CHAPTER VI.

NUMBERS — LOGISTICAL, FORMAL AND APPLIED.

(THE GROUND OF ARTES — THE MONAS — ALCHEMY; 1558-1564)

I. Accession of Elizabeth — Dee taken into favour — commences period of fame and success.

II. Work on binomials and other lost mathematical writings — the revision of the Ground of Artes — Recorde and Dee — their similar views and interests — the popularity of this work — a text book for self instruction from the first elements onwards — its defence of mathematics and plea for wider instruction in it — this knowledge the distinguishing criterion between men and animals (n.21) — its utility — Dee's additions to the G.A.

III. Dee journeys to Continent to print his books — letter to Cecil — copies out the Steganographia — Trithemius' mysticism and magic and their influence on Dee (n.35).

IV. Publication of the Monas — Dee's perpetual high regard for this work — its contemporary and subsequent fame (n.39) — contrasted with Aphorisms — its intentional obscurity — the tradition of unfolding secret wisdom as obscurely as possible — the prefatory letter to Maximilian — geometrical figures the key to natural and spiritual truth — the signs of the planets — the forms of letters of the alphabet — the striking results Dee anticipates from this study.

V. Its theme and underlying assumptions — the "Monad" as God — connections with neo-Platonic doctrines — reasons for choice of this particular hieroglyph — Mercury — Aries — relations of Monas to cabalistic theory — and the later search for a real character.

VI. Analysis of the text — the point and the circle — generation of planetary signs and astronomy — the cross — the semi-circle — numerology of the figure and alchemical sections — Dee's work well within an accepted tradition.

VII. The Monas interpreted as an alchemical treatise — Dee's alchemical writings and manuscripts (n.136) — Alchemy as a spiritual science — consequent repercussions on its physical investigation — Dee and practical alchemy — official Elizabethan attempts at transmutation — encouragement given by reported successes (n.156).

VIII. No accepted theories of matter excluded possibility of transmutation — Dee's view of generation of substances — experiment also holds out hopes of success — no practical basis for distinguishing the elementary from the composite.

IX. Two currents in alchemical theory — the qualitative: all substances tend to their perfection — its plausibility and superficial utility for laboratory investigation — its fundamental barrenness — the quantitative — numerology and geometrical atomism — Platonism — Al Jabir — Newton and Boyle's corpuscular theories — these though of apparent "modernity" belong organically to this tradition — Dee also within this current of speculation — his novel insistence on the importance of exact measures of weight in all chemical investigation — his annotations to Pantheus' work — his interpretation of change of qualitative form through number and motion and group patterns of particles — Alchemy for Dee a valid though inferior, field of applied mathematics since mathematics should be studied as pure reason and employed to assist the mind's ascent to God.

CHAPTER VI

I. On the accession of Elizabeth, Dee rose into secure official favour (1). He was under the immediate patronage of Leicester of presented him to the Queen, and who, on her behalf, invited him to employ his skill in astrology in advising upon an auspicious day for the Coronation (2). He was also, according to his own account written for Elizabeth's Commissioners, to whom it seems unlikely he would overstep the truth, offered the choice of any ecclesiastical dignity he cared to accept; there were a number of bishoprics and deaneries then vacant. But his usual disinclination for taking up any position which limited his freedom of movement and tied him to a routine of specific activities — which was only overcome when, in his last years, extreme poverty compelled him to accept the Wardenship of Manchester College — led him to refuse this advancement. "My most humble and thankfull answer to her Majesty by the same messenger was that cura animorum annexa did terrifie me to deale with them."(3)

The next twenty-five years, during which, apart from brief visits abroad he was throughout resident in or near London (4), represent perhaps the most fruitful period of Dee's life, both as regards mathematical productivity and his other multifarious practical activities as a semi-public figure. His writings, printed or manuscript, however, hardly reflect the true measure of his occupation at this time. His position remained rather that of a private tutor or consultant in which capacities he is to be found associated with a wide range of personalities and contemporary endeavour. His services were frequently engaged for individual voyages of discovery and by the Muscovy Company, by aristocratic amateurs of chemistry as well as uninstructed instrument makers and empirically minded experimenters of an emerging technical class; and by the Queen, who sought his advice on legal questions, such as the extent of the royal titles, or on general measures affecting the whole Commonwealth — as the suggested Calendar reform and also on more personal matters, as when she wished for expert reassurance after the appearance of the new star in Cassiopeia, or after the finding of a wax likeness of herself stuck with pins. In addition his general antiquarian interests led him into correspondence with Camden and Stowe; and Hackluyt reproduced his opinions on certain geographical and historical matters.

II. In 1559 Dee composed a work of which our sole knowledge is his mention of it in a note to the 1570 Euclid (5), for he does not include its title in the general lists of his writings that he drew up, or elsewhere refer to it, and the manuscript is now lost. His account is worth reproducing both as an indication of the mathematical problems that were engaging his attention at this time, and also since it provides a typical example of her delay in publishing his writings, either because of material difficulties or personal diffidence and secretiveness, resulted in Dee's researches being forestalled and rendered unnecessary by others, whose investigations were proceeding along lines similar to his own. He, or perhaps Billingsley, to whom he has supplied the information — though Dee on other occasions adopts a disingenuous third person in speaking of himself — records "Although I here note unto you this Corollary out of Lussas, yet, in very conscience and of grateful minde, I am enforced to certifie you, that, many yeares before the travailes of Flussas (upo Euclides Geometricall Elementes) were published, the order how to devide, not onely the 6 Binomiale lines into their names, but also to aide to the 6 residuals their due partes; and farthermore to devide all the other irrational lines (of this tenth booke) into the partes distinct, of which they are composed: with many other strange conclusions mathematicall to the better understanding of this tenth booke and other mathematicall bookes, most necessary were by M. John Dee invented and demonstrated: as in his booke, whose title is Tyrocinium Mathematicum (dedicated Petrus Nonnus An. 1559) may at large appeare. Where also is one new arte, with sundry particular pointes, whereby the Mathematicall Sciences, greatly may be enriched. Which his booke, I hope, God will one day allowe him opportunitie to publishe: with divers other his Mathematicall and Metaphysicall labours and inventions." The following year Dee produced another geometrical treatise also dedicated to Pedro Nunez: de triangulorum areis libri demonstrati 3; and a work on a subject which he later dignified with the name of Hypogoiodie — de Itinere subterraneo lib 2. This art he defines in his tabulation of the branches of mathematics appended to the Preface as one "which demonstrateth, how, under the Sphericall superficies of the Earth, at any depth, to any perpendicular line assigned (whose distance from the perpendicular of the entrance: and the Azimuth, likewise in respect of the sayd entrance, is knowen) certaine waye, may be prescribed and gone." The Preface states further that it was a particular personal problem on which his advice was sought, that prompted him to the invention of this art — an incident that reveals what might perhaps be described as a characteristic feature of all his thought — his attempt to lend significance and intelligibility to the isolated particular by reducing it to a form in which it could be viewed merely as one of a series of cases arising from a mathematical formularisation of the widest possible generality. He took up this subject he records in order to satisfy "the request of two Gentlemen who had a certaine worke (of gaine) underground: and their groundes did ioyne over the worke: and by reason of the crookedness, divers depthes, and heithes of the way underground, they were in doubt, and at controversie under whose ground, as then, the work was." Dee at this time must also have been engaged on preparing his augmentation of Recorde's Grounde of Artes which appeared in 1561 (6).

Robert Recorde (7) had died in 1558, in the King's Bench Prison, one year before that other acquaintance of Dee's Cuthbert Tonstall, whose arithmetic, de Artis Supputanli of 1522 had been the first work to be published in Britain devoted solely to mathematics of the purely algoristic kind, to which school it had provided a model (8). Recorde's outlook, with the exception of his "Plotinian" astrological views, and interests, were largely similar to those of Dee (many passages in his writings can be found that have bery close parallels in Dee's comprehensive preface to Euclid); he was a classical scholar of repute; a physician, an astronomer, a student of British antiquities (of the semi-mythical variety) and of Anglo Saxon; his technical knowledge he wished to be usefully directed to the public service (he was himself surveyor of Mines and Moneys under Edward VI and Mary). His writings exhibit the same spirit as that which informed the work of Leonard Digges (and, later on, of Leonard's son Thomas) who complained that because the little known art of numbering was so essential for practical craftsmen "yea chiefly those Rules hid, and as it were looked up in strange Tongues, they doo profite (or have furthered), very little the most part: Certes nothing at all the handmeater, Carpenter, Mason, wanting the aforesayd," and therefore was himself resolved to "publish in this our tongue very shortly (if God give life) a volume contayning the flowers of the Sciences Mathematicall, largely applied to our outward practise, profitably pleasaunt to all maner men of this Realme."(9) Recorde's writings were devoted to meeting this very need, and his vernacular textbooks of popular instruction and exposition of scientific learning were among the most widely read, and are probably intrinsically the best of the age. He had a deep faith in the potentialities of mathematics, not only for the solution of fundamental questions of natural philosophy, but also in the most diverse and perhaps surprising practical fields — such as civil law and administration ("wherefore I may truly say that

if any imperfection bee in number, it is because that number, can scarcely number, the commodities of itself" (10)). Like Dee also, he is inclined to speak of the assistance it offers in metaphysical and theological speculations (11), a recurrent theme, however utilitarian his immediate object, being

> If Reason's reache transcende the skye,
> Why should it then to earthe be bounde?
> The witte is wronged and leadde awrye
> If mynde be married to the grounde. (12)

He entertained tolerantly, at least, the hypothesis of Copernicus (13) and the contents of his library show that like those of Dee his interests extended to semi-magical sciences, to prophecy, and to alchemy (14).

The Grounde of Arts was first published about 1540 and appeared in over thirty editions before the final publication in 1699 (15). In sharply characterised, beguilingly dramatic dialogue between Master and Pupil it led the reader from the very first elements of number to a competent knowledge of a wide variety of forms of operation that he would find useful in commerce, technical crafts and other practical affairs — a considerable achievement as no knowledge at all was initially assumed, and as even the multiplication of two single figure numbers greater than five was worked out by a painfully cumbrous process (16). Besides assisting the general adoption of Hindu numerals, it played an important part in regularising English mathematical symbolism of the day — it brought the + and - signs into general use and in it the = sign makes its first appearance. As a standard work of popular instruction it is frequently spoken of by contemporaries with high praise — sometimes being coupled in this respect, significantly, with Dee's Preface (17). John Mellis, a schoolmaster in Southwark who made additions to it in 1582, writes in this preface that he himself "In this art....having great delight, I had no other instructions at my first beginnings but onely this Good Author's Booke," and that he undertook its revision "knowing that this Author was the onely light and chiefest lodestone unto the vulgar sort of English men in this worthy science that ever writ in our naturall tong."(18)

This work which Dee now chose to enlarge did not offer itself merely as a textbook of mechanically performable numerical operations, delivered, as it were, in vacuo, but also contained a general plea for the dignity and importance of mathematics and the recognition of its rightful fundamental position in general education. It laments the lack of respect, which it claims, is accorded learning in England, but suggests that a revival of virtue and wisdom would follow upon an increase of popular knowledge — from a comparison with the results that a similar movement achieved in the reign of Sarron ("which was the first lawmaker of all the West part of Europe" — in 2000 B.C. (19)) and his son Druys. The new education it seems to envisage would utilise the works of the ancients while remaining essentially independent of them as regards its foundations; "Mayster...whe men will receave thinges from elder writers, and wyll not examine the thynge, they seme rather willing to erre with theyr auncientes for company, then to be bolde to examine their workes or wrytinges, which scrupulositie hath ingedred infinite errours in all kyndes of knowledge, and in all civile administration, and in every kynde of arte."(20) The highest place in the new curriculum would belong to mathematics and its directly allied sciences (others being derivative from these): "For whoso setteth small price by the witty device and knowledge of numbering he little considereth it to be the chief pointe (in manner) whereby men differ from all bruit beasts: for as in all other things (almost) Beasts are partakers with us, so in numbring we differ clear from them....he therefore that shall contemne number, he declareth himself as bruitish as a beast, and unworthy to be counted in the fellowship of men" God himself being "that true fountaine of perfect number which wrought the whole world by number and measure."(21)

Recorde is at pains to point out, as Dee was also, what an infinite number of benefits would follow from the attempt to reduce as many political, social and economic questions to clear and undisputable mathematical forms. For it was Arithmetic "by which not onely just partition of lands was made, but also touching buying and selling, all assises, weights and measures were devised; and all reckonings and accounts drawen, yea by proportion of it were the orders of Justice limited, as Aristotle in his Ethicks doth declare, and the degrees of Estates in the commonwealth established (22)....wherefore I may wel say that seeing Arithmeticke is so many waies needful unto the first planting of a Commonwealth, it must needs be as much required to the preservation of it also, for by the same meanes is any Commonwealth continued by which it was erected and established"; "Good sciences," he holds are "the keyes of the lawes." He points to certain corrupted or neglected statutes that cause much distress — such as that for measuring of land, the assize for bread and drink (whose obsolescence has resulted in much cruel oppression of the commons) and the assise of fire wood and coals ("and now how avarice and ignorance doth

canvase that Statute, it is too pitifull to talke of and more miserable to feele"); but there is a means to their restoration, for "these Statutes by wisdome and good knowledge of Arithmetick were made, and by the same must they be continued," (23) adding that he reserves a multitude of useful detailed suggestions of this kind for the ear of the king.

