the architect can also "Mount about the cloudes and sterres: And thirdly, he can by order, Descend, to frame Naturall thinges, to wonderful vses..." (MP, c.iij^V). Therefore, architectural practice may follow the aspirational trajectory of thaumaturgical practice.

The description of Architecture in the *Mathematicall Praeface* opens with a refutation about what constitutes architectural practice. The study of Architecture, Dee claims, is not to be approached with a limited or preconceived notion about the issues at hand. He objects to the belief that Architecture is concerned merely with building, a frequently held view which he disdains for its short-sightedness. Dee refers to the intellectual capacity of architecture by seating it above disciplines of technical facility; because it deals with "sensible" matter and essences, architecture is distinguished from the "mechanical" arts of "Housing, Fortification and Naupegie"¹⁰¹ (MP, d.iiij.).

The Architect is, according to Dee, a Mathematician $(MP, d.iij.^{v})$, he must be knowledgeable in all mathematical arts and sciences:

"And though, the Architect procureth, enformeth, & directeth, the Mechanicien, to handworke, & the building actuall, of house, Castell, or Palace, and is chief Iudge of the same: yet, with himselfe (as chief Master and Architect.) remaineth the Demonstrative reason and cause, of the Mechaniciens worke: in Lyne, plaine, and Solid: by Geometricall, Arithmeticall, Opticall, Musicall, Astronomicall, Cosmographicall (& to be brief) by all the former Derived Artes Mathematicall, and other Naturall Artes, hable to be confirmed and [e]stablished." (MP, diij.)

The Architect's role as mathematician is to guide the mechanician's work by applying the mathematical spectrum to Architecture. Architecture is the umbrella that

¹⁰¹ Probably a reference to naval architecture. The Greek word naus, ship is cognate with the Latin navigare, to sail, go by sea, to steer a ship.

encompasses: it is, Dee claims, "absolute" and "aboue all other Artes" (MP, d.iiij.). Architecture envelopes these arts and sciences beneath its wings; Dee also contends that they are all complementary and related. Architecture's primacy and also its blurring are evident only in its overwhelming integrity with other subjects, its interdisciplinary inextricability. Dee does not place Architecture at the top of the scale of being, but he does emphasize the rarity of its occurrence: Architecture is "excellent...though few (in our dayes) atteyne thereto" (MP, d.iiij.).

Though all the mathematical arts and sciences are encompassed by Architecture several merit consideration because they do not deal solely with mechanical or technical aspects. We may delve briefly into the more profound aspects of Architecture by outlining those arts mentioned in the previous quotation.

Geometry and Arithmetic, we recall, compose the dual-sided being of the mathematical. The moment of their bifurcation is simultaneous with Architecture's aspiration toward knowledge. Architecture relies on these two mathematical essences of measurement and numbering. The Architect directs his mathematical orchestra with Arithmetic and Geometry, his featured players. Geometric figures – points, circles, lines, and planes – and arithmetic elements – numbers and symbols – are combined and composed into melodious arrangements, a notated configuration of noise which is pleasing to the Architect's ear. Without Geometry and Arithmetic, Architecture could not perform its marvellous clatter.

Geometry and Arithmetic are the wellsprings of architectural activity. They are "our two Mathematicall fountaines" (MP, aiij.) toward which Architecture is attuned. In their absence, Architecture could not be articulated or described – it would remain a staffless musical score. In his philosophical discussion of mathematical being, Dee describes Arithmetic and Geometry as a seminal duity, "Whereby such sedes, and Rotes, as lye depe hyd in the ground of *Nature*, are refreshed quickened, and prouoked to grow, shote vp, floure, and giue frute, infinite, and incredible" (MP, aiij.). Geometry and Arithmetic are the rudimentary double germ of the Architect's work.

Optics and Music are two mathematical arts integral to Architecture which are dependent on the senses. Optics, or "Perspective" as Dee calls it in the *Mathematicall Praeface*, deals with vision. "Musike" has to do with harmony. The theory of optics is \cdot

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treated in Dee's discussions of astronomy and astrology (*perspectiva naturalis*) and "zographie" (*perspectiva artificialis*). Optical theory involves: the geometric study of visible rays for understanding movement patterns and change in position of stellar bodies: the influence of invisible cosmic rays on terrestrial phenomena; and direction of light beams with lenses for the effecting of marvels (catoptrics). In "Zographie" (painting, drawing, sculpture), optical theory is concerned with the applied techniques, illustrated by Durer, whereby an image of the observed three-dimensional world can be constructed on the two-dimensional surface of a canvas or drawing. "Musike," on the other hand, has to do with the aural sense. Dee's discussion of Music, or the Greek science called Harmony, is concerned generally with the consonance and dissonance of heavenly motions and the metaphysical contemplation of the so-called "music of the spheres," a notion popular throughout the sixteenth century. Music, for Dee, is essentially an analogical veil draped over the harmonic order of the universe. This order is perceived in the harmonic modes of music and it is made manifest in the hierarchical arrangement of cosmic spheres.

Music is essential for the Architect. Dee translates a substantial passage from Vitruvius dealing with the "sounding vessels"¹⁰² used in ancient theatre.

"Moreouer, the Brasen Vesels, which in Theatres, are placed by Mathematicall order, in ambries, vnder the steppes: and the diuersities of the soundes...are ordred according to Musicall Symphonies & Harmonies: being distributed in ye Circuites, by Diatessaron, Diapente, and Diapason. That the conuenient voyce, of the players sound, when it came to these preparations, made in order, there being increased with ye increasing, might come more cleare & pleasant, to ye eares of the lokers on." (MP, diij.^V)

Thus, Dee introduces the Elizabethan reader to the architectural ordering of the ancient theatre in its aural, acoustic and musical aspects.

¹⁰²Sight and sound were intergral to ancient theatre. Vitruvius mentions both sounding vessels (echea) the curious containers derived and positioned to facilitate resonance and amplification, and the three-sided machines (peraiktci) which revolved to show the tragic, comic and pastoral changes of scene. Vitruvius, V. 5, iii; Yates, Theatre of the World, 113-4.



Images from Robert Eludd's *Utrusque cosmi, ... Instoria*, 1617: The Temple of Music, Correlation of the *monochordium mundi* with the elemental, planetary and angelic spheres. Correspondences between the microcosm and the microcosm.

Later, music would even be manifest in architectural form in the Temple of Music by Robert Fludd. Fludd is indebted to Francesco Giorgi's *De harmonia mundi* (Venice, 1525), which was also in Dee's library. Giorgi develops the theme of the universal harmonic relationship between the microcosm and macrocosm, arriving at the identity of musical proportion with architectural proportion.¹⁰³ The incorporation of harmonic ratios into Renaissance structures is an attempt to put earthly architecture in tune with the cosmic order.

Both Music and Optics are subjects that align Architecture with the tangible, with an experience of things that is felt and lived. They are two approaches to knowledge which mark the Renaissance with the ancient traditions of the *aurile* and the *visile*.¹⁰⁴ While the details of Music and Optics are different they both draw the practice of the Architect toward the senses: one with aural sensations and the other through a visual directive. Architecture

¹⁰³See Rudolf Wittkower, Architectural Principles in the Age of Humanism (London: Warburg Institute, 1949), 1030; Yates, Theatre of the World, 58.

¹⁰⁴bor a discussion of the *aurile*(Hebraic) and *visile*(Greek) modalities present in the Renaissance see Walter, J. Ong, "System, Space and Intellect in Cenaissance Symbolism," *Bibliothèque d'Humanisme et Renaissance*, XVIII, 2 (1956): 222-239.

is enmeshed within the senses: it is both seen, in the realm of light and vision, and heard, in the realm of voice and language. Architecture is ensnared, charmed and enformed by their invisible beams, their characteristic vibrations and perceptible rays. These sensory nodes surround Architecture, one with an harmonic order perceptible to the ear, the other with a diagrammatic, visual mechanism. In identifying them with Architecture, Dee locates architectural practice in common, sense experience.

Astronomy and Cosmography also impress their effects upon Architecture. They place Architecture in the ancient dichotomy of the earth and the sky derived from the Ptolemaic geocentric worldview.¹⁰⁵ Dee describes Astronomy as having to do with the "motions, apparences and passions" of the "Mighty Corporal Creatures" in the heavens (MP. b.ij.). The observation and documentation of mass, size, position, colour, and distance in the planetary realm grants the Astronomer an understanding of the upper world. In the lower world, a "certaine Horizon" is perceptible in relation to the realm above. Influences from the celestial realm, which Dee calls the "thicke... heauenly Palace," rebound as "Beames and Radiations" from the sky to earth (MP, b.ij.). Hinged to Astronomy is the art of Cosmography. Cosmography firmly establishes the connexion between the celestial and terrestrial by matching Heaven and Earth in one frame. The Cosmographer takes advantage of the emanations issuing from the skies, and as a steward of the earth he maintains an equilibrium between the earth and the heavenly firmament. Among the ways he can reveal the effects of heavenly influences on earth are: through culture, the "due manuring of the earth;" as well as by the medicinal "Alteration" of the human body governed by cosmic patterns (MP, b.ij.).

