Two Dictionaries of Mathematics, 1679 and 1989

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2012

MIMS EPrint: 2012.37

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ISSN 1749-9097
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Based on a talk given to the MIMS (Manchester Institute for Mathematical Sciences) Colloquium, 14 October 2009.

Introduction

A dictionary can be regarded as a list of words or terms together with their equivalents, or definitions, or explanations in the same language (monolingual) or another (bilingual). Early examples of dictionaries include the bilingual Sumerian-Akkadian wordlists on cuneiform tablets dated 2300 BC, a monolingual Chinese Dictionary (c.3rd century BC) and Disorderly Words (Ataktoi glossai) by the Greek scholar Philitas of Cos (c.340-c.285 BC) explaining rare literary words, dialect words and technical terms. Following Aristotle’s insistence in his Posterior Analytics [1] on the need for definitions at the base of a treatment of a subject, we have Euclid (3rd century BC) opening many of the books of his Elements with a set of Definitions. For example Book 1 has 23 geometrical definitions, Book 7 has 22 number theoretic definitions, Book 10 has 4 concerning rationality and irrationality, and Book 11 has 28 definitions of terms in solid geometry [2]. It should be added that the source of Aristotle’s mathematical examples of definitions is probably the work described by Proclus as ‘an admirable arrangement of the elements’ made by another member of Plato’s Academy, Theudius of Magnesia (4th century BC) [4]. Moreover Aristotle makes important observations on definitions. When the definition of a thing says what it is, we have a nominal definition. When the definition shows that the thing exists then it is a real definition. Leibniz used ‘the regular polyhedron with ten faces’ to illustrate the distinction between nominal and real definitions. Finally a definition of a
thing can demonstrate why it is or give its genesis. For a more detailed discussion see [3].

Some Early Dictionaries of English terms

The first dictionary involving English words appears to be the Latin-English wordbook of Sir Thomas Elyot, 1538 [5]. But this is not monolingual. Richard Mulcaster in his *Elementarie* of 1582 [6], primarily an aid to teaching, includes a list of over 8000 words in an attempt to stabilise the spelling of English. He gives no definitions but writes of the importance of the need for a comprehensive dictionary of English:

‘It were a thing very praiseworthy in my opinion … if som one well learned and as laborious a man, wold gather all the words which we use in the English tung … out of all professions, as well learned as not, into one dictionarie, and besides the right writing, which is incidente to the Alphabete, wold open vnto us therein, both their naturall force, and their proper use.’

In the following century dictionaries of ‘hard words’ began to appear. In 1604, Robert Cawdrey published *A Table Alphabeticall* [7], a list of 2543 words and synonyms. Thomas Blount’s *Glossographia: or a dictionary interpreting the hard words of whatsoever language, now used in our refined English tongue* of 1656 [8], containing 11000 words was quickly followed in 1658 by Edward Phillips’ 20000 word *The New World of English Words* [9]. Prompted by the belief that Phillips had plagiarised his work, Blount responded in 1673 with *A World of Errors discovered in The New World of Words* [10]. In spite of these and other efforts, Mulcaster’s hopes and requirements of a comprehensive dictionary remained unfulfilled for over a hundred years. Then John Kersey the Younger published *A New English Dictionary* in 1702
[11], and Nathan Bailey published *An Universal Etymological English Dictionary* in 1721 [12]. Finally in 1755 Samuel Johnson’s *A Dictionary of the English Language* was published [13]. It had 42773 words and Johnson illustrated his meanings of words with usage and comments (some humorous, some idiosyncratic). Here are two examples:

Dull; Not exhilarating (*sic*), not delightful; as, *to make dictionaries is dull work*.

Lexicographer; A maker of dictionaries; a harmless drudge that busies himself in tracing the origin and detailing the significance of words.

Some Early Dictionaries of Mathematics in English

The works of Blount (1656) and Phillips (1658) did contain definitions of mathematical terms. For example, in Blount’s book we have the following:

Algebra (Syriack) the Art of figurative numbers or of equations. An art consisting both of Arithmetick and Geometry; *Chaucer* calls it *Algrim*.

Angle (**angulus**) a corner, nook, or secret place. It is also a Geometrical term for a corner, included by two lines; of which there are three sorts, to wit, a *right*, an *acute*, and *obtuse angle*.

1 A *Right Angle*, is when the two lines meeting do frame a just square Angle of 90 degrees.

2 An *Acute*, is when the two lines enclose less than a square, thereby becoming more sharp, and therefore *Acute*.

3 An *Obtuse Angle*, is when the two lines include more than the square, making it thereby the more blunt and dull, and is therefore called *Obtuse*. *Enchiridion of Fortification*.

In Phillips’ dictionary the corresponding entries are:
Algebra, a Syriac word, signifying the art of figurative numbers, or equations.

Angle, a corner, also a Term in Geometry, being the concurse of two lines meeting together, so as that they do not make one line.

However the first mathematical dictionary is that of Joseph Moxon (1627-1691). This was first published in 1679 and entitled Mathematicks made Easie: Or, a Mathematical Dictionary Explaining the terms of Art, and Difficult Phrases used in Arithmetik, Geometry, Astronomy, Astrology, and other Mathematical Sciences [14]. His son James Moxon published an enlarged second edition in 1692 [15] and, with Thomas Tuttell, third editions in 1700 and 1701 [16], reprinted as a fourth edition in 1705 [17].