Dee's revisions are not only diffused throughout the text, improving and correcting it in detail, he also enlarged the scheme of Recorde's book to cover operations with fractions, some more advanced computational rules and a further variety of practical applications of arithmetic (24). He continued the dialogue form (which later augmentors did not attempt to do, confining themselves to tacking on various appendices), showing himself as expert in this form of conversational exposition as Recorde had been (25), and works out in detail some examples of the latter's generalisations about the application of arithmetic to statutes (26). Part 2, in which Dee's hand is apparent though it may be in substance Regarde's, breathes throughout the same spirit of earnestness to promote general education and serve the commonwealth — it opens for instance iwth the pupil's apologetic request for further instruction though he knows the master is hard pressed with more important affairs. He receives the answer "If my leyser were as greate as my wyll is good, you should not neede to use any importunate crauing, for the attaynynge of that thinge, whereby I may be perswaded that I shall anywaies profite the Commonwealthe, or healpe the honest studyes of any good membres in the same."(27) Dee's contribution to this practical vernacular handbook are a token example and indeed he regarded the two productions as related (28) to what nine years later in the Preface to Euclid he was to proclaim, on a far wider scale, were the virtues and utility of mathematics.

III. About a year after his revision of the Grounde of Artes (during which period our only item of information concerning him is that he compiled a series of "tables" on the Hebrew Cabala) Dee journeyed again to the Continent, in order, he wrote to Cecil (29), to seek the acquaintance of more advanced and skillful mathematicians than he was able to meet with in England. His travels were mainly in the Low Countries, and possibly Germany (though it appears that he also visited Italy at this time (30)). Smith (31) declares that in September 1563 Dee was in the capital of Maximilian, which does not seem improbable in the light of a letter written to him in 1564 by Bartholomoeus de Rekingen dicti Caricter, Medici Caesarei, as to a personal friend (32), and the dedication of the Monas to Maximilian (33). Another purpose of his visit was the purchase of books and manuscripts unobtainable at home. These, he wrote, "have cost me all that I could here with honesty borrow," in addition to the twenty pounds he had brought out with him originally, for "God knoweth my zeale to honest and true knowledg: for which my flesh, blud, and bones should make the marchandize if the case so required." He asks Cecil for a further leave of absence from England; he has been negotiating with Dutch printers "but lo, so falleth it now cute that I cannot cumpas this my Entent on this wise, but am driven to deale with Printers of high germany, whereby a longer tyme will run." He trusts that Cecil will not "have me forthwith to reterne, My bokes unprinted and out of my hands." He hopes Cecil will procure him "dulcia illa cosa" he requires for his studies "the frute whereof my Cuntry et tota Resp. Literaria iustly shall ascribe to your wisdome and honourable zeale, towards the avauncement of good letters, and wonderful divine and secret sciences." That his visit had official approval is indicated by the certificate he later received from Cecil stating that his time had been well spent while he was beyond seas (34).

One work which Dee acquired on the Continent deserves special mention for the considerable influence it later had upon him and the high importance he declared it to possess, for he wrote in this letter to Cecil that he had found a book "for which many a learned man hath long sought and dayley yet doth seeke," "the most precious juell that I have yet of other mens travailes recovered." This was Trithemius' Steganographia. He was lent a manuscript of it, of which he copied the half in ten days continual labour, a Hungarian nobleman offering to complete the rest, if Dee could remain in Antwerp and take charge of his studies for a time. He carries his copy with him on his later journeyings in the Empire and the great similarity between its cabalistic angelical doctrines, and the "Revelations" he later received through Kelly, and between the incomprehensible language of its conjurations and the celestial speech in which many of Kelly's communications were delivered, indicates it as one of the chief "source books" for the occult investigations into which Dee was led (35).

IV. In 1564 Dee published at Antwerp his Monas Hieroglyphica; he had been mentally preparing it, he states in the preface, for seven years, and finally wrote it completely in twelve days (Jan. 13-25th 1564). To the end of his life he set great store by this work, presenting it to numbers of his acquaintances, and apparently as did others later, constantly finding more in it than he had originally consciously intended. He expounded it to Elizabeth (and seems to have wished to do the same with Rudolph II), after which she "in most heroicall and princely wise did comfort and encourage me in my studies philosophicall and mathematicall," and declared herself ready to defend the book's reputation "against such Universitie Graduates of high degree, and other gentlemen, who therefore dispraised it, because they understood it not."(36) The cryptic nature of its style and contents led to a cry of "magic" being raised against it (37), the Queen herself being, said Dee in the Preface to General and Rare Memorials, "a sacred witness...of the strange and undue speeches devysed of that Hieroglyphicall writing." But it gained some fame in its day and subsequently a translation was projected but apparently not completed by Thomas Tymme (circa 1600); Bongus drew upon it for his Numerorum Mysteriae of 1585 (38), it was reprinted at Frankfurt in 1591 — the same year Bruno's de Triplici Minimi appeared there, to which in some points it is not dissimilar — and in Zetzner's Theatrum Chemicum of 1613 (reprinted 1659) and the symbol Dee had devised in it was adopted and put to a variety of uses by later writers (39).

It is interesting to find Dee composing such a work as the Monas in this the most actively practical, period of his life. Its title page indicates that it is intended to be in conformity with and complementary to the doctrines set forth in the Aphorisms, for though made from a different block, and much less crude in its execution it is almost identical (the arch supporting the stars, its cornerstones the four elements, the heavenly bodies shedding effluences, the central hieroglyphic) with the title page of one edition of that work (40) and indeed Dee specifically refers back to it at the end of his prefatory letter, citing Aphorism 52 as evidence that the present work is the product of no sudden fantasy, but has been, in essence, occupying his thought for seven years. Nevertheless this work is remarkably different in tone from his previous production, for here Dee is dealing with signs and numbers in their purely "formal" aspect (in the sense in which he employs that term in the Preface)(41).

But all the injunctions to exact observation of nature and to experimentation that marked the Aphorisms are now abandoned, they are indeed almost belittled, and held up as unnecessary; all attempt to describe some physically verifiable overall scheme to explain the mechanism of the universe is likewise cast aside, or emerges only secondarily; the few remarks in the Aphorisms in which the names of the celestial bodies seem confused with their natures, have here grown into the central theme, the cosmic riddle is solved by figures, numbers, and proper names alone — the form of the letter, of the sign, is regarded not only as holding the explanation of all heavenly mysteries and physical phenomena but also as possessing efficient power over them. The work is in many ways a prelude to Dee's speculations with Kelly, but though there are in this period indications of the close attention he was giving to these subjects — in 1562 he had written Cabalae Hebraicae Compendiosa Tabella — and his preoccupation with Trithemius has already been noted — it was an interest that was not materially to affect his life for some twenty years yet.

Throughout, Dee employs the most enigmatical and elusive form of exposition he can commend. But in doing this he is working within a convention, and one already noted in connection with the Cabalah. It grew up as a consequence of the belief that there was a type of wisdom that was the prerogative of an elite alone, to be communicated by personal intercourse, or, if in writing, only through the medium of obscure riddles undecipherable to the uninitiated. The foreword to the Steganographia explained how this tradition of secret knowledge conveyed by hints, or parable, symbol and code, had been a recognized feature of ancient thought, among the Greeks, and among the Jews. This position could call into evidence the seventh epistle of Plato, where, referring to the Good it is said "any man who ventures to write upon such subjects can know nothing about them in my opinion," and where a theory of learning such matters is developed which perhaps reflected Dee's willingness to expound in private from the text of the Monas what he felt he could not state plainly there, "for this knowledge is not a matter that can be transmitted in writing like other sciences. It requires long-continued intercourse between pupil and teacher in joint pursuit of the object they are seeking to apprehend; and then suddenly just as light flashes forth when a fire is kindled, this knowledge is born in the soul and henceforth nourishes itself."(42) Moreover, Diogenes Laertius had declared "Plato has employed a variety of terms in order to make his system less intelligible tothe ignorant," (43) a statement with a distant echo in Dee's conclusionof his prefatory letter to Maximilian here, when he declares that it is usual, treating of such subjects to intermingle false or meaningless figures and phrases among the true to mislead the uninstructed (though how far this is the case with his own Monas it is now probably

beyond the power of human understanding ever to determine). A host of examples might be gathered with a similar burden reflecting this tradition in the main perhaps of a somewhat "Platonic" cast. Thus Synesius develops the theme that to expose philosophy to the multitude is wantonly to provoke men to despise divine matters (44). Says Clement "All those in a word who have spoken of divine things, both Barbarians and Greeks have veiled the first principle of things, and delivered the truth in enigmas, and symbols, and allegories and metaphors and such like tropes," and goes on in his next chapter to interpret the Pythagorean symbols as expressing the Mosaic Law (45). Obscurity is a strongly recommended by Boethius when treating of "secret doctrines" — he opens a philosophical "letter" on a theological matter with the advice "prohinc tu ne sis obscuritatibus breuitatis aduersus, que cum sint arcani fida custodia tum id habent commodi, quod cum his solis qui digni sunt conloquuntur."(46) Roger Bacon quotes Cicero with approval that philosophy is always "an object of suspicion and hatred" to the generality of men, and "I think all things are more praiseworthy if they occur without the knowledge of the public," adding himself "The wise have always been divided fromthe multitude and they have veiled the secrets of wisdom not only from the world at large, but also from the rank and file of those devoting themselves to philosophy."(47) His nephew explains the banning of Pico's theses as the consequence of his disregard in publishing them of such wholesome precepts for though they had Alexander VI's approval in themselves, they "were more mete for secrete communycacyon of lerned men than for open herynge of commune people, which for lacke of connynge myghte take hurte thereby."(48) Ficino for similar reasons held back the publication of his early translation of the Orphic Hymns, though he sung them in private — they contained mysteries and power not fitted to be generally divulged; and Thomas Tymme, in the "Epistle Dedicatory" to Francis Baker he prapared for his projected translation of the Monas itself, comments "He then shall be greatly overseene, that publisheth secret mysteries to the multitude. Yea he shall breake the Celestiall Seale who shall make the secrets of nature and art common...Secrets are no longer to be reputed secrets when the multitude is acquainted with them."(49) In the following century Butler commented satirically on the Hermetic Philosophy who writes works such as Dee's Monas in which secret wisdom is quite shrouded in obscurity "He comes forth in public with his concealed Truths as he calls them, like one that hath stolen something under his cloak...But though he bury his Talent, he never fails to write an Epitaph upon it that shall improve it more among the credulous than if he had put it forth."(50)

The twenty-four theorems of the Monas are preceded by a dedicatory letter to the Emperor Maximilian, which explains some of the objects of the book. Dee states here that he rejects in his investigation all human authorities, relying solely on God and Reason, though he claims, his work may well be used to illuminate the writings of the ancient philosophers, and Hermes, Pythagorus, Democritus and Anazagoras he will adduce as witnesses to his words (51). The monad which lies in the centre of the centre has a certain terrestrial body, which is instructed by divine power, wordlessly, and in which are joined the generating influences of sun and moon. But the monad is more accurately represented by a geometrical conception than by matter. Hence geometrical figures will partake more of its true nature. The monad and its operations are to be understood by a study of the form and construction of the planetary signs and the letters of the alphabet; these themselves are primary to the material objects they serve to designate and a knowledge of their generation from the monad is the key to all the secrets of nature. This is so since its hieroglyph is the pattern of God's act of creation, a comprehension of which — he cites St. Paul in evidence (52) — leads to the vision of God's truth by natural observations, even in the absence of scriptural revelation.