¹⁰⁵Although Dec owned two copies of Copernicus' De revolutionibus orbium caelestium [On the Revolutions of the Heavenly Spheres], (Nuremburg, 1543), Dee's cosmology is earth-centred. It was the event of looking through a telescope, not invented until the seventeenth century, that lodged the Copernican sun-centred view of the universe in the metaphysical imagination.

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Todus mundis agit historionem.¹⁰⁶

Dee clearly ushers architectural ideas into England during the sixteenth century. While his discussion of architecture does culminate in an understanding of the theatre derived from Greco-Roman sources, his articulation is, however, not limited to a singular theatrical construct. For Dee, the theatre stands for the world. Vitruvius himself discusses the theatre more in its archetypal role as an architectural idea than as a specific building type. According to Frances Yates, Dee's Mathematicall Praeface is a Vitruvian treatise. The trajectory, she proposes in the Theatre of the World, traces a path from Vitruvius through Dee to Robert Fludd's memory theatres and onto the stage of the Globe theatre. She describes the idea of the Globe as a manifestation of Vitruvian theatre which, Dee implies, is the architectural embodiment of mathematical knowledge. Dee's irreducible conception of the theatre as life may be illustrated by giving reference to Alberti who, in De re aedificatoria, gives an account of the different shows (spectacula) available in ancient Rome.¹⁰⁷ They were performed in a variety of structures which include: theatres (which Alberti relates were traditionally built of wood), where plays were acted; amphitheatres, where animal baiting shows were displayed; and circuses, where the noble youth exercised themselves in chariot racing and other sports.¹⁰⁸ Expressions of the theatre similar to that described by Alberti persisted in England in the wake of the Mathematicall Praeface where Dee describes architecture, "Princess Mathematica" (MP, d.iiij.), as a kind of show place for all of the arts and sciences. Numerous wooden playhouses built in London from 1576 to 1614 (theatres with emblematic names like Swan, Red Bull, Globe, Fortune, Curtain, Hope, and Rose) are examples of the extent to which the theatre developed in England not just as a constructed place, but as an archetypal emblem of architectural thought.

¹⁰⁶ Translated as "All the world's a stage" in William Shakespeare. As You Like It. Act 2, Scene 7, line 139. However, the English translation does not convey that historionem comes from historia (a narrative, or story); also agit is cognate with the Latin agito (to put a thing in motion, to drive or impel, to shake, rouse up, excite) and agitatio (agitation, motion, contemplation, practice, exercise).

¹⁰⁷Dec owned the 1523 and 1553 French editions of Alberti's De re aedificatoria.

¹⁰⁸In book 8 there are several references to what have been translated as show grounds, which were intended for large-scale public enjoyment. Leon Battista Alberti, On the Art of Building in Ten Books, translated by Joseph Rykwert and others, (Cambridge, MA.: MIT Press, 1988), VIII, vi, 262 [145ff]; 268ff [148ff].



Sketch of the Swan theatre by Johannes de Witt (16th c.). Measuring templates for the London playhouses from the collection of John Byrom (1691-1763).

The notion of the *theatrum mundi* (theatre of the world) permeated architectural imaginations throughout the Renaissance.¹⁰⁹ This notion is crucial in understanding how Dee's architectural discussion fits into the magical and alchemical discourses pervading his time. Thought of not just as a particular place but an idea pervading the world, the theatre is the locale of metaphor, analogy and memory. The *theatrum mundi* stands for the world.¹¹⁰ Theatre as place is the site for study, for astrological questions and astronomical observations. It is the site of measure that extends from the internal humours of the human body to the outer extremities of elemental cosmology. But why theatre described in relation to the cosmos?

¹⁰⁹Vincenzo Scamozzi was interested in the *theatrum mundi* as the embodiment of meaning in architectural constructs. This analogical structure is presented in relation to the theatre in his architectural treatise, *L'Idea dell'Architettura Universale* (Venice: Expensis Autoris, 1615). See Marco Frascari, "A Secret Semiotic Skiagraphy: The Corporal Theatre of Meanings in Vencenzo Scamozzi's *Idea* of Architecture," VIA, 11 (1990): 33-51.

¹¹⁰The theatrum mundi prevailed throughout the Renaissance in the form of painted scenes, allegories and rhetorical discourses. See Lynda G. Christian. Theatrum Mundi – The History of an Idea. (New York: Garland, 1987); Yates, Theatre of the World, ch. ix. Dee's world is inhabited by the strange landscapes and macabre topographies of the Flemish painters Pieter Breughel and Hieronymus Bosch. In Breughel's work the theatrum mundi is most pervasive in the paintings Netherlandish Proverbs, 1559 and Carnival and Lent, 1559. See Walter S. Gibson, "Theatre of the World," Breughel (New York: Oxford University Press, 1977), 77ff.



The classical (Roman) theatre as described by Vitruvius (Cesariano edition, 1521). *Theatrian mundi* engraving by Theodor de Bry, from Jean Jacques Boissard's *Theatrum Vitæ Humanæ*, 1596.

Dee's basic idea and the obsession of his life was to organize the encyclopedia of human knowledge described as the mathematical arts and sciences within the analogous structure of the theatre. His aim was to develop an organizational system, a thaumaturgical machine in which the entire universe of thought could be circumscribed. The theatre is the *topos* for the unfolding of past, present and future, where human experience is localized in the architectural consciousness. This is a "storehouse," i. e. a theatre, where the alchemical and magical powers of mathematical being would activate the imagination. As a metaphor for architectural order, the theatre includes pneumatic and mechanical devices, and the consequent respiration of spirit (*pneuma*) through catharsis and transmutation.

The understanding of the theatre as a small scale *imago mundi* can be further illuminated by analyzing the idea of the theatre as vessel. As a vessel of sound, the theatre encompasses the realm of the aural and harmonic connection. It is the site of metricality and the place for speech, dance and action. As such, the vessel as theatre is a receptacle, the site of dynamic exchange between the human senses and the world of experience. In this relation, Dee's understanding of the theatre expresses an idea of space which is detailed by Plato. In the *Timaeus*, Plato describes *choras* in relation to the formless, puzzling, yet particular receptacle: that is, the vessel of becoming. Plato's idea of vessel – a container for

moving, indeterminate substance - is described as a kind of neutral plastic material on which changing impressions are stamped by the things which enter it.¹¹¹ This understanding of the receptacle of space pervades numerous vessels to which Dee refers, the most obvious being, the "brazen" sounding vessels of Vitruvian theatre mentioned in the Mathematicall Praeface. These vessels, intended to amplify sound, resonate with Plato's vessel description in the sense that vibrations impress their effect on substance. By referring to the musical proportions of the Greco-Roman theatre, Dee places architecture in relation to harmony, arching through space from sensory experience to the theatre itself. Dee also echoes Plato's strange encompassing description of space in his description of "Chorographie." Dee's translation of the conditions of primordial space are transferred into the demarcations of architecture, delineated along geo-metric and alchemical lines. In the capacity of navigational adviser, he was quite familiar with vessels of the sort used in the expeditions and voyages of English seafarers, extending the theatre through the measure of earthly magnitudes to the outer reaches of the cosmos. And, Dee's own use of apparata and instruments in the practice of alchemy further demonstrate the notion of the theatre as vessel. The bubbling, hissing spectacle experienced in the pursuit of the philosopher's stone, and consequent traversal of spiritual essences through the vessels of the alchemist's trade clearly relate to the cathartic event of theatre. Thus, architecture also circumscribes the theatre of alchemy: a theatre of learning, architecture communes many arts and sciences, through tempests and entanglements toward the shores of knowledge.

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¹¹¹Plato, Timaeus and Critias, translated by H. D. P. Lee (Hardmonsworth, U.K.: Penquin Books, 1965), 69.