The signs of the planets Dee argues in the prefatory letter, are a clear example of his thesis. They must be a divine creation themselves for they are eternal, since different languages of men, or the passing of ages, affords no barrier to the ready and universal understanding of them. "An non hoc Rarum, quaeso, Astronomicos Vulgares Planetarum Characteres, (ex Mortuis, aut Mutis aut saltem quasi Barbaris ad hanc hora Notis) Iam Vita imbui Immortali: & in omni Lingua & Natione, proprias suas Eloquentissime explicare posse vires?" The motions and positions of the planets, their astrological qualities, the secrets hidden in the myths of the ancient Gods whose names the planets bear, are all for Dee apparently embraced by, and implicit in, these signs; it is notable, Dee remarks, that all mysteries are summed up in the single figure of Mercury, plus a slight addition, which converts it into his hieroglyph. "Vere ergo, Ille, nobis totius Astronomiae Restitutor & Instaurator nominari potest: et nostri Ieovae in hoc genere Nuncius, vt Sacram hanc Scriptionis Artem vel Novam Conderemus Primi, vel extinctam prorsus, & ex omni hominum Memoria deletam, eius Revocarimus Monitis."(53)

That letters have similar properties he maintains with like arguments; grammarians have taught that the position of the various letters in the alphabet is related to their shapes, which

indicates clearly the importance of these. The shapes of the letters in turn are made up of combinations of a few geometrical figures, his purpose, therefore, Dee declares, is to show "primas Mysticasque Hebraeoru, Graecorum, & Latinorum literas: a Deo solo profectas, & mortalibus Traditas (Quicquid humana jactare solet Arrogantia) Earumque omnium Figuras, ex Punctis Rectis Lineis & Circulorum peripherijs (mirabili, Sapientis simoque dispositis Artificio) prodijsse."(54) Every word and letter in the Mosaic law is formed from the 100 (monad) and the "Churec" (line) (55), an invention he claims impossible for men to have made if they had not been guided by divine inspiration. The fact of this construction and its deeper natural establishement he holds to be proved by a text from Matthew (56). "Neq; mireris," Dee exclaims rhetorically, "O Romanorum Rex Inelyte; Me, Alphabetariam Literaturam, magna cotinere Mysteria, nunc obiter referre: Cum Ipse, qui omnium Mysteriorium Author est, Solvs ad Primam & Vitiman, Seipsum Comparauit Literam....O, Quanta, tum debeant esse, Intermediarum Mysteria?" (57) (However, Dee goes on to point out, and it casts a sidelight on his theory of knowledge — that there are two forms of Kabbala — the higher is innate in all men, uniformand divine, the more vulgar makes use of Letters in its procedure, but is to be detected in different forms in all letters and languages.)

The results of this study are as striking in their breadth and scope as the method seems in its limitations. All geometrical difficulties, and all the problems which puzzled Archimedes will be immediately solved by its application. "Musicus," he demands "quo stupore Ille possit jure affici meritissimo; cum sine Motu Sono Inexplicabiles Caelestesque hic Intelliget Harmonias?" Will not the astronomer regret his experimentation, his endurance of cold and night, when by means of this procedure within closed doors, at every, or any moment he can observe the exact motions of the heavenly bodies without the aid of any machines or instruments? The manual labours of the optician, by this science, are entirely obviated "et Perspectivvs sui Ingenij Stupiditatem condemnabit, Qui, Vt juxta Parabolicae Coni Sectionis Leneam (apte in gyrum circumactam) speculum efficeret modis laborarit omnibus: quo propositam quamcunque (igni obnoxiam) Materiam incredibili ex Radiis Solaribus vexare Calore; cum hic ex Tetrahedi Sectione Trigonica, linea exhibeatur, ex cuius Forma Circulata, fieri potest Speculum; quod (vel Nubibus Soli subduct-is) quosqunque Lapidis, vel Metallu quodcuque in Impalpibiles quasi, vi Caloris (verissime maxima) vedigere potest Pulveres." All medical lore too is to be found in the concise formulae of the planetary signs (58). Dee ends this account of the marvels which may be wrought by the science he here reveals, by expressing a fear lest he should have spoken overplainly and allowed the vulgar to understand too much (59).

V. The text however affords no warrant for such alarm. It is more than sufficiently obscure and cryptic, certainly so as concerns the notable practical consequences to be extracted from its teachings. But before proceeding to a brief resume, with some detailed comments, it will be of more value to examine some of the underlying assumptions, principles and general mental attitude which inform the work. First, as to Dee's concept of the "Monad" itself. For him it represents God considered as the primal unity, the original concentrated potentiality, to be represented intuitively by the point, from which all other figures flow in orderly fashion. The complex symbol Dee arrives at from this starting point is the Hieroglyph of the structure of creation, which is also monadic, as it presents a simple coherent patter, and is a logical unfolding of its source, so far as it represents the universe regarded as a hypostasis of God. His view of God as the force standing over and above the point, or in the number series above the One (and in arithmetical textbooks until the late eighteenth century One is conventionally defined as not a number at all but as the principle of number in general), and his partial equating of God with these entities from which all other geometrical and arithmetical objects, which last are summed up in the decad, emerge might be compared with the concept of God, as cause, attributed to Pythagoras which Speusippus had formally imported into the tradition of the academy (viewing the First Cause as a self-developing germ, whose unfolding is expressed in numbers) who, it is said, like the Ionian school, "fait tout sortir d'un germe primordial; seulement au lieu de prendre pour germe un element materiel, il prend une chose intelligible, l'unite."(60) Dee's original monad as Godhead, of which the simplicity rebuts all conceivable ascriptions, beyond the statement of its Unity, is again similar to the One of the Parmenides (a work which Proclus declared taught not merely an Ontology, but a Theology, a declaration that served as a text, laying down a line for its interpretation for many neo-Platonists of the Renaissance (61)) — a monad, Plotinus taught, that stands beyond all existence, for it is the Essence and not Being (62). This doctrine as Dee echoes it in its direct relation to number theory makes explicit appearance in the writings of ancient mathematicians, such as Theon (63) and Nicomachus (64) and is echoed in many passages, redolent with metaphysical suggestion, in praise of One, or Unity, in Arithmetical textbooks, by Recorde and others, in the sixteenth century (64). Macrobius traces the successive emanations of Mind and Soul and lower entities proceeding fromit declaring "unum autem, quod movis id est, unitas dicitur, et mas idom et foemina est; par idem atque impar; ipse non numerus, sed fons et origo numerorum. Haec monas initium finisque omnium, neque ipsa principii aut finis sciens, ad suorium refertur Deum, ejusque intellectum a sequentium numero rerum, et potestatum, sequestrat: nec in inferiore post Deum gradu eam frustra desideraveris Haec illa est Mons ex summo erata Dee" (66) etc. The general term "monad" in the sense Dee uses it, developed from this view, indicates not at all the atomic individual of a Leibnizian variety, but the unity of a gropu; a concept that is the basis for the description of God solely as the "Monas Monadum," which, says Proclus, is set above even intelligence for this latter cannot be granted, the title of bare unrestricted "Unity" which is here implied, since in knowing itself, the intelligence is also the object of its own activity. This presentation of the "monad" which emphasises it as being that of which any members of a group may be displayed as particular functions rather than its character as a separately subsisting entity, is quite explicit in Proclus, in whose writings Dee was profoundly and very evidently versed: "Every order has its beginning in a monad and proceeds to a manifold coordinate therewith and the manifold in any order must have such a monad as its originative principle, for though the terms are mutually causative, internally, the monad is that which is the cause of the series as a unity, and hence must be prior to the individual terms, which appear as particular series also then appear — as a plurality of natures dependent upon the universal nature (67). The concept with its geometrical associations used analogically, early makes its appearance in certain Christian writers as a manner of representing God and thereafter was to hold a central position in the tradition of the Negative Theology. Thus Synesius calls the Father "The first Monad of monads," who becomes a glorious Trinity and generates all essences from himself and "La source supreme se couronne de la beaute des enfants qui echappes au centre retournent vers le centre" (68) (an image implicit in Dee's work). Thus Clement writes "Stripping from concrete existence all physical attributes taking away from it in the next place the three dimensions of space, we arrive at the conception of a point having position," when, to attain perfect simplicity we must reject the idea of position and the Monad that remains is God (69). In the sixteenth century Reuchlin describing the generation of numbers expresses a similar view, citing the Pseudo-Dionysius (70). Cornelius Gemma under the heading "Vunitatis diuina potestas" writes "Nam & Pythagorae nihil est aliud numerus, nisi actus seminalium rationem in unitate regnantium; Vnitas vero idipsum per quod Entium quodlibet Vnum denominatur; quoque, velut seminario, & radice sempiterna, rationes proportionisque in vtramque partem procedunt infinitae; hic quidem multiplicando, illic vero dividedo Vel, Vnitas est specierum species, exemplar

idearum omnium numeros reliquos & particulares rerum rationes in se complexa."(71) And in certain aspects the Minimum of Bruno presents the same idea (72). The monad thus conceived approximates, as has been noted, also to the cabalistic treatment of the yod (Dee's "Iota" — for his attitude to which he could also derive some collateral support from the Cratylus (73)) — for which "Le iod figure par une virgule, au bien par un point, represente le principe des choses," for since the universe, in which the word is primary, is the manifestation of a single law "aussi le iod formant a lui seul toutes les lettres, et par suite tous les mots et toutes les phrases, de l'alphabet, etait il justement l'image et la representation de cette Unite Principe dont la connaissance etait voilee aux profanes" (74); similarly according with Dee's presentation, as the point symbolises the Monad in its character of the single originative potency, so the Monad is symbolised in its aspect of Unity as End, by the circle drawn about a central point, which is the completion of its development, its unity here being the coherence embracing all created beings which singly form constituent parts of the whole.

Throughout Dee's work the magical and metaphysical implications are only hinted at, what he is discussing openly is the generation from the point of the particular figure he has devised, accompanied by an analysis of the properties of its various parts. But his manner of synthesizing it in the work itself, is clearly artificial, and does not represent the original reasons for his invention or choice of this figure, whose prime virtue for his purposes here is that from it can be extracted — since it is in effect a combination of them all — the various planetary signs. It is actually composed merely of the sign of Mercury set upon a rather formalised version of that of Aries, and it must have appeared to Dee a fortunate, if not inspired discovery that such an apt and simple combination would lend itself so fittingly to his purposes, and show itself as containing under analysis the entire celestial system. Apart from the fact that being the most complex of the signs it would be the obvious starting point for the building up of such an emblem, Dee's choice as a basis for his present endeavour of that of Mercury, on which he had already written a treatise (75) seems for reasons already noted in that connection, almost inevitable; it represented Dianoia, which produced, in God, and comprehended, in men, natural law, conceived as the intellectual schematisation of the Universe Paracelsus took "Mercury" as the name of the force through and by which all things existed, approximating it to the Joannine word (76); similarly Tymme writes on Dee's Monas "Pythagoras saies, that there is one Essence in everything which God hath created wch Essence dyeth not, untill the day of Judgment. This is that Essence wch is in anything and in any Place which the Philosophers call " (77) (i.e., Mercury; in alchemy the sign of "male secret Mercury" as opposed to that of common quicksilver; the chief necessary in manufacturing the Stone). Again the selection of the Ram, though obvious reasons for it are not given in the text which scorns to take note of anything unmysterious or lacking in difficulty, needed to supplement Mercury in completing the compound planetary figure Dee was designing, could be argued as inevitable with equal justification. It was the leader of the zodiacal constellations, thus in a manner representing all, summing up the power of the fixed stars in itself, which of course had to be introduced but are not otherwise presentin Dee's Hieroglyph, and was not unassociated with Mercury for it governed man's lead, having, says Manilius who declares it the chief zodiacal sign, Pallas for its guardian (78). It was also the sign in which the Sun — guardian and controller of the system — received its greatest exaltation. Just as Mercury according to Roger Bacon, and Dee from his prefatory letter, governed the true Christian religion, so was the Ram, in all works touching on astrological geography conventionally taken as the sign governing the Jews and Holy Land (though also England and the English!). It was also the first sign of the year, which commenced in March, and was generally accepted as the one under which Creation had taken place. Thus Albumasar (a Latin translation of whose major works had appeared at Augsburg in 1489, though they had been known through multitudinous manuscripts previously) attempted to prove in De Magnis Coniunctionibus that the World had been made when the seven planets were in conjunction in the first degree of Aries. Roger Bacon, as on many other matters followed Albumasar; the sun was placed by God in the Ram at the beginning he writes since it has its major dignity there, adding "it was necessary for the world that the aux of the sun should have been in Aries because the position of aux is far nobler than any other part of the eccentric orbit."(79) Dee adds a variation when in his Almanac of 1591, explaining the principles on which his calendar reform was made, he states (as his starting point) that Christ was conceived at the sun's entrance into Aries, i.e., the vernal equinox (80). Moreover as an alchemical symbol, and Dee's world has also particular reference to this science, it represented fire, which was the chief external agent necessary for the carrying out of the Grant Work (particularly so emphasised by the Paracelsians (81)) and stimulated "Male Mercury" to produce the stone; "the Sun in the Ram's belly," is one of the most common alchemical phrases, referring to the last stage of purification of the material in

the fire from which process artificial gold will be born. Proclus had also contributed to this picture of the virtues of the Ram — associating it with the triangle which Dee adopted as his personal emblem — in a manner which must have appeared compatible with all these other qualities, the celestial triangle which divinely connects all things in the universe he declared is "proximate to the Ram, which the Egyptians particularly honour on account of Ammon having the face of a ram, and also because the ram is the principle of generation, and is moved with the greatest celerity, as being among the constellations established about the equinoctial"; the city of Plato he adds has Neith as its tutelary goddess, who is Athena, which goddess has "an allotment in the heavens, and illuminates generation with forms. For of the signs of the Zodiac, the Ram is ascribed to the Goddess, and the equinoctial circle itself where especially a power motive of the universe is established."(82)

From the combination of these two signs — of Mercury or Intellect, the all pervading law and reason of things, and of Aries, or divine fire, chief instrument of creation, which is under the direct surveillance of Wisdom (Pallas) — Dee produces a symbol from which he finds he can easily extract the "signatures" of all the subsidiary powers operating in the universe; he therefore proceeds to investigate its particular virtue, by subjecting his hieroglyph — however fantastic and puerile his methods may seem today — to what is in effect a vigorous logical analysis, along fairly well established lines (83). This treatment of the symbol in the Renaissance was so common an activity and has been so frequently discussed that there is perhaps no need to dwell on these general aspects here, examples could be indefinitely multiplied to represent every gradation in the use of abstract figures from what were intended as no more than elegant artificial allegories embellishing rhetoric to the profoundly serious contemplation of them as of central metaphysical significance that Dee's work here exhibits (84). The connection with magical theory is also obvious — Dee states indeed that there is no need for him to treat of the theoretical basis of this work as he has already expanded it fully in his defence of Bacon, the Speculum Unitatis (85) — where (and it is the general theme of Agrippa's second book of Occult Philosophy) the figure, the talisman, is considered, just as the Word, to be the Act, the realisation, of an intention of the Rational Soul, and hence the vehicle of its power. Dee's figure however, though its parts may be put to such "artificial" uses, is not held to derive from the thought of any subordinate intelligence, but to contain the original schema of God's own total idea of his creation, and he is more concerned with it as a pathway to knowledge, than as a potentially practical instrument of "magic."

Now, although many early neo-Platonists such as Plotinus (who praises for instance the way the Egyptian sages have expressed the true natures of each thing in the hieroglyphs standing for them (86)) or Iamblichus, dealt with the virtues of figures from this point of view, it is Proclus who offers some of the fullest, most explicit discussions, and the most obviously relevant to Dee's present work. He recurs frequently to the theme, seeming to regard the best method in all instruction to be that which he attributes to the Pythagoreans, which falls into three stages (perhaps corresponding to the familiar levels of Sensible Intuition, Abstract Reason, and Spritual Reality) the first and third of which employ this approach. For prior to scientific doctrine the Pythagoreans render manifest the proposed objects of enquiry by approximate similitudes and images, and finally once more have recourse to symbols of a different kind to reveal the arcane virtues of these objects (87). In the preface to his commentary on Euclid, a work in which Dee seems to have been thoroughly steeped, Proclus declares that in Numbers, Figures and Musical Accords are to be found the three ways in which the constitutive reasons of all intellectual, moral and theological truths are presented to the human mind, and later has a lengthy discussion on the virtues of figures reflecting directly on the position taken up in Dee's Monas; after mentioning those used in Art he goes on: "Mais il y a des figures plus importantes et plus remarquables que ces dernieres, notamment celles des ouvrages de la nature: les unes qui concretisent les rapports qui leur sont inherents dans les elements sublumaires, d'autres qui assignent leurs puissances et leurs mouvements dans le ciel; car les corps celestes presentent en particulier et les uns par rapport aux autres une abondante et admirable variete des figures qui montrent tantot d'autres formes apportant les puissances incorporelles et immaterielles par leurs evolutions bien proportionnes," beyond these are the figures of souls "pleines de vie et se mouvant d'elles memes, anterieures aux choses mues...qui...sont au dessus des choses dimensionnes et materielles: figures au sujet desquelles Timee nous renseigne..." "Above these, and more divine, are figures partaking of intelligence," "elles sont fecondes, actives et perfectionnantes de l'universalite des choses; elles sont presentes en toutes celles ci d'une maniere egale et resident en elles avec stabilite; elles apportent l'union aux figures des ames et rappellent les changements des figures sensibles dans les limites qui leur sont propre." Above these again are those of the gods which "terminent ensemble toutes les figures et maintiennent toutes les choses dans leur uniques limites." "La Theurgie, en representant leurs

proprietes confere diverses figures a diverses images des dieux," these figures it evolves "d'une maniere mysterieuse, par des signes caracteristiques car ceux-ci revelent les puissances ignorees des dieux." That significant communication is possible in this manner Proclus justifies on the assumption that "il y a, anterieurement aux figures sensibles, des concepts de propre impulsion, intellectuels et divins des figures; nous sommes impressionnees par les figures sensibles et emettons en nous memes des concepts qui sont les images d'autres figures; et c'est pourquoi nous avons la connaissance des figures sensibles par des exemplaires et la connaissance des figures intelligibles et divines par des images; car les concept developpees en nous memes nous montrent les formes des dieux et les limites d'une seule espece de toutes les choses par lesquelles toutes sont ramenees a elles memes et se contiennent mysterieusement en elles-memes." In contemplating such figures the mind is looking as it were in a mirror, being at once both viewer and viewed (88).

Such a position provides an answer to Socrates' objection to such procedures at the end of the Cratylus (89) that the far better and surer way to knowledge is to avoid such an attempt to learn from the image (word or sign), however exact an imitation it may be, and to examine the things themselves, that are supposedly represented. For to Dee, the figures he examines would appear to stand for intelligible concepts, employed by God in creation, principles not directly manifest to sense through particular objects, complex symbolic syntheses of the universal law. This also applies in part to his more conventional "Cabalism," using words and letters, in the Monas, while the way in which other standard objections — as those raised in the Cratylus — were thought to be adequately answered has already been discussed (90). It is interesting however that Roger Bacon relies on the same text as Dee cites in the prefatory letter, to justify such practises; writing "For the Lord says, one jot or one tittle shall in no wise pass from the alw till all be fulfilled. And therefore there is an admirable exposition in the book on the meanings of the scriptures stating how the individual letters of the Hebrew Alphabet had significance respecting the ancient people, and how they show the number of centuries through which the state of that race passed as regards its different periods and ages, in accordance with the special powers and potencies ofthe letters....I cannot sufficiently admire the manner in which the examination was derived, although it may seem to the uninitiated to have a weak basis in the letters of the alphabet which are the first rudiments of children. But according to the teaching of the Apostles lesser things are more necessary and are to be accorded greater honour...."(91) Bacon, as Dee here also, gives equal status to the Greek and Latin alphabets. Agrippa does the same, declaring that it is God who has given man discourse in different languages, of which the written characters have a fixed order, and particular shapes which are not the result of chance, or human invention, but divinely formed in accordance with the celestial bodies and angelic powers and the virtue of these. In a manner very close to the method of Dee's Monas, he attempts the reduction of letters to zodiacal and planetary signs (92). Tymme sums up the case in his preface to his proposed translation of Dee's book. Adam he says gave names to creatures "agreeing with their nature," he inscribed in two tablets of stone with prophecies and philosophy in hieroglyphical characters, one of which Noah discovered after the flood in Armenia, and from this the signs of the planets derive. A universal science was then possible by their means, but the knowledge it embodied has since then not only diminished but has been divided up in such sort that its surviving fragments "make one an Astronomer, another a Magitian, a third a Cabalist, and a fourth an Alchemist"; but this lost unity of science Dee's work aims at reestablishing by means of the primitive planetary figures and the Cabalah, which last says Tymme "out of hidden and misticall sciences serveth to make away for men to come unto God."(93)

It is of interest to note the intellectual and historical relation between Dee's approach in the Monas and the search for a real character (Francis Bacon in the Advancement of Learning, called for one which would represent "neither letters nor words but things and notions," and would "serve for an antidote against the curse of the confusion of tongues") and the universal language which occupied so many in the succeeding century — Kircher, Dolgarno Hartleb and through him Boyle, Wilkins (who declared "As men do generally agree in the same Principles of Reason, so do they likewise agree in the same internal Notions or Apprehensions of things") and others, and received in England the attentions and encouragement of the Royal Society (94); Dee's manner of regardig his hieroglyph and its constituent parts approaches in some respects Leibniz' conception of the universal character which underlay, though it has been inevitably overshadowed by his more fruitful vision of a general logical calculus, for this latter implied the possibility of the reduction of all scientific concepts, by analysis, into a small number originally constitutive of them, to be expressed in ideographic symbols, revealing their nature and the operations they allowed of and from which all scientific knowledge might be then deduced. A direct link with seventeenth century thought in this sphere is supplied by Ashmole, who practically quotes verbatim Dee's passage on

the planetary signs from his letter to Maximilian: "there are certain Characters for the Planets, Signes, Aspects, Metals, Minerals, Weights, etc., all which have the power of Letters and run current in the Understanding of every Language and continue as Reliques and Remaines of the more Sacred and Secret Learning of the Ancients, whose intentions and words were not expressed by the composition of syllables or Letters, but by Forms, Figures and Characters." This Ashmole urges as a proof of the possibility of a universal language, setting forth the advantages to follow "if some general Forms and Characters were invented (agreeing as neer to the natural quality of the Thing they are to signifie as might be) that (to Men of all Languages) should universally express, whatsoever we are to declare by writing."(95) A further link is the puritan John Webster, educational reformer on utilitarian principles and polemicist against the vanities of conventional academic instruction in the time of the commonwealth, in a work which relies heavily and exlicitly on Dee's Preface for many of its views and proposals. He too presents the current arguments in favour of the possibility of a universal language and the benefits, commercial and other, which would follow from its adoption, but his discussion is oddly involved with cabalism, digressions on the language of Adam, and that in which God conversed with him in the garden, and the musical and geometrical language which provides the structure for creation, and his argument includes a strong plea for the revival and endowment of the study of "Hieroglyphical, Emblematical, Symbolical and Cryptographical learning" by which only the secret knowledge of the ancients will be restored to light, and sure avenues to the comprehension of scientific and religious mysteries opened (96).

One further basic assumption must be noticed as it is fundamental to Dee's whole procedure here, the doctrine — commonly met with in Renaissance neo-Platonism — of the close interweaving and logical interconnection of all things in the universe, which was invoked to justify what otherwise seem very arbitrary mental transitions, when conclusions reached through considerations of one topic are transferred bodily to another, over only the flimsiest bridge of analogy, and which allowed almost indefinite deductive extensions to be made (97) from any one fact that was felt as rightly formulated — that as Plato had declared, since all things are akin, if man could only remember (i.e., learn) one thing rightly, nothing should prevent him attaining a knowledge of all the rest (98). Thus Dee here claims to have discovered the true mystico-mathematical symbols of the planets (they are somewhat formalised compared with those of conventional usage) and their natural combination in a single scheme, and he makes the claim that from this sure starting point by "logical" progress, all sciences should be derivable.

VI. Dee first proceeds in the text to build up his hieroglyph by justifying its constituent parts. He opens (99) with the assertion that all things, natural, non-evident, or spiritual, can be represented and demonstrated by means of the circle and straight line (Theorem I). This would seem to be merely a cryptic manner of affirming the geometrical structure of the universe by an allusion to the classical limitation, to which Dee strictly professes adherence in the Euclid, though it was frequently forsakenin the Renaissance, of geometrical procedures to such constructions as could be performed by means of the straight edge and compasses. The Circle, Dee continues, is dependent for its production on the line (its radius), and this in turn on the (central) point, therefore it is from this and from the Monad (which stands "beyond" this) that all things in principle emerge originally, for no matter how large the periphery, no matter what may be manifest there, the existence of such things still refers for support to the centre (Theorem II) (100). The point would seem to represent God as originative potency, the line, according to Theon, and most Pythagorean mathematicians — and Dee's representation is at least compatible with this teaching — signifies, as the indeterminate Dyad, the primitive unformed matter of the sensible world, the circle is the full perfection and unity of extended creation, as has been noticed the point when completed in this manner is the Cabalistic form of the iod, as end. Dee's direct extraction of this metaphysical analogy from the construction of the circle can be exactly paralleled in many passages of Renaissance writing in a similar tradition (102) and its basis in the view of the circle as the symbol of eternity, spiritual perfection, unity of a whole, and the line — a position Dee develops in later theorems — as the symbol of the elemental, the material considered in itself, are very ancient, thoroughly conventional, interpretations (103).