ARCHITECTURE AND HIEROGLYPHIC WRITING

"As writing is a sign of speaking, and speaking, of the mind, in the same way mathematical figures and geometric diagrams are the signs of their concepts."¹¹²

Hieroglyphic Knowledge

In the Monas Hieroglyphica, Dee demonstrates a link between language and architectural order. In this work he sets out to explore writing as a means to regain and elicit a "written memorial... inscribed by God's own finger on all creatures" (MH. f. 4^v, 125). In the letter of dedication, Dee says that,

"the first and mystical letters of the Hebrews, the Greeks and the Latins, issued from God alone and were [by Him] entrusted to the mortals... the shapes of all those [letters] (which are disposed by a wonderful and most wise artifice) are derived from points, straight lines, and the circumferences of circles." (MH, f. 5, 127)

The Monas Hieroglyphica involves a hieroglyphic manner of writing that is intersubjective. It includes the establishment of a grammatical system using a number of symbols or geometric parts and the functions of rearrangement and transposition using an eclectic blend of alphabetical and typographical techniques that sets out to reform the disciplines of astronomy and alchemy. In this treatise, Dee expresses, as well as encodes, how mortals can be transfigured by direct participation in astral and supercelestial influences, elevated to an existence in which one would be free from the limitations of ordinary life in the body and the restrictions of conventional language.

Dee's Monas Hieroglyphica is in part inspired by the sort of Art of Memory advocated by Ramon Lull (1234-1316). Lull's memory system, a continuation of medieval mnemotechnics, was intended to construct a world of symbolic characters which expressed

¹¹²Daniele Barbaro, I Diecie libri dell'Architettura di M. Vitruvio (Venice, 1567) 274, quoted in Werner Oechslin, "Architecture and Alphabet," VIA, 8 (1986): 97.

approximately the realities of intelligible order. This system involved the stamping of magic images of the stars on memory. During the Renaissance, the Art of Memory had a widespread revival in the form of astral memory systems, which used the principles of the art, its places and images, in an attempt to organize memory by harnessing it to the forces of the cosmos.¹¹³ The Lullist art inherited by Dee involved a system of notation that aspires to universal knowledge through hieroglyphic notation.¹¹⁴

The Monas Hieroglyphica is also strongly rooted in the kabbalah.¹¹⁵ an essentially mystical discipline that supposedly constituted the oral part of God's revelation to Moses. The kabbalah enabled contemplation of the celestial and supercelestial mysteries through permutations of the sacred Hebrew alphabet, which was thought to contain symbolically the names of God and the entire universe. Use of this system took two forms – contemplative kabbalah and its extension and complement, practical kabbalah, which tried to employ the highest spiritual powers.¹¹⁶ During the Renaissance, kabbalistic operations, intent on exercising the beneficent effects of demonic intelligences, dealt with symbolic numbers and letters that may be transformed into numbers.¹¹⁷

What Dee proposes in the Monas Hieroglyphica is a reinterpretation of the Hebrew language. He presents a "new kabbalah" that is not confined to the Jewish tradition, which he explains as a revised language of hieroglyphs. This "new kabbalah" is exemplified by a

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¹¹³Yates, Theatre of the World, 42. The art of memory was clearly one of Dee's interests. He owned Guilio Camillo's Idea del theatro (Florence, 1550), the famous work in which architectural means were propounded for the increase of artificial memory. Camillo's theatre is described in Jacques Gohorry's De usu et mysteriis notarum (Paris, 1550), in the copy Dee owned he has underlined and added notes about his own "Monas." Another source for memory is Cicero's Rhetorica ad herennium, Dee's surviving copy is heavily annotated. Roberts and Watson, John Dee's Library Catalogue, 37.

¹¹⁴In addition to a large number of works by Lull, Dec owned John Reuchlin's De verbo mirifico and De arte cabalistica, works dealing with Christian kabbalah. Another indication to Dec's kabbalist interests is his early ownership of Francesco Giorgi's De harmonia mundi and Johannes Trithemius' works dealing with ciphers and secret writing: Polygraphia and Steganographia. Roberts and Watson, John Dee's Library Catalogue, 28-29.

¹¹⁵Kabbalah, literally means "tradition," that is the tradition of things divine, according to Jewish mysticism. See Gershom Scholem, On the Kabbalah and Its Symbolism, translated by Ralph Manheim (New York: Schocken Books, 1965), 1. Dee's collection of Hebrew books was unusually strong in tables and alphabets suitable for beginners in Hebrew, in grammars by the leading European Hebraists and in Hebrew-Latin dictionaries. Roberts and Watson, John Dee's Library Catalogue, 29.

¹¹⁶ French, John Dee - The World of an Elizabethan Magus, 111.

¹¹⁷For Agrippa there are three orders of intelligences or demons with which the kabbalist operates. First, supercelestial having to do only with divinity; second, celestial, the demons belonging to the signs, planets and other stars, all of which have names and characters, the former used in incantations, the latter engraved; and third, the lower world, as demons of the elements. Agrippa, De occulta philosophia, III, 16; Yates, Giordano Bruno and the Hermetic Tradition, 140.



Theroglyphic characters of the planets, from Heinrich C. Agrippa's De occulta philosophia, 1533 Table from the "Book of Eucoch," from Dec. A True and Faithful Relation..., 4659.

unified construction of significant astro-alchemical symbols that embody the underlying unity, or *monas*, of the universe.¹¹⁸ Dee represents *monas* (essential oneness) with his Monas symbol. In order to understand why Dee chose to name the universal principle of transmutation, and his symbol thereof. *monas* (or, in the English terminology of his own coinage, a "unit").¹¹⁰ we must recall the definition of oneness according to Heinrich C. Agrippa.¹²⁰ Like Dee's *monas*, Agrippa's notion of oneness in the elementary world denotes the principle of mercurial transmutation: "There is one thing created by God which is the subject of all wonderment on earth and in the heavens. It is in its action animal, vegetable, and mineral, found everywhere, yet known to very few, and by no one called by its appropriate name, but veiled under countless figures and enigmas without which neither alchemy, nor natural magic may attain their fulfillment.^{*121}

^{11S}Urench, John Dee - The World of an Elizabethan Magus, 78, n. 2.

¹¹⁹Dec introduces the term in the Mathematicall Praeface, "Note the worde, Unit, to expresse the Greke Monas, & not Unities as we have commonly, till now, used" (MP, 7, 2).

⁴²⁰In chapter iii, of book II of *De occulta philosophia* Agrippa expounds the idea of the *scala unitatis*, a scheme listing the manifestation of essential oneness in the archetypal, the intellectual, the celestial, the clementary, the microcosmic, and the infernal worlds. See Josten, "Introduction," 106.

¹²¹ vgrppa quoted in Josten, "Introduction," 107, n. 117.

A relation must be made here between Dee's symbol, the Monas, and the idea of a monad.¹²² In metaphysics, a monad is an individual and indivisible substance. The word was introduced into philosophy by Giordano Bruno to denote the minimum parts of substances supposed by him to be at once psychical and material. According to Bruno, the soul is a monad: it is never entirely without a body. God is the monad of monads; he is the minimum because all things are external to him, and at the same time the maximum, since all things are in him.¹²³ A monad is simultaneously the primeval unit, which is the source of all numbers but not a number itself, and the analogous point, which is a dimensionless unit with position; both were associated with the divine.

As an embodiment of unity, composed as a language of symbolic images, the Monas fits within the "emblematic worldview," an influential tradition rooted in the Renaissance.¹²⁴ The essence of this view is the belief that every kind of thing in the cosmos has myriad hidden meanings and that knowledge consists of an attempt to comprehend as many of these as possible.¹²⁵ Emblems, imbued with a web of correspondences, were thought to contain and conceal these meanings; similitudes lead to understanding, the universe is written as a code that reveals the attributes of God. Closely related to the emblem is the "device" or *impresa*. Dee states that the writing of the *Monas Hieroglyphica* is sealed with the Monas symbol, his own "London seal of Hermes so that in it there may be not even one superfluous dot" (*MH*, f. 4, 123), establishing the Monas as a sort of personal device with an image and motto particularly appropriate to the owner. He also points out the importance of "every jot and tittle" (*MH*, f. 5, 127) in the text, indicating a preoccupation with typography and textual detail that is characteristic of English

¹²²Monad - a unit, unity, from the verb unite - to one or as one, join together, incorporate, ally, link together, join in interest, affection, to harmonize, consolidate, coalesce, combine, commingle, to join in action, concur, act in concert.

¹²³ Whitney, The Century Dictionary: An Encyclopedic Lexicon of the English Language, 3828.

¹²⁴Since the prospect of citing the current literature on the emblematic and hieroglyphic traditions is too daunting, I will seek relief in the fact that these traditions are represented in Dee's library. Dee owned copies of: Piero Valeriano's Hieroglyphica (Basel, 1556) a popular Renaissance work signaling the attention given to hieroglyphic meanings: Andrea Alciati's Emblemata (1531) with its particularly enigmatic epigrams; Vincenzo Cartari's Le imagini colla sposizione degli dei degle antichi [Images of the Gods] (Venice, 1571); Natale Conti's Mythologiae (Venice, 1568); as well as two books on emblematic games, Girolamo Bargagli's Dialogo dei guiochi and Innocenzio Ringhieri's Giuochi diversi.

¹²⁵See William B. Ashworth, Jr., "Natural History and the Emblematic World View," in *Reappraisals of the Scientific Revolution*, edited by David C. Lindberg (Cambridge: Cambridge University Press, 1990), 303-332.

Renaissance grammarians.¹²⁶ Dee's embracing of the emblematic and hieroglyphic traditions, conceiving the natural world as a divine language encoded by God, is most certainly related to his view on human language.

Dee's admixture of the Lullist, kabbalist and emblematic traditions is grafted onto the main subject of the *Monas Hieroglyphica*, the alchemical quest for the philosopher's stone. The treatise is "woven together by a manner of writing" which, Dee declares, is fully "hieroglyphic, he who has examined its inner structure will grant that... there is [in it] an underlying clarity and strength almost mathematical" (*MH*, 3^V, 121). Dee himself indicated his Monas pertained to *astronomia inferior*, a very old synonym for alchemy (*PA*, LII; *MH*, XIII). While the *Monas Hieroglyphica* deals with astronomy and alchemy, it is actually about a new form of writing. Through this new writing, astronomy and alchemy will be rebuilt and restored because

"the common astronomical symbols of the planets (instead of being dead, dumb, or, up to the present hour at least, quasi-barbaric signs) should have become characters imbued with immortal life and should now be able to express their especial meanings most eloquently in any tongue and to any nation." (*MH*, f. 3^{v} , 121)

Furthermore, these planetary symbols and also those of the signs of the zodiac have been restored to their true symmetry and "mystical proportions." Mercury, or rather Dee's symbol of the Monas in which the astronomical symbol of Mercury predominates, is thus the restorer of all astronomy. In its treatment of alchemy, the *Monas Hieroglyphica* is an attempt to illuminate existing alchemical discourse by transferring it into the discourse of Dee's hieroglyphic writing.

¹²⁶The extensive use of punctuation, italics, parentheses and grammatical embellishments was characteristic of sixteenth century writing. As Marjorie Donker comments, "[Typographical] symbolism became an important literary means for poets to explore the personal spiritual life with profundity and psychological complexity." See Marjorie Donker and George M. Muldrow, "Type and antitype," in Dictionary of Literary Conventions of the English Renaissance (London: Greenwood Press, 1982), 234-237. Dee's text demonstrates this penchant for visual minute.

A Language of Hieroglyphs

Dee claims that alchemical transmutation cannot take place without mercury and fire. His hieroglyphic-kabbalist recipe for mercurial fire is illustrated by mixing the sign of the planet Mercury with the sign of Aries (or Fire). The result is his Monas symbol:



The Monas can be read as an embodiment of both microcosm and macrocosm. As microcosm (human), it is a kind of geometrical stick-man with a circle representing the head, wherein mental and spiritual life repeats the higher celestial world, whereas the Monas as macrocosm (universe) is a cosmic diagram with a circle representing the Sun; both physical form and corporal life repeat the elemental composition of the world of matter. If the Monas can be viewed as an emblem of cosmic order, then what is the nature of the analogy between hieroglyphic writing and architecture?

Dee's geometrical construction of the Monas and the derivation of meanings from the placement, arrangement, and rearrangement of its parts and their numerical equivalents fulfil his charge to grammarians that "reasons must be given for the shapes of the letters, for their position, for [their] place in the order of the alphabet, for [their] various [ways of] joining, for their numerical value, and for most other things" (*MH*, f. 4, 177); these aspects Dee maintains, must be considered in both a linguistic and literary regard. What Dee intends here is not the geometrization of letters into a universal writing system; rather, he implies that the particular aspects of these distinct languages be dissolved through hieroglyphic understanding, thereby establishing the Monas as a form of language.

The nature of Dee's hieroglyphic writing is quite distinct from alphabetic writing. The kind of writing that emerged in ancient Greece grew out of the abstraction of phenomena into schematically abbreviated symbols similar to the letters of the alphabet. Dovetailed to the establishment of such an alphabetical system of writing is the propensity to objectify meaning; today we tend to understand writing as such a "reduction" of speech. Hieroglyphic writing, however, originating with the Egyptians, is something very different. Even though it fixes an image, hieroglyphic writing reveals, in a way, a mystery "beyond" speech. Hieroglyphic writing is a non-phonetic form of language that communicates meaning across a distance, suggesting the estrangement of being from the original inscripted message. Attempts at decoding result in a variety of interpretations. In a sense, hieroglyphic writing remains "undeciphered," in that its mysteries are not transparently unveiled. The riddle of hieroglyphic knowledge can only be solved through the revelation of meanings, giving a name to nameless things through transference. Rather than identifying the characters of language with a finite meaning, hieroglyphic writing gives

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Finished Monas (MH, f. 25, 207).

The celestial egg (MH, f. 17, 175).

itself over to "proportional metaphor." offering an understanding of things that is polysemantic and manifold.127

Dee's Monas Hieroglyphica, which he calls "a magic parable" (MH. f. 7, 135). aspires to both store and reveal meaning. It it is thereby linked to the ancient themes that are built around the notion of historia, Alberti's narrative structure for the arts of painting and sculpture. In book two of On Painting, a work familiar to Dee,¹²⁸ Alberti outlines the fundamental intentions of a work of art in relation to composition, circumscription and movement. The features of organization and execution are summed up in aesthetic considerations - proportion, harmony, movement, decorum, variety.¹²⁹ For Alberti, beauty in the painted historia, is communicated through the unequivocal rendering of idea, whereas for Dee, meaning finds its voice embedded in the "very stupendous fabric" (MH, f. 5, 127) of language.

¹²⁷ Aristotle, Poetics, translated with an introduction and notes by James Hutton (New York: W. W. Norton, 1982), 68.

¹²⁸Dee's copy of *De pictura* (Basel, 1540), contains underlining by him throughout and a few marginal notes. Roberts and Watson, John Dee's Library Catalogue, 96. In the Mathematicall Praeface, Dee discusses "Picture," the narrative structure to be learned from Alberti, "[t]o what Artificer, is not Picture, a great pleasure and commoditie? Which of them all, will refuse the Direction and aid of Picture? The Architect, the Goldsmith, and the Arras Weaver: of Picture, make great account" (MP, d.ij. v-d.iij.).

¹²⁹ Leon Battista Alberti, On Painting and On Sculpture, translated by Cecil Greyson (London: Phaidon, 1972). 13-14.

Dee's concern with language as artifice, which he takes great care to explain in relation to the Monas symbol, reveals how hieroglyphic writing is analogous to architecture. Theorem twenty three of the Monas Hieroglyphica contains elaborate instructions for the mathematical construction of the symbol, each part of which has to be of a size that is in numerical proportion to the size of other parts (MH, ff. 23^v-23, 201-207). Geometry and mathematical order are the structural footing of Dee's language, upon which the power to communicate meaning is grounded. Vitruvius himself had identified the origins of architecture with those of language.¹³⁰ Dee constructs the hieroglyphic Monas upon principles that are clearly resonant with the Vitruvian principles of architectural order. In chapter ii of Book 1, Vitruvius maintains that architecture depends on arrangement, eurythmy, and symmetry. His explanation might indeed serve without any modification as the ground for Dee's Monas: "Order gives due measure to the members of a work considered separately, and symmetrical agreement to the proportions of the whole... Arrangement includes the putting of things in their proper places and the elegance of effect which is due to adjustments appropriate to the character of the work...Eurythmy is beauty and fitness in the adjustments of the members... when they all correspond symmetrically."131

¹³⁰Vitruvius, The Ten Books on Architecture, II, i, 1, ¹³¹Ibid., I, ii, 2-3.

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Writing as Drawing

The hieroglyphic Monas as architectural emblem may be understood in reference to the architectural proposal made by Andreas Libavius in *Alchemie* (Frankfurt, 1597).¹³² In Libavius's treatise, alchemical knowledge is organized and delineated in architectural and hieroglyphic terms.¹³³ Several illustrations printed in *Alchemie* clearly demonstrate how Dee's Monas has influenced Libavius's architectural drawings. These drawings were designed for the construction of an "alchemical institute" (*chemischen Instituts*). They are done under the influence of Dee's *Monas Hieroglyphica*, where his Monas drawing is conceived as a way to store knowledge. There are several insights to be gained through a comparison of Dee and Libavius, aside from the link between architecture and alchemy. First, what has been called hieroglyphic writing is deeply interrelated with architectural drawing, and second, as a representational device, the Monas is in effect a kind of architectural drawing.