Dee immediately particularises astronomically. The centre is the earth, round which other planets revolve; the Sun having supreme dignity, is represented by a circle with a visible centre (III). Upon this, intersecting it, he sets a half circle for the moon, the sun's nearest rival, who borrows her light from the sun, reflecting it always from a semisphere (IV) (104). The mystical level of "causal" explanation at which Dee here is working emerges plainly from the reason he gives for the moon's phases (reminiscent of Hegel's description of that body) — which completely ignores the "natural" physical account, of which he was perfectly well aware; the moon's regular "disappearance" from the heavens, and reemergence some days later, he declares, is a result of its ardent desire to be impregnated with the solar rays, and its successive attempts (which apparently it cannot continuously maintain) to transform itself from silver to gold as an alchemical process). This description perhaps suggests a doubt as to whether the Ptolemaic scheme which is used in Theorem III, and elsewhere, indicates Dee's actual acceptance of it for other purposes than such metaphorical reveries as he is here indulging, but even if it does, and the motives for his adoption of it are of the order revealed in this work, this in turn implies, that his reasons for rejecting Copernicanism are entirely of a metaphysical type, lying beyond the limits of astronomy proper; and if this is so it would account for his unstinted praise of that system when speaking with reference strictly confined to methods of describing conveniently, and calculating from, observable astronomical data. In the conjoining of these two signs Dee sees — claiming it as justification for the validity of his procedure so far — the Evening and the Morning, which made up the first day, on which the light (of the Philosophers), as distinct from that of the particular heavenly bodies) was produced. (This accords well with Dee's later observation that when turned sideways, their union reveals the letter Alpha: the beginning.)

Dee next considers the nature of the cross which supports this figure in his hieroglyph. It is Ternary, for it consists of two lines and a central point. These represent the Body, Spirit and Soul of man. It is Quaternary for it has four lines enclosing four angles (105); combining its powers, a Septenary is reached (seven was frequently employed by the numerologists as the number governing the natural world, constrasting with the ninefold celestial orders (106))(VI). The figure represents the four elements, since these when forcibly removed from their natural places, return to them, as observation proves, along straight lines, and here four straight lines run to a central point (VIII) (107). Dee expatiates on the virtues of the quaternary (108), it generates the Decad by addition of its parts, and this Dee relates to his general procedure by stating that it was therefore that the Roman Sages adopted the right angled cross — the twenty first (3 x 7) letter of their alphabet — to signify ten (VIII). He then shows the compatibility of the figure with the previous one — on the grounds that a circle may be drawn passing through the extremities of a straight line of any length (IX). This recalls a symbol frequently employed by Al Jabir in alchemical writings for the natural world — the cross of the four elements quartering an enclosing circle — representing "substance."(109)

Dee then (110) adds two inverted semicircles to the base of his figure, the sign of Aries. His reasons for employing this have been previously considered, and those given in the text are

purposely obscure; standing for Aries, he claims this sign represents the quarter of the Heavens in which the Triple Fire originated, and also shows that fire is necessary to separate the natures of Sun and Moon (i.e., in alchemy)(X), and its properties are revealed when it divides a twenty-four hour period by the equinox, thus giving rise, in some unspecified manner, to highly secret proportions (XI). The Hieroglyph which Dee used thereafter almost as a personal monogram is now completely formed, and the rest of the work investigates its virtues. Among its other striking properties as a universal scheme, though this is not directly observed but the features contributing to this are discussed separately, is that of denoting the religious history of the universe through time. For in the upper portion of the figure, Alpha is to be seen, and in Aries, inverted, Omega, while between them stands the cross. The variety of apt and easy applications he was able to extract from this device, were clearly the chief cause of the great impression it made upon Dee's mind, and of his conviction of its multitudinous mysterious virtues, which certified it, for him, as a genuine discovery of a portion of the divine truth.

From the complete figure it is easy to arrive, by omitting various parts and reorienting the remainder, at the six signs of the five planets (Mercury has two signs, while those of the sun and moon were original constituents); a process Dee sets out in tabular forms (XII). (His reasoning seems to be that since the planetary signs can be derived from a single sign compounded of a few primitive ones of known meanning, the nature and influence of the planets can be determined from this basis.) Thus Mars is composed of the Sun and Aries, with the magistery of the elements partly intervening; Venus of the sun and elements, which shows how they are concerned in the work of "revivification." Mercury has always a double nature and Dee exclaims in a phrase redolent with Cabalistic, Alchemical and Christian neo-Platonist associations, on the mysteries of its principle signs "Et (NUTU DEI) iste est Philosophorum MERCURIUS, ille Celeberrimus, MICROCOSMVS & ADAM" (XIII)(111). Dee emphasises the alchemical import by adding that the whole magistery depends therefore on sun and moon, for Hermes Trismegistus has declared these to be his Father and Mother, and it is known that Terra Lemnia (perhaps Mercury calx, sometimes called Red Earth) is singularly affected by their rays (XIV). The principles of the "Inferior Astronomy" — i.e., the family relationships of the metals (an alchemical treastise of Kelly's for instance has the title The Theatre of Terrestrial Astronomy) as they are revealed "in the anatomy of our Monad" are set out in a table, and various astrological consequences on the nature of the planets deduced from the whole figure (XV).

Dee proceeds to a further analysis of the cross (112) (XVI and XVII); his earlier remarks on it having largely been limited to what would justify its inclusion in his figure. Though it is a quaternary when upright, turned through forty-five degrees it represents 10, its upper part alone is five, i.e., V, and includes the decadal virtues within it for, turned through a further forty-five degrees this is seen to be multiplied tenfold as L, and profound mysteries of God are revealed, since the name of thihs letter is EL — the Hebrew name of God (113), and L is the tenth letter of the alphabet (omitting J and K) and the tenth from V (if U is overlooked); moreover the Mecubales (114) employed X to represent 21, this confirming the position it holds in the Latin Alphabet. Combining these results (4 x 5 + 4 x 50 + 10 + 21 + 1) the "significant" total of 252 is attained. The virtues of the Cross examined in this way are further proved, Dee declares, since from it the word LVX is directly obtainable (115).

Since he has shown how physical astronomy is guided by the intelligible astronomy of the monad, Dee now turns to showing how the parts of the latter may be arranged in the figure of the egg (i.e., alchemically) from which the misguided alchemists can truly learn what it is they ought to refer to when they use the terms "calcined eggshells," "the White," and "the Yoke"; he tells the fable of the Scarab and the eagle's eggs, affirming it is not Aesop but Oedipus (who first revealed the deepest mysteries of nature under disguise of symbols) who promptgs him (116). From the second example he concludes that it is clear that nothing can be said to exist except by the virtue of the Hieroglyph of the Monad (XVIII). He reaffirms — with special reference to alchemy — the doctrine of the emanations from sun and moon which control all generation and corruption, though the moon's "aqueous" humour is of less importance than the fiery liquor of the sun "quibus rerum mortalium sustenatur corpulentia terrestris."(XIX) This is an echo of the doctrines he had set out in the Aphorisms; they are quite usual (117), but it is of interest to observe the conformity of his expression in the Monas, and his additional use of the five planets, to Diodorus Siculus' interpretation of the Egyptian theology, of which Dee was probably well aware (118).

From the cross, symbol of the natural world, he proceeds to demonstrate the insufficiency of the binary, i.e., its inability to exist by itself here (a reminischence of the ancient numerologists on the indeterminate dyad) — for the point at which the two lines intersect, though without dimensions, is nevertheless an integral part of thse, indeed represents the secret conjuntion of the

elements, and thus converts the figure into a Ternary; whilke if it be removed a quaternary — four separate lines — is immediately apparent (119). He proceeds darkly to explore the consequence of this, but breaks off fearful lest he has expressed himself too plainly; "Tu mi, Deus mihi ignoscas obsecro, Si ergo tuam Peccauerim Majestatem, tatum in Publicis Scriptis Reuelans, Mysterium." Nevertheless he hopes this secret will bring Maximilian and the house of Austria to supreme power on earth, who will then restore the Glory of Christ's name, and remove the abominable darkness which at present, declares Dee, covers the earth (XX). These follow sections on the virtues of the hieroglyph reversed (XXI), and on how secret letters may be extracted from it, and on the true shapes of all chemical vessels and types of apparatus — one of the most important is that formed of two hemispheres, or omega (" notatum videtis Vasculum est, Mysteriorum Plenissimum") — and relations between these and letters of the alphabet are pointed out, the figure is said to reveal the pestle and mortar in which "Margaritas Artificiales non perforatas, Laminas chrystallinas, Beryllinasq; Chrysolitos, Rubinos deinde prestiosos Carbunculos et alios Rarissimos Lapides Artificiales in Pulueres subtillissimos Conteramus" (120) — which if taken literally appears a very costly recipe, but the figure also apparently offers a way of obtaining the ingredients artificially (XXII).

A number of tabulated parallels between the parts of the hieroglyph, the life of Christ, and the stages of alchemical transmutation are set out (XXII). A claim is made of direct inspiration by christ "cujus Spiritus celeriter haec per me Scribentis, Calamum tantum esse Me & Opto & Spero," (121) and a detailed examination of the numerical proportions of the figure is made, for those who wish to engrave it on their seals or rings, or otherwise employ it, in which Dee warns strictly against any infringement however small of its mystical symmetry. He explains to Maximilian the method of working out permutations by continuous multiplication, which he hopes he will find "tum in omni Naturae examinatione, tum in aliis Reipubl. Negotijs utilissimo, remarking that he himself uses this calculation with the greatest joy in the Themurah of the Hebrews. Numerical tables of alchemical combinations are derived in this manner, with the note "Numeri nostri hanc habet Dignitatem; ut illoru violare Leges, Peccatum sit contra Natura Sapientia: quae eisdem nos docere velit (in Mysterijs suis maximis examinandes) quibus certis limitibus. Statisque Illi deuincieatur," (122) these last being Virtus, Pondera and Tempora. Under the table of combinations is written "Sic Factus est Mundus," and the number of the Philosophers' Stone declared to be 252 (XXIII). This long and crowded penultimate theorem is perhaps indicative of Dee's difficulties in forcing all he has to say into the limits of the twenty-four which he has prescribed to himself for the reasons set out in the final one — i.e., the use of this number in the Apocalypse. This twenty-fourth theorem also gives praise to God in conclusion, and is signed with a triangle, denoting Dee himself, for he is, he says, "the fourth letter." After the date, a diagram is given of a circle, with the inscription "Intellectus Judicat Veritatem," and a tangent, with the subscribed words "Contactus and Punctum" (123) and a concluding, far from unjustified, comment "Vulgaris hic Oculis Caligabit Diffidetque plurimum." On the last leaf is an emblematic version of the imperial coat of arms; the shield is here ovoid, containing the Hieroglyph of the Monad, the crowned helmet from which plumes emerge in the coat of arms, here becomes a sphere with the Hebrew name of God inscribed on it, small human figures (?) cluster round it and tongues of flame issue from it; overall, in place of the imperial eagle, is a seated female figure, as it were enthroned, or upona cherub, holding a plam branch in the left hand, and, aloft, a seven-pointed star in the right. This would seem to represent the soul, and it is perhaps not too improbable that a reference to the Timaeus is intended — as appropriate to the book — for the demiurge originally implanted knowledge in the souls of men, when, "mounting them as it were in chariots, he showed them the nature of the universe and declared to them the laws of destiny," and the righteous soul after death returns to live in glory "with its consort star."(124)

It is somewhat difficult to comprehend the considerable attention, and no little credit, the Monas received in its day. At best one must take it for a collection of fragmentary hints delivered in a sort of conceptual shorthand; the general metaphysic or natural philosophy which Dee related it to, and felt his reasoning in this work supported, remains entirely submerged. However, as has been remarked of similar expositions "what appears to the modern mind as a conscious and often strained divagation from simplicity and sincerity was more often than not an entirely natural mode of expression," (125) and Dee's work lies within a well-recognised tradition that legitimised its methods and lent colour to its pretensions in many contemporary eyes.