The idea of drawing originated in Dee through the reading of Barbaro's commentary on Vitruvius' discussion of *ideae*, i. e. three types of architectural drawings. Of the three types of drawings described by Vitruvius, *ichnographia* and *orthographia* are the ones which appear to have been clearly understood by Dee.¹³⁴ Although these terms would eventually be curtailed into the English "plan" and "elevation," for Dee, they retain a dual meaning – expressed as writing and drawing.

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¹³²Andreas Libavius, Die Alchemie des Andreas Libavius, edited by Friedemann Rex (Frankfurt am Main: Verlag Chemie, 1964 [1597]).

¹³³ William Newman proposes an identity between the ideational structure of the Monas and Libavius' construction of alchemical knowledge. See William Newman, "The Alchemist and His Laboratory: Representations from the Early Modern Period." A paper presented at a conference on *The Architecture of Science*, Cambridge: Harvard University, May, 1994. Although I have not had the opportunity to profit from Newman's recent study it has been brought to my attention that the correlation of Dee and Libavius is significant.

 ¹³⁴Ichnographia is the drawing of a ground-plan. Orthographia in the full sense of the term means 1) the art of writing words correctly and 2) the elevation of a building. Vitruvius, The Ten Books on Architecture, I, ii, 2. The interpretation of Vitruvius' third and most ambiguous kind of drawing, sciografia (skiagraphy - profile, section, shadow) during the Renaissance would require further study. See Frascari, "A Secret Semiotic Skiagraphy: The Corporal Theatre of Meanings in Vincenzo Scamozzi's Idea of Architecture," 43-45.



Ichnographia, fen forma ediam (pagiricarum inxta fundamentum.



Plan (ichnographia) and elevation (orthographia) of Libavius's alchemical institute. Diagraph for the outline of a furnace ("Diagraphe fornaculae Fachsianae"), from *Die Alchemie des Andreas Libavius*, 1597.

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The reading of the Monas as ground plan (ichnographia) may be understood in reference to the plan of Libavius's alchemical institute. The inscription on Libavius's planimetric drawing reads in Latin "Ichnographia, seu forma ædium spargiricarum¹³⁵ iuxta fundamentum" ("Groundplan, or the ideal form distributed as foundation"). Through his peculiar graphic representation, Libavius extends the nature of architectural drawing by transferring alchemical knowledge into an analogous structure. Some of the aspects of the programme designated in the plan include a museum, chemical storehouse, woodroom and furnace, vegetable crypt, hearth, wine cellar, vapour bath, incinerator and communal fireplace, as well as some rather unfamiliar architectural features including a sublimatorium, distillatorium, coagulatorium, respiratorium, and a philosophical oven.¹³⁶ Libavius's architectural drawing disperses a programme across a horizontal plane in the form of a coordinated building. Similarly, the drawing of the Monas distributes and integrates astrological and alchemical signs in the form of a unified semiotic emblem. Though these planimetric drawings serve differing purposes - building substructure versus hieroglyphic footprint - both have their common ground in geometrical symbols and figures. Like Libavius' plan, the Monas encompasses a place where programmatic elements are related, ordered and assembled. The features of symmetry, orientation and circumscription expressed in the Monas are fundamentally architectural.

In addition to being considered as a planimetric drawing (*ichnographia*) the Monas may be considered as a form of *orthographia*, i.e. as drawing *and* writing. In the drawn sense of *orthographia*, the Monas is upright or elevational. It may be read vertically because it is composed symmetrically about an axis, a kind of centre line akin to the human spine, connecting the rectilinear limbs of the cross to the circular head. Located at the bottom of this axis is the symbol of Aries, which functions both as an anchor or footing and as a pair of wings (when the Monas is inverted). In a way the Monas, like the human body, is intermediary. Acting as a link between the microcosm and macrocosm, the Monas faciliates the ascent and descent of cosmic spirit (*pneuma*) through its spine. The idea that the human soul is made up of semi-circles and of the letter "X" derives from Plato's *Timaeus* where the cosmic soul is described as composed of two axes in the form of "X,"

¹³⁵From the Latin spargo - to distribute in various places or positions, to intersperse (in speech or writing): to sow, spread out, to sprinkle the ground with water, to variegate, fleck, dot (with markings).

^{136&}quot;Grundriß eines 'chemishen Instituts'" ("Groundplan of 'alchemical institute' "). Libavius, "Commentarii," [I, s. 95], in Die Alchemie des Andreas Libavius, 6.

ARCHITECTER RELAND HEEROGLY PHEC WRITES G



Man microcosm, from Robert Fluid, Utruisque cosmi... Instoria, 1617. The Monas, with elaborations along vertical axis. Measuring template of The Globe (c.1599), from the Byrom collection.

beat into a semi-circle and joined at the ends.^{1,37} While this interpretation may not serve to elucidate the Monas as building elevation, it does relate to the verticality and intermediate position of architecture, the connecting link between upper and lower worlds. The Monas is also an orthographic representation because it is exact, drawn according to geometrical principles and mathematical proportion. In addition, the Monas is a written form of *orthographia*. In the literary sense of the word, orthography concerns the precise use of grammatical structures and the accurate rendering of meaning through language.¹³⁸ As orthography the Monas is a correctly written language that is composed of symbolic characters which signify a host of meanings, revealed through transposition and rearrangement. For instance, one way Dee has effected the multiplication ot meaning in his Monas is by revising the kabbalist techniques, normally confined to the Hebrew language, for his own use.¹³⁰ The Monas includes, for example, the cross which. Dee maintains, is

¹³⁷ Plato, Timaeus, 34b, 36b.

¹³⁸Quintilian, Institutiones, I, iv, 17; I, 7, 11, Dee's 1540 edition of Quintilian was heavily annotated. The Latin prefix of orthography is ortho+, meaning straight, rectangular, regular, true, correct, exact, upright, rightcous.

¹³⁹Gematria, notarikon, and tsiruf were Hebrew exceptical techniques which were used to derive hidden, mystical and at times magical significance from the Old Testament. *Notarikon*, is a form of shorthand in which letters, dots, and dashes are used to represent whole words or concepts. Through *tsiruf* the individual letters of words.



The genesis of lunar mercury (MH, f. 14, 163),

Signs of the planets generated from the Monas (MH, f. 14, 163). Alchemical vessels generated from the Monas (MH, f. 22, 195).

to be understood as signifying the four elements issuing from a central source by drops becoming a flow (*MH*, f. 13, 159), as a hieroglyph it represents the Latin cross, tilted on its side the Roman numeral "X" and it may be disassembled to form the Roman numeral "V" twice.¹⁴⁰ Through various recombinations of the components of the Monas, Dee is able to construct not only signs for all the planets in addition to the sun and moon, but also symbols for several alchemical vessels, including a retort and a mortar and pestle (*MH*, f. $13^{v}-14^{v}$, 161-165; f. 22-22^v, 195-7). These features of the Monas serve to clarify how it may be used in the pursuit of the proverbial philosopher's stone. Nevertheless, this alchemical writing of the Monas, its orthography, could not have been developed without the initial reading of the Monas as an architectural trace – correlated as geometry and hieroglyphic emblem.

The hieroglyphic Monas, not unlike Libavius's alchemical institute, is a kind of "poetic diagram" achieving a synthesis of elements.¹⁴¹ One can perceive in its integrated,

are rearranged to discover other words. Gematria, involves the use of the numerical equivalents of letters to reveal hidden meanings (MH, 6^{V} , 133).

¹⁴⁰It is not unworthy to mention that in Vitruvius's tenth book (Book "X") may be found the descriptions of mechanical devices, machines and technical implements.

¹⁴¹Bachelard, The Psychoanalysis of Fire, 110.

interactive branches the residue of Alberti's lineamenti, the skeletal framework of geometric, architectural construction, as well as the divine movement of the primum mobile in its capacity for transposition and metamorphosis. The monadic vessel is the site for the performance of movable signs; the folly of their disconnection and rearrangement of parts within the alchemical egg is "waiting for an occasion to perform its task" (MH. f. 22° , 197). As an alchemical device, the Monas is grounded upon the archei, the unifying lines of alchemical exchange and transmission. In effect the Monas is an emblem of the universe. Within this vessel is encompassed a host of celestial and earthly symbols, making it a diagram of the cosmos circumscribed on the stage of the small world, a written document of hieroglyphic knowledge. It may be read in its universality, both horizontally and vertically, as a syncretic form of architectural drawing. Encircled in the Monas Hieorglyphica are the multifarious meanings of Monas as a talisman: insignia of alchemy, emblem of proportion, and medium of sublimation. On the one hand, the strength achieved by Dee's Monas seems to be related to its representation of the triumph of unitary organization over multiplicity, mobility and the disorder of impulses. On the other hand, it seems that the more Dee strives to embody meaning in the lines of the Monas, the more he realizes that the idea of the organic, of geometrical simplicity, of structural rigour dissolves in his hermetic vessel, "its parts loose, flowing, and dissolute, and not [yet] solidly framed into a solar shape" (MH, f. 21, 191).

The geometry of relationships between the astro-alchemical symbols in the Monas informs the structure of each part and is manifest throughout the physical world. For Dee's term geometry, meaning "earth-measurement," may be substituted the term *metricality*, understood simply as "measure." Metricality is the underlying structure of the measurable fabric of language woven by movement and transposition. Dee's Monas synthesizes the planimetric distribution of hieroglyphic lines with its complement, the orthographic elevation of an analogous structure. The various metrical systems employed, such as alchemy or proportion, are often metaphorical in k_{\perp} .d and have superseded purely geometrical expressions of physical continuity. Dee's concern in the Monas, writing and drawing and their fundamental unity, are profoundly comprehended in architectural form.

EPILOGUE

Far from being reduced to a mere definition, in either the sixteenth or the late twentieth century, the architectural practitioner is subjected to a vast field of arts for the construction of knowledge and marvels of the human imagination. Vitruvius himself supplied the ideal example of a two-fold approach in seeking to combine theory or innate gift and practice or acquired art, so that he dealt with every aspect of architecture from the technics of building to astrological cosmology. Dee's own practice – as surveyor and magician, cosmographer and kabbalist, astronomer and alchemist – exemplifies a similarly unified approach that is analogous to architectural practice. Architecture brings together the knowledge created in all the arts; it is the ultimate discipline, Dee maintains, and is therefore a profound understanding of the physical world.

The making of architecture is attained through continuous engagement with the world's fabric and the skillful, spontaneous blurring of contours. Sympathy and metricality are the threads linking the arts and sciences through the exercise of the imagination; like flowing sensible rays, "they come together especially in our imaginal spirit as if in a mirror, show themselves to us, and enact wonders in us" (*PA*, XIII). The arts and sciences find their ultimate and cosmic synthesis in the coordinating, coalescing act of architecture, delivered by Dee's language in the form of writing and drawing. In order to fully comprehend the architectural implications of Dee's thought one must acknowledge the "mimetic gift" of language. Walter Benjamin has described language, with its archive of correspondences, as the origin of art,

"the mimetic element in language can, like a flame, manifest itself only through a kind of bearer. This bearer is the semiotic element. Thus the coherence of words or sentences is the bearer through which, like a flash, similarity appears... In this way language may be seen as the highest level of mimetic behaviour."¹⁴²

For Dee, architecture is a medium that absorbs and communicates meaning, it is construed as an erotic search for union of knowledge and dwelling. His language is the locus wherein an understanding of architecture, as a mimetic act, may be imagined.

¹⁴²Walter Benjamin, "On the Mimetic Faculty," in *Reflections*, edited by Peter Demetz (New York: Schoken, 1978), 335-336.



"The Spiritual Brain" from Robert Fludd's Utriusque cosmi... Instoria, 1617. "Building on the Side of the Gable," drawing by Walter Pichler, 1981.

In this relation architecture tends toward the poetic by lending itself to the unconscious, to play and ex-centricity. As Richard Kearney claims the imagination

"can open us to the otherness of the other... And in its movement toward self dispossession and self-surpassing it may even offer what some might call a mystical or sublime intimation of alterity."¹⁴³

This reading of human action runs counter to the mechanistic interpretation of Dee's practical bent as an extreme unfolding of the rational and technical organization of human science. In that sort of conception there would be no room left for art, and hence there could be no architecture. Fortunately, however, Dee understood that art is the outcome of a magical process, thereby, making it impossible to identify architectural practice with the assumptions of hegemonic technocracy and the consequent liquidation of metaphysical

¹⁴³Richard Kearney, The Wake of the Imagination, (Minneapolis: University of Minnesota Press, 1988), 369-370.

EPILOGUE

residue. Architecture is an art, to be sure, but it is also a human desire if we take seriously the assertion that there is no such thing as art without the pleasure of nonsense; without artistic travesty and invention. The idea of architecture as play in practical terms, encountering the obstacles of both production and performance, compels the discovery of an active language in which the customary limits of expression are transcended.

Dee's action, which includes the art of thaumaturgy, analogically inserts into the discourse of architecture a call for the poetic imagination as well as an opportunity to exercise the human will. On the latter question, it important to note that the active power of architectural practice may be identified with divination, pleasure and exaltation. Architecture is willfully oriented, both as a form of the spirit that moves in the world of appearance, as well as an art which pursues truth. On this issue, Gianni Vattimo has considered the "will to power" as the artistic principle for destructuring hierarchies,

"[t]he will to power appears in its destructuring nature when it is seen as art and therefore as a production of symbols, which do not function solely or even mainly as 'equilibrators' of the passions, but rather as pulsive mechanisms themselves, not assuaging but activating the affective life."¹⁴⁴

The destructuring tendency of architecture gives it the opportunity to contest the assumptions of conventional practice. In this connection power becomes associated with intoxication, and the extreme enhancements that alchemical fire produces. By association the effect of architecture should be to excite the state that creates art - wonder.

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¹⁴⁴Gianni Vattimo, "The Will to Power as Art," in The Adventure of Difference – Philosophy after Nietzsche and Heidegger, translated by Cyprian Blamires (Baltimore: Johns Hopkins University Press, 1993, (1980), 93.



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A.D.	1234	• Ramon Lull born (dies 1316); works on the Art of Divine Names, or attributes of God,					
		bear influence into the 17th century.					
	1455	• John Reuchlin born (dies 1522) author of De Arte Cabalistica					
	1433	Marsilio Ficino born (dies 1499); celebrated Florentine astronomer, studies Plato and					
		Plotinus. He was widely read and quoted in England.					
	1463	• Pico della Mirandola born (dies 1494)					
	1471	Albrecht Durer born (dies 1528)					
	1485	• Leon Battista Alberti publishes De re aedificatoria (editions in Italian 1550, French 1547					
		and 1572)					
	1493	Paracelsus torn (dies 1541)					
	1504	• John Colet (d. 1519) Ficino's pupil, founds St. Paul's School, London.					
	1509	• Henry VIII born (dies 1547)					
		Luca Pacioli publishes De divina proportione at Venice					
	1525	• Francesco Giorgi publishes De harmonia mundi at Venice					
	1527	• July 13: John Dee (DEE) born in London, son of Rowland Dee a gentleman server to					
		Henry VIII, and Johanna Wild					
	1533	Henry VIII divorces Catherine of Aragon, marries Anne Boleyn (exec. 1536)					
		• Henrich C. Agrippa publishes De occulta philosophia (first edition 1531)					
	1537-47	• Serlio publishes five books of Architettura					
	1542	• DEE studies Latin in London, in November he enrolls at St. Johns, Cambridge (earning					
		his BA, 1546 and MA, 1548)					
	1543	• Copernicus publishes De revolutionibus orbium caelestium (On the Revolutions of the					
		Heavenly Spheres, written between 1507 and 1530). The heliocentric theory of					
		Copernicus revolutionized the accepted universal structure. Although DEE had read the					
		De revolutionibus by 1556 he uses the Ptolemaic-Chaldean (geocentric) framework in his					
		Propaedumata Aphoristica and Monas Hieroglyphica.					
	1544	• DEE refuses a stipend to lecture on the mathematical sciences at Oxford.					
	1545-63	Council of Trent occurs. The Council having failed to reunite Christendom, spurs					
		interest in religious Hermetism, containing doctrines common to both Protestants and					
		Catholics.					
	1546	• DEE awarded fellowship as an under-reader of Greek at Trinity College, Cambridge. At					
		Trinity he produces Aristophanes's Peace, which includes a mechanical flying scarabeus in					
		1547.					
		• Tycho Brahe born (dies 1601), crects first observatory (Kassel), tutors Kepler. The					
		observations of Brahe are decisive in undermining Aristotelian cosmology.					