VII. The figures which Dee analyses in the Monas and the propositions he draw from them, have, and were intended to have, significance at a variety of levels — his hieroglyph Dee claims is an all inclusive, universally effective, symbol. One of the most immediately apparent of these is the alchemical — indeed the import of the work seems often to have been regarded as being purely, or chiefly of this kind (126) (and it is indeed obviously similar to some alchemical writings, particularly to those of the Paracelsian school (127)). Thus Tymme, praising it as "The rich and golden Jewell, wch the famous and profound Dr. Dee thought not unfit the royall Ma.tie of Maximilian the Emperor," declares "In this Hieroglyphical Monas of he hath comprehended the whole Science and practise of Alchimie."(128) Dee gave full attention to this aspect of his work as his annotations to other works (129), and the alchemical verse letters he wrote to Gwynne in 1568 employing the same terminology, testify (130), moreover alchemy was a fundamental branch of natural philosophy, and on the theory of intimate analogies existing between all forms of knowledge, it was hardly possible to write truly on any topic in a way that the adepts could not construe as referring strictly to the transmutation of elements. Thus the works of ancient philosophers, or myths, could be interpreted as embodying alchemical teaching, Norton cites names of numerous philosophers who he claims have written on the subject "in rhetorical guise," "musically" or under cover of treating of "Astrologia" "Science Perspective" or "Magick natural!"(131) Plato in especial is frequently cited in such contexts (132). Dee's use of a fable of Aesop's and his reference in the same theorem, to Anaxagoras as an authority on Alchemy, and to Oedipus as one of the first to reveal its secrets, denote the same attitude; and a poem of Kelly, whose writings, all dating from his association with Dee, reflect very closely in many places his master's known views — stresses the alchemical content of the classic legends:

"Remember also how the Gods began
And by descent who ws to each the sire,
Then learn their lives and kingdoms if you can
Their manners eke, with all their whole attire
Which if thou do, and know to what effect
The learned Sophists will not thee reject."(133)

(Galileo later commented satirically that Chymists...find being led by their melancholly humour, that all the sublimest wits of the World have writ of nothing else in reality than of the way to make gold" and proceeds to mock at the alchemical interpretations of classic myths (134).)

Dee's knowledge and practice in this science has sometimes been questioned — and it is a matter of some significance in regard to his relations with Kelly. A.E. Waite lent his authority to this view, declaring Dee "knew nothing of Alchemy," and "in particular he wrote nothing on Alchemy, and it is necessary to accentuate this point."(135) But abundant evidences remain, if rather fragmentary in form, of Dee's painstaking and long continued studies, industry, and even ingenuity of invention, in this field (136). They reveal his investigations as not merely directed towards transmutation but to a considerable extent to the preparation of medicines, or other directly useful ends (137), so that he was able when his servant Roger Cook (136b) being "of a melancholick nature," determined to leave him, Dee's Diary notes (Sept. 3 1581), to impart to him by way of reward "some pretty alchemicall experiments, whereuppon he might honestly live." Dee speaks of his three laboratories at Mortlake their "storehouses, chambers and garrets...replenished with chemical stuff (for above twenty years) of my getting together far and neare, with great paines, costs and dangers" — in his journey to Lorraine in 1571 "we brought from theme one great cart lading of purposely made vessels &c." (138) and his Diaries show him to have employed a number of assistants; but probably it was not until a later period of his life than the present, impelled by the enthusiasm of Dyer and the greedy curiosity of Kelly, that Dee became at all deeply involved in the pursuit of transmutation and the Philosopher's Stone on any practical level. He seems from the Monas to have been chiefly attentive to the science in its purely speculative aspects, and because of its coherence with the general cosmology and its symbolical representation of this that he was developing, and also for its spiritual implications as a revelation of divine order and power in nature, full comprehension of which implied a mystical ascent. This last claim had always been a feature of Alchemical writings from those of Zosimus — some of the earliest authentic western specimens onwards. (Even Roger Bacon — to whom Dee perhaps in excessive admiration ascribed several treatises of other writers on the subject — for all his praise of experimentation, seems to have regarded the true student of alchemy, which he called "the lord of all sciences and the end of all speculation" as a "knower" rather than a mechanician or a "doer," and "is interested rather in the theory of alchemy than in the practical devices of the Alchemist."(139)) Thus of the Stone Ashmole declared "the making of gold" was "the lowest use the adepti made of the Materia," and elsewhere "For on whomsoever God out of his especial grace

is pleased to bestow this blessing he first fits them for a most vertuous life...and...they straightway lay aside ambitious thoughts and take up a retiredness...The consideration of this Magistery being theirs does more fill their mindes than all the Treasures of the Indies were they entailed on them."(140) Rabbards gives a similar account of the consequences of success; the Stone is "founde of very fewe and they such as rapte with the excelling thereof, have in contempt of the worlde retired themselves from common societie keeping the same most secret to themselves esteeming the world not worthy of so precious a jewel."(141) Dee's attitude is similar; thus in notes on a treatise of Bacon he declares Alchemy to be the greatest of all sciences "quia majores utilitates producit," dividing it into two parts, a speculative part, and "est autem alchymia operativa et practica quae docat facere metalla nobilia, et colores, et alia multa, melius et copiosus per artem quam per naturam"; but the first, which accounts for the generation of all things from their elements, and is connected with theology, he seems to regard as by far the higher and more worthy the philosopher (142). Thus he records in Theorem 23 of the Monas that four illustrious men, friends in Philosophy, when practising the work were astonished at the miracle that resulted. They forthwith dedicated themselves wholly to singing praises to God and preaching his word because he had thus given them so much wisdom and power and so great an Empire over all other creatures (143). Alchemy indeed is not infrequently spoken of not only as a universal science but as a mystical theology. Sir Thomas Browne writes "The smattering I have of the Philosopher's Stone (which) is something more than the perfect exaltation of gold, hath taught me a great deal of Diminity..."(144) and tenable discussing this aspect of the science — that under cover of "Goldmaking" it taught the path to a spiritual resurrection, a new birth attained without scriptual revelation to which he relates Paracelsian legends of the homunculus, comments "L'Alchimie ressemble fort a une contre-Eglise."(145)

Alchemy was seldom even in its practical manual experimentation regarded merely as a matter of mechanical operations, it was also a "spiritual" discipline. This aspect of the science contributed largely to its survival in the face of its continual and notorious failure to produce results (146), since it forbade the application of any purely empirical standards of judgment to the process of transmutation, by prescribing the necessity for special spiritual — and unobservable — conditions in the operator which were of as much importance for the result as the purity of the constituents of the accuracy of the procedures. Thus an experiment was not invalidated by its failure on any occasion, and might be endlessly repeated with undiminished hopes, since previous ill success might be attributable to the moral defects of previous alchemists, covetousness, for example, to attempt to make gold while desiring to possess gold — was held to be invariably fatal to success. Norton gives strict injunctions that the workmen at the furnaces must be kept from all "ribaldry" or disaster will ensue and points out that:

> "Wise men which for this Arte sought
> Found some Places concordant, some places nought,
> Trewly such Places where lechery is used
> Must for this Arte be utterly refused."(147)

The English commentation on Pancirolli lists the qualities it is necessary to possess before embarking on a study of the Spagyricall Art: "As for the Scholar or Learner he must be virtuous and pious, an earnest Supplicant for this Gift to Heaven. He must be prudent, and learn'd, a Linguist and a Philosopher, well seen and vers'd in the Principles of Nature. He must be laborious and patient, clear of all Troubles, disbanding all Cares; as free from passion as tenacious of secrets; neither prodigal nor covetous; competently rich both in Money and Books; very Studious and reserved, full of deep Contemplation, and hugely wary of Diabolical Delusions. In a word, he must be well endow'd with Goods of Body, Soul and Fortune."(148) Even so only a special grace of God accords the final knowledge for "Cette Divine Philosophie, n'est point en la puissance des hommes; moins peut-elle estre connue par leurs livres, si nostre bon Dieu ne l'inspire en nos coeurs par son Saint Esprit."(149)

But it seems probably that a conference of Dee's with Elizabeth — Feb. 1568 — in the gallery at Westminster, related to more directly practical aspects of the subject. It was just after a second edition of his Aphorisms had appeared, which had been presented to Elizabeth who expressed her "well liking" of it by Pembroke, and for which Dee received L20 in return. Dee notes (in 1594) that he talked with the Queen "as concerning the Great Secret for my sake to be disclosed unto her Majesty by Nicolaus Grudius Nicolai, one of the Secretaries to the Emperor Charles the Fifth &c. What was the hindrance of the perfecting of that purpose on all sides God best knoweth."(150) The expression is vague, but in the light of his later statements on the Queen's concern with his alchemical labours, this seems the most likely explanation (151). The Queen's interest in this art may well have been instrumental in involving Dee, whether he so

desired or no, in the increasingly extensive experimental practise of it that may be traced in his later career; her support would have been in any case necessary to him, for transmutation was a felony if practised otherwise than with Royal Licence (152).

Dee never believed himself to have attained the Philosopher's Stone, though he thought on occasions that Kelly knew the secret, and his son Arthur remained convinced that his father had successfully manufactured gold. This promise to Elizabeth was clearly conditional on the receipt of further information, which was apparently not forthcoming (153). But the attempted transmutation of metals was purused, with official support, on quite a large scale in the sixteenth century. Thus Strype records of the year 1574 (the names mentioned seem to be those of Dee's associates) "A great project had been carrying on now for two or three years, of Alchymy, William Medley, being the great undertaker, to turn iron into copper. Sir Thomas Smith, Secretary of State, had by some Experiments made before him, a great Opinion of it. And for the better carrying it on and bearing the Expences it was thought fit to be done by a Corporation: into which by Smith's Encouragement, the Lord Burghley, and the Earl of Leicester entred themselves with others: each member laying down an 100 L to go on with it" (154); and Rabbards, confident of the ultimate success of the science properly pursued, refers in 1591, to "Your Majestie's manifold fruitlesse still houses."(155) The pursuit was encouraged not merely by legends such as those of the exploits of Raymond Lull in England (where he turned 50,000 lb of quicksilver, lead and brass into gold for Ed.II) but by the abundant well accredited contemporary examples of success in the art (156) and the firm ocular testimony of participants in such experiments of known integrity that could be produced (157).

VIII. It must be noted also that no physical theory of the time, as to the constitution of matter and in terms of which all observable chemical changes could claim to be explained, excluded the possibility of transmutation (158) (and indeed it followed almost as a necessity on the widely held, long prevalent belief in the natural formation and growth of metals within the earth (159)). On the account in the Timaeus the elements, with the exception of earth (the cube), were defined as merely a fusible type of water composed of large, and similar sized, icosahedra, and chemical investigation was spoken of approvingly there as the diversion of a wise man, for speaking of these speculations on the nature of metals "when a man, for the sake of recreation, lays aside discourse about eternal things and gains an innocent pleasure from such plausible accounts of becoming, he will add to his life a sober and sensible pastime."(160) Aristotle also had described how the elements were generated from each other, and were hence interchangeable, and censured Plato for holding the construction of "earth" to be such as to exclude it from this cycle of mutual transformations (161). A typical Renaissance view of the implications of the process, is provided by Panciroli's discussion as to whether alchemy is not perhaps a sacreligious activity: "it is doubted whether chymistry be lawful or not...in regard it is the only Prerogative of the Creator to change one substance into another." He concludes it is not forbidden, for in any case "the Art of Man cannot transmute one substance into another" — that is change some divinely imposed specific form of any truly elemental substance — but alchemy is nonetheless feasible, and the actual chemical operations, theoretically simple "because all Metals proceed from Sulphur and quicksilver...which if they have Air, Water and Sun in them in due and right Proportions are converted into Gold," and "Heat and a due temperament" merely rectify the defects of nature apparent in base metals; but he warns as previously noted, that extreme virtue in the human agent is the prime condition for success (162). Dee's view of generation as set out in the Aphorisms and the Monas — the Monad, working internally to all things, as a controlling germinating force in varying manners, describably in terms of portions of the hieroglyph made up of various planetary signs, in interaction with the emission of effective species from all other entities, but primarily with those from the heavens which could be modified and redirected by human art — was entirely concordant with much current alchemical theory (163). In many respects it still remains similar to the doctrine of the generation of "natural things," expounded by Roger Bacon, in, for instance, his "Questions" on the Physics and Metaphysics of Aristotle (164): An undifferentiated substratum of matter gives rise to individual substances and creatures, in combination with Forms. These appear as a development of a secret, internal active power (the Monad), in which they are latent, or which is perhaps the latent forms themselves. This "germ" needs the cooperation of external agents before the forms can be brought to actuality, and these work upon the matter through its "receptive power" which it possesses in addition to its active principle. They are of two kinds, the immediate particular agent — such as a man directly assisting the process by art — and universal agents such as the sun, planets and heavens. The emergence of any entity may be analysed into some combination of these three types of cause. However theoretically satisfying, such a scheme would not appear heuristically very fruitful. The unobservable internal seminal reasons, linked with the universal workings of the divinely ordered cosmos, which acts by largely unobservable emanations from every point, which Dee declared were fundamentally "spiritual" in nature, controlling all change, approaches very close to the "Anima Mundi" beloved of the Alchemists (165), and which performs the same functoin as Henry More's "Spirit of Nature," "the great-quarter-master-general of divine providence," whose omnipresent "plastical power" is employed in "raising such phenomena in the world, by directing the paths of the matter and their motion, as cannot be resolved into mere mechanical powers."(166) As chemical theory, if unsupplemented by qualifying additions of a different order, it is clear that such descriptions opened unlimited fields to purely metaphysical speculation but provided no guide to directed experimental procedure, since they left the appearance, or production of anything whatsoever in the realm of the possible and as conceivably entertainable but were barren of concrete suggestion as to how, in practise, anything at all could be attained. Yet explanations on this level seemed unavoidable if any general theory were demanded at all to account for what was observable in natural process, to provide some sort of coherent connective tissue for data of the sort which would otherwise remaina mere accumulation of diverse unrelated particular mysteries. Francis Bacon summarises the situation at the end of his Natural History — though for his own part he is prepared to accept the second alternative rather than entertain the undemonstrable; "I would have men know" he writes — referring especially to chemistry and medicine "that though I reprehend the easy passing over the causes of things, by ascribing to them secret and hidden virtues, and proprieties, for this hath arrested and laid asleep, all true enquiry and indications, yet I do not understand, but that in the practical part of knowledge, much will be left to experience and probation, whereunto indication cannot so fully reach; and this

not only in specie but in individuo."(167)

Practice as well as theory encouraged the hopes of the alchemists. There were no workable criteria on which to decide what substances might be primary and irresoluable; the metals seemed obviously related and similar, and far more drastic chemical alteration could apparently be effected in various materials in the laboratory than would appear necessary to change these one into another. Boyle has usually been accredited with being the first to set forth clearly and explicitly an idea of an element in the modern sense, for in The Sceptical Chemist of 1651 he defined "elements" as "those primitive and simple Bodies of which the mixtures are said to be composed, and into which they are ultimately resolved." He did not however venture to identify any substance as even probably being of this kind, and does not seem to have thought that the variety of distinct types of original corpuscles that composed matter was very extensive, if indeed he considered them as differing fundamentally at all. His description found no echo in chemical practice for a century, and on the other hand the concept it embodies has been traced back, and shown to have had a long history in previous thought, though it there remains, as with Boyle, only of theoretical importance (168).

Moreover nearly all the tests by which gold and other metals were identifiable in the sixteenth century — colour, weight, ductility, were simulable by fairly well known methods. (The chief, perhaps only, exception being cupellation — which process had been placed by Agricola in De Re Metallica, a work Dee refers his reders to in the Preface (169) on a very exact quantitative basis, which later ages have found no reason to modify to any extent. Dee himself seems to have been regarded as one of the contemporary experts on metallurgy, as he figures as one of the commissioners in 1571 of the government company formed to exploit Frobisher's "black stone" — but the years of controversy over Burcoth's assayings and supposed extractions of gold, are a further illustration of the confusion on such matter and inexactness prevailing in the day — 1701.) Thus the shiftless apprecntice Quicksilver announces in Eastward Ho: "I will blanch copper so cunningly that it shall endure all proofs but the test: it shall endure malleation, it shall have the ponderosity of Luna, and the tenacity of Luna, by no means friable."(171) Even Francis Bacon while reprehending such tintings and imitations as fraud, and not overconfiden of effecting large scale transmutations, was yet fertile of suggestions by which alchemy might be turned to profitable account, for he considred there was "a middle way" to set about the process, and thus declares "the drowning of metals within other metals, in such sort as they can never rise again, is a thing of great profit. For if a quantity of silver can be so buried in gold, as it will never be reduced again, neither by fire, nr parting waters, nor other ways: and also that it serve all uses as well as pure gold, it is in effect all one as if so much silver were turned into gold."(172) His scepticism towards making gold is based on no better reason than that gold is the heaviest of metals and it is much more difficult to increase weight by condensing a substance than to lighten it! Therefore, he declares, "we commend the wit of the Chinese, who despair of making of gold, but are mad upon the making of silver," but nonetheless "we conceive indeed that a perfect good concoction, or digestion, or maturation of some metals will produce gold."(173) One further suggestion of Bacon's may be mentioned, for a considerable school of wholly empirical alchemists developed in the seventeenth century claiming to derive from his teachings (against whom Mersenne was to polemicize in La Verite des Sciences), and this formula reveals him, though rejecting Aristotelian "essences," yet as still thinking of things as made up of combinations of forms and qualities, enquiry into whose separate causes, by induction, would be the key to Natural Philosophy. "Gold hath then these natures; greatness of weight; closeness of parts, fixation; pliantness, or softness; immunity from rust; colour or tincture of yellow. Therefore the sure way, thought most about, to make gold is to know the causes of the several natures before rehearsed, and the axioms concerning the same. For if a man can make a metal that hath all these properties, let men dispute whether it be gold or no."(174)

IX. But two significant and contrasting themes may be discerned running throught he history of alchemical theory, not infrequently, as in Dee's case, mingled, but nonetheless pointing in different directions in so far as they influenced general physical doctrines and experiment. The dominating and most generally stressed theory, up to and beyond Dee's own time, seemed much more plausible and closer to observation, and to offer directions for practical chemical investigations, yet it proved nonetheless thoroughly illusory; the other, which in its early appearances seemed more related to pure speculations of a fanciful and extravagant numerological type, and apparently as a hypothesis irreconcilably divorced form laboratory work, nevertheless exhibits in its theory certain formal features, and also as a consequence of similar fundamental assumptions, come gradually increasingly to stress the importance of quantitative method in practical chemistry, which allow it to be related to what today appears as the "scientific" alchemy of Newton and Boyle in the seventeenth century, and even beyond them, to modern chemical thought. The first theory gave an account of change, and the interrelation of substances, drawing its strength from accepted Aristotelian theory that all things tend naturally to their perfection, the full realisation of their essences, and Gold was taken as the perfection, the entelechy, of all other metals, perhaps of all other substances. Thus "Albertus Magnus" asserts "Non dari rem elementatam, in cujus ultima substantione non reperiatur aurum."(175) Norton, Ripley, "Dunstan," "Lull" all stress as the groundwork of the feasibility of transmutation, the "sickness" that infects all imperfect bodies — gold being the most nearly perfect of those found in nature (the "Stone" itself being that entirely perfected substance which impels all other substances to their improvement), but all imperfect bodies are by their constitution corruptible, and from their putrefaction, if it can be induced — St. Paul is usually cited here on the death of the seed in the earth as the necessary preliminary to resurrection in glory — they will arise in their true purity and emerge as gold. An excellent expression of this view is Nysement's Poeme philosophic de la Verite de la Phisique Minerale, 1620, in which the science is not unexpectedly closely bound up with the adoration of the "Spiritus Mundi." Of the Alchemists he writes:

"Ils firent des Metaux la vraye anatomie
Vivifiant par Art leur vigeur endormie."

And again:

"Le but universal de la vraye Alchemie
Est d'oster aux metaux une impure cadmie
Qui leur pure substance empesche en l'infectant
D'arriver au sommet ou la nature tend."(176)

All the traditional laboratory stages in "The Work" — which follow fairly closely a standard pattern — can be directly related to this interpretation of the process that was supposed to be occurring. The theory suggested immediately practical applications, and in performing these the alchemist could have at least some idea of the effects he was aiming to produce, which would control and direct his endeavours. At the same time observation was in fact crippled and its results unprofitable, by being made always in relation to governing concepts of vague and disputable content and implications, such as "perfection," and "improvement."(177) The doctrine suggested no exact terminology for assessing results which would render even classified "failures" significant data; moreover, ultimately it discouraged experiment, and cramped all investigation, by its insistence that all that could be done was to imitate nature by reproducing the conditions which within the earth allowed the spontaneous generation of metals one from another — by a mysterious power whose causal operations it was beyond man's wit to comprehend in other than "mystical" phraseology. This passive, incurious, but ever hopeful attitude can be illustrated for instance by a seventeenth century treatise of Henry Harrington's: "I would wish" he declares, "the Students of this Arte to continue in the true and simple way of Nature....Be assured (Reader) that noe manuall rescip or work is or can be true, thou shalt but delude and cosin theyselfe, for no manuall worke appertaineth to this Arte, a true Ph.[ilosopher] doth but sett Nature in order by Placeing a true matter in a convenient vessell, and keeping a true regiment of fire, Nature performeth all the rest."(178) Nevertheless the theory long persisted, commending itself by a superficially attractive simplicity and order. Many standard 17th century chemical works continue to assert that there is a single type of perfect metal which is gold, since those who denied this would have to prove that every metal was a different "species," whereas the similarities between them were obvious to all (179), and the doctrine lent itself readily to the attempt to construct evolutionary chemical patterns — such as Glaubet's cyclical theory of the life histories of metals.

The second trend in alchemical thought that may be contrasted with this doctrine, seems frequently to derive from purely a priori considerations, to make dogmatic statements impossible of verification, and to have little or no possible connection with any observation or performable

experimental work. Its fundamental difference from the first may be illustrated by the view of the constitution of the underlying character of nature that they respectively implied; the one led to the idea that, in Arnold of Villanova's frequently cited phrase from the Speculum "there abides in nature a certain pure matter, which being discovered and brought by art to perfection, converts to itself proportionally all imperfect bodies that it touches" (180); the second was inclined to regard "matter" as some undifferentiated substratum, whose only quality was to be susceptible of arrangement, and from the geometrical patternings mathematically definable that it assumed all particular qualities took their being. This view stems largely from the account of the elements in the Timaeus — not infrequently thereafter to be encountered in Platonist writings — it is adopted for instance by Nichomachus, and set out by Plutarch (181) — or even from Pythagorean teachings, if their concretisation of number regarding it as the essence of things be interpreted as referring to orderly groupings of "points" having a certain extension (182). The connections between this "geometrical atomism" (which must be sharply distinguished from that Epicurean atomism which accounted for the qualities of varying substances by ascribing to their atoms such shapes as if they had possessed them on a macroscopic level might plausibly have explained the sense impressions they produced — that is, by making them round, pointed or hooked — an interpretation advocated by various chemical writers such as Lemery until the eighteenth century) and neo-Platonism generally have been previously touched upon — thus quantity and divisibility were the only features Avicenna would admit matter as possessing per se; traces of this view are to be found in Roger Bacon's Questions on Aristotle that have already been compared to Dee's views on "generation," in which it is implied that the forms which are imposed on the single undifferentiated matter to produce all variety in it are "numerical"; and by the seventeenth century, the Cambridge Platonists were prepared to find a mechanical corpuscular theory not merely compatible with the intellectual structure of the universe, they postulated but the only "intelligible" system that could be devised for the interpretation of physical phenomena. As regards alchemy the most influential exponent of comparable views was al Jabir, to whom Dee's thought seems in many respects to be indebted, his prime thesis applicable to every science would seem to have been that the specific qualities of things are "measurable" and depend on definite numerical proportions and Kraus has given detailed description and analysis of his work from this point of view. Al Jabir makes no distinction it is true between exact physical measurement and numerological fantasy, but he represents a sharp break with the verbal, mystical tradition of alchemical writing, and these "donnees arithmologiques represent sans aucun doute le trait le plus caracteristique du Corpus"; his applications of them vary in detail "mais leur principe est toujours la meme: c'est de fonder l'alchimie aussi que toutes les autres sciences sur les lois du nombre et de la mesure, de soumettre toute la Nature a ce que Jabir appelle la theorie de la Balance."(183) This last "a pour but de ramener tous les changements qualitatifs du monde corporel a des changements de quantite, et de construire avec les donnees du Timee et de la doctrine pythagoricienne le system d'une physique quantitatif."(184) The number 17 plays a leading part in his theories; one of the chief reasons being that there are 17 consonants in the Greek alphabet which divide into 9 mutes and 8 semivowels, the proportion 9:8 being that of the tone (the seven vowels are the seven notes of the scale)(185). He postulates that all bodies have related structures "governed" by this number, and it is the exterior part of this structure which produces their observable chemical properties, the retruse and not easily affected inner structure — composed of the "unmanifested" remainder of 17 — endows their nature with stability. "La transmutation d'unm corps en un autre n'est donc pas le fait d'un simple chamgement par augmentation ou diminution survenue du dejors. L'operation alchimique n'a pour but que de changer les rapports qui existent, dans le corps meme, entre ses parties manifestes et ses parties latentes, de rendro manifeste une quantite determinee de telle Nature latente ou d'en repousser une quantite determinee a l'interieur. Ainsi, le corps primitif disparaitre et un autre prendre sa place, mais l'equilibre exprime par la somme des Natures manifestes et latents restera toujours le meme."(186)