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1547	• May: DEE makes first trip to continent, visits Low Countries where he studies
	navigation with Gemma Frisius, one of the most prominent geographers of the time, and
	Gerard Mercator, renowned cartographer and maker of navigational instruments. Dee
	returns after some months to Trinity College with astronomer's staff and a ring of brass,
	both made by Frisius, and two globes by Mercator.
1548	• DEE graduates from Cambridge, enrolls at Louvain (where Agrippa had been one
	generation before and Gogava is translating Ptolemy's Tetrabiblos). At Louvain Dee
	studies mathematics and astrology with scholars from as far away as Bohemia and
	Denmark.
	Giordano Bruno born
1550	•April 30: DEE travels to Antwerp, where he first encounters the influential
	cosmographer Abraham Ortelius, then on to the Court of Charles V at Brussels, in May
	returns to Louvain briefly before travelling to Paris in July.
	• DEE lectures on Euclid in Paris where he becomes acquainted with the likes of Oronce
	Finé, Professor of Mathematics at the Collège de France and important french geographer;
	Turnebus, respected classicist and Hemeticist; Peter Ramus, anti-Aristotelian and
	educational reformer; Guillaume Postel, Hebrew and Arabic scholar; and Pedro Nuñez, the
	Cosmographer Royal of Portugal and Professor of Mathematics at Coimbra.
	- In England, Edwardian reform destroys large numbers of books on astronomy, geometry
	and mathematics.
1551	• December: DEE returns to England, introduced to the Sidney circle and to Edward VI via
	Sir John Cheke and William Cecil.
	• Cesare Cesariano publishes an illustrated edition of Vitruvius's De architectura
1552/53	• DEE invents "paradoxal compass," instrument for navigation in polar regions
1553	accession of Mary
	• DEE tutors the Duke of Northumberland's children. Among them the future Earl of
	Leicester, Robert Dudley, and his nephew Philip Sidney, who becomes Dee's close friend.
1554	• Turnebus publishes his influential edition of Corpus Hermeticum
1555	• 8 June to 29 August: DEE imprisoned under Mary after an accusation of treason
	possibly for his practice of thaumaturgy in conjunction with a theatrical presentation.
	August 1: Edward Kelley born
1550s	• DEE studies and collects medieval Latin and Arabic treatises on geometric
(mid)	optics by al-Kindi(d. ca. 873), Robert Grosseteste(1168/70-1253), and Roger Bacon(1220-
	te. 1292)
1556	• January 15: DEE writes "Supplication to Queen Mary" and "Articles for the Recovery
	and Preservation of the Ancient Monuments" imploring the Queen to establish a library
	to preserve what remains of the dissolution of the monasteries and their libraries.
	 July: DEE catalogues fifty-six alchemical works he has read

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- Daniele Barbaro publishes an Italian edition of Vitruvius's *De architectura* with a commentary; Barbaro is Ambassador to England during the reign of Henry VIII.
- 1558 accession of Elizabeth I (dies 1603)
 - DEE publishes Προπαιδευματα αφοριστικα (republished as Propaedeumata Aphoristica, 1568), a work on geometric optics and astral influences.
 - Giovanni Baptista della Porta publishes Magia naturalis (translated into English 1658)
- Muscovy company explores Asia via northeast passage based on the navigational advice of DEE.
- 1560s DEE continues to study and collect books on magic, alchemy and kabbalah,
- (carly) including numerous works by Roger Bacon, Pliny's Natural History, Joannes Pantheus's Voarchadumia, Johannes Trithemius's Steganographia, and Thomas Norton's The Ordinall of Alchimy.
- DEE augments and reprints Robert Recorde's Grounde of Artes (originally published in 1540). Dee's revised version (the standard arithmetic text of the period) goes through twenty-six editions before 1662.
 - Francis Bacon born (dies 1626)
- DEE leaves England for the continent, stays in Antwerp with William Silvius who later publishes the Monas Hieroglyphica. He visits Louvain and possibly Paris, and in 1563 begins a journey to Zürich in April where he discusses Paracelsus with Conrad Gesner, to Venice in June, and to Urbino by mid-summer, where he meets and gives to Federico Commandino the manuscript of Machometus Bagdadinus's *De superficierum divisionibus*, a Euclidean mathematical work, that Commandino later publishes. By September he is in Pressburg, Hungary (now Bratislava, Czechoslovakia) for Maximilian's coronation and then goes to Venice in November and Padua in December before returning to Antwerp by January 1564 where he writes the Monas Hieroglyphica.
- DEE studies Proclus's Commentary on Euclid.
 John Foxe's Actes and Monuments uncomplimentarily refers to Dee as "the great
 - Conjurer."
- 1564 Galileo born (dies 1642)
 - 31 March: DEE publishes Monas Hieroglyphica; returns to England in June
- DEE settles in family home at Mortlake(until 1583), begins the practice of spirit-magic and crystal-gazing, builds elaborate laboratories and with Roger Cook, his alchemical assistant, conducts experiments into the 1580s.
- In English, DEE publishes his "Mathematicall Praeface" to Henry Billingsley's translation of Euclid's *Elements of Geometrie*. The "Praeface" will be reprinted in a 1661 edition of Euclid, nearly one hundred years after it was written.
- Johann Kepler born (dies 1630); Thomas Digges publishes Pantometria (Geometrical Practice)

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- 1572 The appearance of a super nova in Cassiopeia inspires DEE to write the astronomical work, *Parallatica commentationis praxeosque nucleus quidam* (published 1573).
- Robert Fludd born (dies 1637)
- DEE and John Stow, a London annalist and antiquarian exchange books and manuscripts frequently.
- DEE devises a solution to the nautical triangle. From 1576-78 English navigators seek a north-western route to the Orient under DEE's guidance. His influence as a geographical and navigational advisor lasts into the 1580s.
- The "Theater," the first of many playhouses constructed in London, is built by James Burbage at Shoreditch.
- DEE publishes General and Rare Memorials Pertayning to the Perfect Arte of Navigation.
- February 5: DEE marries Jane Fromond (possibly his second or third wife), they bear two children, Arthur and Katherine.
- DEE's extensive practice of spirit magic begins: in presence of Adrian Gilbert, Dee interrogates angels regarding a marine voyage planned to America.
- March 9: Edward Kelley arrives at Mortlake
- DEE reforms the Julian calendar for Britain

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- May 13: Sidney brings the Polish Prince Albrecht Laski to Mortlake
- May 23: DEE communicates to the angels Laski's questions about his political future.
- 1583

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- September 6: DEE compiles a catalogue of works in his library before leaving for Cracow with Kelley and Laski. Upon his departure a mob plunders Dee's residence at Mortlake, pillaging library, laboratory and antiquarian articles.
 - September 21 to December 2, 1589: DEE on the continent where he openly practises kabbalist angel-magic with Edward Kelly acting as his skryer.
- DEE in Prague by September at the court of Emperor Rudolph II. Carrying his brand of Hermetism to eastern Europe DEE becomes the leader of a religious movement centered on a kabbalist-alchemical philosophy that becomes the root of the later Rosicrucian movement.
- April 17: Stephen Bathori, King of Poland, grants DEE an audience to hear about his magical philosophy
- May 6: DEE and Kelley flee Prague for Leipzig, (3 weeks later they are summoned to Rome for interrogation about their angelic actions at Prague) shortly afterward they are taken under the protection of the powerful Count Rosenberg of Bohemia, by September they take up residence at one of Rosenberg's castles at Trebona for about two years.
- November 10: Queen Elizabeth writes to DEE commanding him to return to England.

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- After unsuccessfully convincing Rudolph II or the Polish King of the relevance of his angelic communications Dec returns to England; suffers neglect, poverty and the increasing scorn of his countrymen.
- Long after Dee became deeply immersed in kabbalist angel-magic, the astronomer Tycho Brahe mentions in a letter to Sir Thomas Savile that he is sending a copy of his latest book, *De mundi aetherei recentioribus phaenomenis*, (1588) to Dee for his opinion.
 Invention of microscope
- 1594/5 In a letter to the Archbishop of Canterbury DEE tries unsuccessfully to dissolve his reputation as a conjurer and necromancer.
- DEE's medium, Edward Kelley, who had been knighted for his alchemical efforts by Rudolph II, is imprisoned because he produced no gold, and in November dies from injuries incurred when trying to escape.

• DEE granted the Wardenship of Christ's College, Manchester

- Jean Jacques Boissard publishes Theatrum vitae humanae (The Theatre of Human Life)
- 1597 Andreas Libavius (d. 1616) publishes Die Alchemie.
- 1599 Globe theatre built.
- William Gilbert (1540-1603) publishes De magnete.
 - Giordano Bruno burns as a heretic.
- 1603 James I succeeds Elizabeth on the throne.
- 1604 June 4: James I petitions the King to have DEE tried for sorcery.
- DEE returns to Mortlake after being forced to relinquish his post as Warden of Manchester.
- 1608 Invention of telescope; December: DEE dies, age eighty-one.
- Robert Fludd publishes Utriusque cosmi...historia (The History of the Macrocosm and Microcosm); and in 1623 Anatomiae Amphitheatrum
- Elias Ashmole (1617-1692) publishes Theatrum Chemicum Britannicum at London
- Meric Casaubon publishes A True & Faithful Relation..., reviving old doubts about Dee's conjuring.

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- 1632 Spinoza born (dies 1677)
- 1647 Liebniz born (dies 1716)

PROJECT XX

The following appendix is the summary of an architectural studio which preceded the writing of the thesis.

Resource

Giambattista della Porta's *Magia naturalis* (Naples, 1589) is the point of departure for my investigation which explores the relationship between language and architecture. *Magia naturalis* is the only printed record of the activities of the *Otiosi* (Men of Leisure) a group forming one of the first scientific societies of our age. Brought together by della Porta during the early sixteenth century this group performed a variety of experiments and investigations. Their speculations and observations as well as della Porta's reflections are written in twenty "books." In the book on optics della Porta gives the first clear description of the Camera Obscura. The sciences of distillation, pneumatics and metallurgy are dealt with in others; writing, plants and cooking are also investigated. What is exceptional about the work is not the inclusion of such subjects in a book dealing with experimental science, rather it is the manner in which they are described. For example, in the seventh book "Of the Wonders of the Load-stone" della Porta explains magnetism as follows:

"The operation is this: Because there is such a Natural concord and sympathy between the iron and the Loadstone, as if they had made a League; that when the Loadstone comes neer the iron, the iron presently stirs, and runs to meet it, to be embraced by the Loadstone. And that embraceth it so fast that with tossing it up and down you can scarce part them. And the Loadstone runs as fast to the iron, and is much in love with that, and unity with it; for neither of them will refuse to be drawn."¹⁴⁵

In the context of late twentieth century science it is doubtful that one might hear such a compelling account of magnetic forces. Yet, for della Porta the immediacy of observing the lodestone, seeing the phenomenon of magnetism remains a vital, mysterious experience. There is for della Porta no division between the animate and substantial conceptions of the magnet; the two are mingled in an inextricable fashion. Whereas in a general treatment

¹⁴⁵Giambattista della Porta, Magia naturalis libri XX in quibus scientiarum naturalium divitiae et deliciae demonstrantur (Naples, 1589), VII, NN, 201. The book was republished as Natural Magick (London, 1658).

modern science has been able to analyze these conceptions separately, della Porta studies them in their confused, awe-inspiring state.

Magia Naturalis may seem an enigmatic book with its mixture of recipes, half-truths and observations, yet its significance cannot de denounced. The very act of reading della Porta's words is a tangible experience, an activity that invites engagement. One finds that in reading the text one can readily distinguish the subjects laid out from book to book. Moreover, the relationships to be encountered reveal that these subjects cannot be disconnected. Della Porta's words are caught in the fabric of the world.

Still the question remains: what is the significance of a book like *Magia Naturalis* for us today? We live in an era where the integrated subjects explored by della Porta have become separated into the specialisations of the plastic surgeon, philosopher, zookeeper, jewel maker, genetic scientist, physician, goldsmith, horticulturalist, poet, pyrotechnician, navigator, cosmetician, housekeeper, chemist, optometrist, meteorologist, chef, structural engineer, and musician. Is architecture too destined to become another category on a list? Can the lines between disciplines be so easily drawn? Perhaps in della Porta's words there is some clue to restoring the coherence of the whole, or at the very least acknowledging that sympathetic correspondences between things and disciplines did (and may very well still) exist.

Magia Naturalis is a parable of curiousities, a written tribute to marvel in the world. Della Porta's words speak about immediacy, both in the experiments he describes and the mysterious phenomena he perceives. Where his language may be interpreted as imprecise or insubstantial according to the criteria of modern science, it is particularly apt in expression, connotation and allusion, opening up avenues for discovery.

Intent

"The site of immediate reality has become an orchid in the land of technology."146

My fascination with the language of *Magia Naturalis*, both what is disclosed and how it is expressed, grew into the subject for my design project. Della Porta's writing demonstrates the art of drawing thoughts clearly. In an effort to elicit instructions for

¹⁴⁶Walter Benjamin. "The Work of Art in the Age of Mechanical Reproduction," in *Illuminations*, translated by Harry Zohn (New York: Schoken, 1969), 223.



making from his words I set out read, encounter and draw from the text itself. A different book was chosen randomly each week and became the subject for investigation. Twenty specific passages from della Porta's treatise were selected. The criteria for making the selection was based on the text's suggestiveness and potential for architectural making. Each passage, a fragment belonging to the larger work, lent itself to consideration and questioning. The challenge was to extract clues from the grammatical structure of each quotation that could be named, interpreted and transferred.

Magia Naturalis was referred to as an instruction manual, not in anticipation of finding a specific answer but with an attitude of purposeful purposelessness. Points within the pages determined numbers for counting and locating subject, object and action words. The process devised for conducting this word-play was disciplined, generating its rules from the experience of being with(in) the text. An attempt was made to be sensible to the invocations of each passage, thus generating a structural and material order for what emerged as a kind of reading and making device.



The purpose of establishing a writing system which calls to question the rules of grammar was intended to challenge the conventions of prescriptive (specification?) writing. A less direct, less transparent approach to instruction was desired, one that offers the possibility for discovery and invention. By thinking of grammar as the geometry of language one can comprehend the points of contact between language and architecture. If language is a vehicle of culture, then nouns and verbs – being part of an analogous structure for architecture – might in reconfigured combinations suggest alternate *action* for the *subject*.

Legend

Textural analysis of each *tag* generates an assortment of items. *Key* items are located by *name* number. Upstanding *name* characters, except for those of circular nature, indicate a particular *code*. Textural analysis of each *code* generates an additional assortment of items. From these items the *label* is located by the character length of each *key*. *Kev* length indicates the location number of the *subject*(uncapitalized noun) in the text. *Label* length indicates the location number of the *object* (capitalized noun in sub-title phrases). Action words are located by the character length of the *name* minus the date the exercise took place or vice versa.

Tag		Name	Key	Code	Label		Subject		Object		Action
bw	6	Of Benutifying Women	akin	bw	axiom	4	water	5	hair	3	froth
me	1	Of the Causes of Wonderful things	maul	cw	by reason of	4	another	12	compound	12	agree
ьо	15	Of Fishing, Fowling, and Hunting	board	ffh	eye-catching	5	water	12	animals	5	bound
fm	6	Of Counterfeiting Gold	eye-opening	8	byline	n	smoke	6	gems	21	make
sq	2	Of the Generation of Animals	rushing	şa	fussy	7	feet	5	creatures	1	born
ŋa	8	Of strange Cures	quota	sc	savoury	5	person	7	woman	2	transmitted
sp	3	Of the Production of new Plants	source	PP	OWNER	6	dayes	5	fruits	14	written
lp	16	Of invisible Writing	labourer	iw	hypothesis	6	news	10	letters	6	make
dw	12	Of Artificial Fires	duty	af	adjust	4	frame	6	compositions	12	nin -
mf	7	Of the Wonders of the Load-stone	luxuriant	wls	vote	9	iron	4	stones	4	stirs
sp	5	Of changing Metals	souse	m	luscious	5	dream	8	metal	5	seeing
pl	13	Of Tempering Steel	placard	8	truant	7	quality	6	tool	4	delights
ma	11	Of Perfuming	mother	P	OWNEr	6	chamber	5	skins	13	anovnt
apg	14	Of Cookery	apartheid	c	byword	9	pen	6	flesh	17	make
dľa	4	Of increasing Household-Stuff	cup	hs	gun	3	salting-tubes	3	fruit-safes	3	put
55	19	Of Presentick Experiments	desecration	pe	pay up	12	pipes	6	air	5	shut up
wb	20	Of the Chaos	wagon	c	bull	5	other	4	stones	8	strike
ds	10	Of Distillation	dare	d	dabbie	4	belly	6	oil	11	be
mk	18	Of Statick Experiments	maraud	se	seance	6	bodies	6	things	13	descends
сh	17	Of Strange Glasses	chaff	58	shake	5	quantity	5	operations	n	fiving
				•	-	_		-			



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