Now passing to the seventeenth century, Boyle may be taken as an enthusiastic alchemist, working along lines typical of the age. He petitioned parliament and obtained the repeal of the Act of Henry IV against "multipliers of gold"; he claimed to have purified quicksilver into an essential mercury which approached closely the Hermetic "prima materia" (an experimental discourse of Quicksilver growing hot with gold, 1675), he "reduced" gold to silver, using a dark red powder — reminiscent of that employed by Kelly (An historical account of a degradation of gold made by antielixir: a strange chemical narrative). These activities seem traditional, but the general theories from which Boyle is working are radically different from those based on the tending of metals towards their perfection — gold, for "Boyle as a consequence of being a Corpuscularian would regard transmutation as a necessary principle of nature."(187) He envisaged differing chemical

qualities as arising from differing geometrical patternings of identical atoms, and these "forms" as being directly alterable by experiment. Even more striking is the case of Newton who similarly declared "God in the Beginning, form'd matter in solid, massy hard, impenetrable, moveable Particles of such sizes and Figures, and with such other Properties, and in such proportion to Space as most conduc'd to the End for which he form'd them."(188) Newton's alchemical papers in the Portsmouth Collection run to over half a million words; once more many of his experiments are in appearance along very traditional lines, and this connection is emphasized by his view of the science as being "an inlet to something more noble," which was not to be communicated to the world (189). However a recent examination — "defence" or "apology" might better convey its flavour — of Newton's alchemical theories has been made by Soviet Academician S.J. Vavilov, who claims that Newton "built up a picture of the microstructure of matter remarkable for its profundity, foresight and correctness."(190) Regarding all "pure" substances as made up of elementary complex "particles" in which the corpuscular pattern determined the qualities of the substance, Newton attributed ordinary chemical change, resulting from the formation of compounds, as alterations solely in the outer "layers" of such structures; his alchemical researches it is pointed out were directed chiefly to the discovery of a solvent penetrating enough to affect the more stable core. Apart from Newton's obvious unawareness of the actual magnitude of these chemical atoms, the scheme is said by Vavilov to be otherwise comparable to, even an anticipation of, modern chemical theory, which ascribes "normal" chemical changes to affections of the outer electrons and transmutation as only produced when an alteration is made in the nuclear structure. But it is clear tht the similarity between Newton's and modern theories (or the no less striking similarity between Newton's and for instance Al Jabir's (192)) are not a result of any similarity between the empirical evidence available in these different ages, from which inductive conclusions were drawn; nor, however, are the similarities the result of mere chance. They arise from the employment in all cases of related concepts, they are systems which indicate a departure from similar initial "axioms" which define, inevitably, a similar approach to, and therefore similar conclusions about, nature. All three of these examples are particular formulations emerging froma continuous, though developing tradition, it survived up to and through the Renaissance by its association with, or logical derivation from, certain metaphysical assumptions; in the seventeenth century, as far as its chemical application is concerned, its strength is drawn from its concordance with views and methods which in other branches of science had achieved direct practical success; but it is perhaps only from the end of the eighteenth century onwards, though in all its manifestations it had reacted on, not always insignificantly, experimental technique — that it begins to be truly reflected in the methods of practical chemistry and "confirmed" by a rapidly expanding body of direct empirical evidence.

Despite the presence of many superficially dissimilar features we have noted in the Monas, Aphorisms and elsewhere, Dee's chemical theories can be said, broadly, to belong within this tradition. (He would even seem to have taken over along with much else from Al Jabir the doctrine of the significance of 17 as applied to the material structure of things (193).) His approach chiefly contrasts for instance with those of Newton and Boyle in that Dee generally prefers to look upwards from the numerical harmonies which he affirms maintain in nature, to search for their correspondencies in the intellectual and angelical worlds, which unprofitable path he regards as philosophically superior, rather than to develop in greater detail and explore the physical applications of these theories, though he held this to be an equally possible and legitimate course. Nevertheless he is insistent in the Preface that in terms of number, measure and weight alone, the essences of all things and their natural causes are to be understood, that the exact operations involving thse, and the mathematical logic which bases its calculations upon the results of the precise measurements of these, made up the true method in natural philosophy. This triplicity had long received lip service from the alchemists (194), without however greatly infiltrating their practice or producing any marked attention to quantitative considerations. But Dee's treatment is of a far different kind, particularly so in his references to "Weight" as a factor to be attended to in investigation. Indeed he is conscious of dealing with an almost new science when he discusses it in the Preface and inserts a prayer to God for guidance as a preface to his exposition, which he regards as needful, since men are "advertised by thy mercifull goodness, that three principall wayes, were, of the, vsed in Cration of all thy Cratures, namely Number, Waight and Measure, and for as much as, of Number and Measure, the two Artes (auncient, famous and to humaine vses most necessary) are, all ready, sufficiently knowen and extant. This third key, we beseech thee (through thy accustomed goodness) that it may come to the nedefull and sufficient knwledge, of such thy Servauntes, as in thy workemanship, would gladly finde thy true occasions (purposely of the vsed), Whereby we should glorifie they name...."(195) Dee's views lend him to break with

the Aristotelian doctrine — at least to evade its pernicious consequences for he speaks of the "lightness" of fire as a limited force susceptible of measurement — that heaviness and lightness were equally existing contraries, so that some bodies were possessed of absolute lightness, and which, since it taught that no substance possessed weight in its proper place, implied that perceptible weight — a result of a substance's dislocation from such a place — was a mere adventitious accident, a purely local manifestation (it may be noted here that Dee's investigations in this field also lead him to reject Aristotle's declaration that speed of fall is proportional to weight — for often describing some part of the rare Art Statike, which he calls "the Experimentes of the Balance" he adds "By thse vercties, great Errors may be reformed, in Opinion of the Naturall Motion of thinges, Light and Heavy. Which errors, are in Naturall Philosophie (almost) of all me alloweds: to much trusting to Authority and false Suppositions. As Of any two bodyes, the heavyer to move downward faster then the lighter" (196)). Dee on the other hand seems to ascribe some degree of heaviness to all substances and to regard the proportion of weight to volume, while the density of the surrounding medium remains constant as one of the permanent identifying characteristics of any particular substance. He translates into English for the first time here some sections of Archimedes statics (197), he informs his readers that especially by this science "You may deale for the proportion of the Elementes, in thinges Compounded" and suggests numerous "experiments" to which the exact determination of weights will provide the key (198) — these are in great measure inspired by the fourth part of Cusa's Idepts, which is an exposition of the utility of the "Bolanxe" as an instrument in all fields for the inquisition of nature.

But this topic, in relation to the contents of the Preface, their influence, and connection with the growth of dynamics and experimental investigation, it is intended to cover more fully in a later study, and as it has only an indirect bearing upon alchemical doctrines further expansion would be irrelevant to the present purpose. However some side lights on Dee's more strictly chemical theories are provided by his copy of Pantheus' Voarchadumia, a work he commends to the emperor in the Prefactory letter to the Monas, and of which later, the angels, through the mouth of Kelly expressed their high approval (199). This little work attacks the methods of tinting, etc., usually employed by the alchemists as "sophistic," for they leave the basic substance of the materials they are applied to unchanged (200). It sets out to explore the principles of chemistry from a more fundamental point of view. In order to do this it employs an extensive artificial vocabulary which has been constructed after tha manner of word building recommended in the Cratylus, Pantheus apologising for the necessity of this, says the justification for it will be apparent to the intelligent reader "Cui (sane) veritati aptissimo astipulatur illa peripateticorum Principia doctrina edocentis (ingenere relationes) oportere aliquando pro explicandis rerum proprietatibus nomina cofingere."(201) The chief instrument employed throughout is the Cabalah — an examination of the construction and numerical values of the Hebrew characters revealed by God to Moses (202), and an analysis of Hebrew words and phrases made after this fashion. At the same time it aims at being a practical handbook and has many full-page illustrations of laboratory equipment and machines for use in the Work, showing complex arrangements of gears, rollers, and presses, with instructions for their use. Dee has interleaved his copy with manuscript, containing comment often fuller than the text, sometimes merely extracts from it. Going back beyond the hypostatised qualities of moist, dry, heat and cold, and the conventional four elements, Dee interprets these as affections of matter resulting from its organisation, and seems to approach a corpuscularian point of view, as quantitative indivisibility seems the one characteristic he allows to the concept of Element declaring "Elementa minima particula corporis est."(203) Discussing "corruption" as produced by alchemical processes he declares it is not of matter, for that is indestructible, in itself, by natural or artificial powers, but of the substantial form which is a result of the proportion and arrangement of "elements" — "Sed Essentia et forma qua ex mixtione susceperant bene pentus annihilatur" (a statement which conforms with the long directios he gives for arithmetically determining "the newe Forme resulting" when compounding a medicine when the exact proportions and the specific qualities quantitatively represented — of the ingredients are known, in the Preface (204)); a whole, Dee continues, is an integration of parts, a house may be taken to pieces, in which case the "house" is destroyed but the wood and stone from which it was built remain. He interprets various natural processes on this model. Water in a vessel stood upon a fire will evaporate. Has not, he asks, the fire destroyed the moistness so that nothing remains? and answers that the water has taken on another form, and is now steam — it has assumed the form of air, which is generated by heat and dampness, as a consequence of rarefaction. Thus, he says, clouds ascend by virtue of fire against "Nature," since water is heavier than air in its normal "form"; "et cum venit ad locu perpetui frigorus, in quo frigidatas superat caliditate tunc Nubes converitur in aqua; virtute sua frigidatus inspissantias" and rain results (205). (His treatment of the

four qualities as effects of varieties of motion with a body is reminiscent of Urac's theories previously noted.) He attempts to explain standard alchemical processes such as putrefaction interms of the rearrangement of parts that is taking place internally to the substance. As far as possible he employs numbers in his descriptions, but while his notes have many observations and calculations, of proportions by weight and measure of the possible constitution of various substances, he, like the text, derives most of this data from Cabalistic exercises; thus (206) he writes "Primu ergo principium naturale, est materia, seu causa materilis terrae aquae, Ignia et aeris, sub Nutu Dei, vel Marthek: quod graece neusi theu dicitur, et Hebraici rec on Heloim positio in literis et numeris: notatis per Linea perpendiculario; ut infra ac divisis ot aequales et inequales pertes tali videlicet modo." There follow tables which set out Nuta Dei, and Marthek, in Latin, Greek and Hebrew, turn them into numbers, and combine these in turn, in various manners, and apply the totals to "Putrefactic," "Generatio," "Alteratus" etc.(207)

Despite the fragmentary nature of the evidence it is perhaps enough to indicate Dee's place in regard to Alchemical theory. But though it formed an organic, and in practise far from neglected, part of his whole cosmology, he seems to have regarded it like mechanics and other applied sciences, chiefly as a wholesome diversion that might prove not unprofitable in daily life, and by no means comparable in worth or importance with the principles of pure mathematics, and the intellects upward ascent from them. These embraced in turn such activities as alchemy, which were to be viewed as valid deductions from them. These embraced in turn such activities as alchemy, which were to be viewed as valid deductions from them, but except in private notes, and in the Preface — a manifesto on the utility as well as the divinity of number — Dee largely refrained from any direct discussion in his works of these lower branchesof knowledge, except in the manner he employs in the Monas (if considered as an alchemical work), where the primary reference of his thought is always the more general aspects of the hideen relationships and mysterious harmonies maintaining in the universe as a whole, and their significance for the dianoetic faculty operating in the service of the soul's felicity that follows on this comprehension of them. So even in the Preface he concludes his discussion of Statics, which has dealt with its utility, and act out physical experiments at considerable length, with the comment "Thus, can the Mathematical minde, 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 vses: and when he list, retire home into his owne Centre: and there prepare more Meanes, to Ascend or Descend by: and all, to the glory of God, and our honest delectation in earth."(208)