In his introduction to the first edition, Moxon describes how he had been ‘storing up Words and their Interpretations’ for thirty years. He mentions his having lighted upon a book by ‘Vitalis, a French Author, printed in Latin’ which had less ‘Words purely Mathematical’ than he had collected. This will be a reference to Lexicon mathematicum astronomicum geometricum by the Italian Girolamo Vitali (1624-1698) published in Paris in 1668 [18].

The first dictionary of mathematics in French was Jacques Ozanam’s Dictionnaire Mathématique ou Idée Generale des Mathématiques (1691) [19]. This work, which is more of an encyclopaedia than a dictionary, is mentioned as a source in the title pages of the reprints of Moxon’s dictionary from 1701 onwards. It motivated the next dictionary in English, A mathematical dictionary: or, a compendious explication of all mathematical terms, abridg’d from Monsieur Ozanam, and others by Joseph Raphson FRS (1702) [20]. The title page misspells the surname as Ralphson. Subsequent publications include A new mathematical dictionary (1726) by Edmund Stone FRS [21], and A new mathematical dictionary (1762) by Thomas
Walter [22]. Then Charles Hutton’s *A mathematical and philosophical dictionary with an historical account of the rise, progress and present state of these sciences, also memoirs of the lives of the most eminent authors both ancient and modern* (1795) [23] is followed by Peter Barlow’s *A new mathematical and philosophical dictionary* (1814) [24]. Hutton (1733-1823) and Barlow (1776-1862) were Professor and Assistant Professor respectively at the Royal Military Academy at Woolwich, and renowned makers of Mathematical Tables.

**Joseph Moxon (1627-1691)**

Joseph Moxon spent most of his working life in London as a printer of maps and charts, a maker of globes and mathematical instruments, and a printer and publisher of popular scientific or technical books. He had a good reputation for printing mathematical texts and tabulated data. For example, he was engaged to print the tables of trigonometric and logarithmic functions constituting the second part of William Oughtred’s *Trigonometria* of 1657 [25].

He was born at Wakefield in 1627 and was educated at Queen Elizabeth’s Grammar School at Wakefield for some of his childhood. But some time also seems to have been spent in Holland, with his elder brother James, accompanying their father James, an ardent puritan, who went to Delft in 1636 and on to Rotterdam in 1638 in order to print English Bibles, containing marginal notes of a kind forbidden in England under Archbishop Laud’s policies. This experience will have introduced Joseph to Dutch printing practices and to the Dutch language. Following the First English Civil War and the impeachment of Laud, the family returned to London and in 1646 the brothers set up a printing business and were admitted to the Stationer’s
Company, thus gaining a licence to print. For the next three years they printed a number of works almost all of which were of a puritan nature.

About this time Joseph began studying the making of globes, maps and mathematical instruments and in 1652 set up his own business as a printer and maker of terrestrial and celestial globes. By 1662 his reputation was such that he was appointed Hydrographer to Charles II ‘for the making of Globes, Maps and Sea-Platts’. Samuel Pepys records several visits to Moxon’s premises, one to buy ‘a payre of Globes’ for his wife, another to examine globes he had ordered for the Admiralty [26]. Over the next twenty years Moxon was involved as printer, translator, or author in the publication of almost 40 works. His scientific interests were wide and included astronomy. He was a friend of Robert Hooke, and, though not proposed by him, was elected a Fellow of the Royal Society in 1678, and thus became the first tradesman to join the Society. The voting was 27 for and 4 against. This was the first and only instance of negative voting at the election of a Fellow in the Society’s early history, and may reflect the reluctance of some to elect a tradesman. Given his established reputation in the mathematical and scientific community, this remarkable election came late in his career. It may have been helped by the favourable impression made on Hooke and others by his Mechanick Exercises, or, the Doctrine of Handy Works [27]. This was published serially in 14 parts from 1677 to 1680, the first six, which he presented to Sir Joseph Williamson, the then president of the Royal Society, coming out together prior to his election. The work describes in detail the techniques of smiths, joiners, carpenters, turners and bricklayers. Besides being the first work in English to be published serially, it was also the first technical encyclopaedia, making public the technical skills that previously had been confined to members of the guilds. Along with 22 others Moxon was expelled from the Society in 1682 for not paying
any of his annual subscriptions, but nonetheless he continued to record himself as ‘a Member of the Royal Society and Hydrographer to the King’s most Excellent Majesty’ on the title pages of his books. For a more detailed account of this episode see [28].

In 1679 he achieved another first with his *Mathematicks made Easie*, the first dictionary of mathematics in English, of which more is said later in this paper. This was followed by another innovative work, *Mechanick Exercises: or, the Doctrine of Handy-Works. Applied to the Art of Printing*, published serially 1683-84 [29]. This is perhaps his most important work as it gives for the first time in English a comprehensive and detailed account of contemporary printing techniques.

These publications show Moxon to have been a pioneer in the developments in popular technical education that led to the setting up of the first Mechanics Institutes in the 1820’s and the widening of school curricula in the nineteenth century to include scientific and technical training.

One of his most unusual publications is his *Compendium Euclides Curiosi, or Geometrical Operations* of 1677 [30]. This is his translation from the Dutch of a work by the Danish mathematician Georg Mohr, in which it is shown that all Euclidean constructions can be performed with a straightedge and a fixed compass. [All Euclidean constructions are possible with just a variable compass. This too is shown in Georg Mohr’s little known *Euclides Danicus* of 1672 [31], but constructions of this type have always been called *Mascheroni constructions* after Lorenzo Mascheroni (1750-1800) who published a proof of the possibility in 1797 [32].]
Mathematicks made Easie (1679)

The first edition opens with a short dedication to ‘the Honourable, Sir George Wharton, Baronet, Treasurer and Pay-Master of his Majesties Office of the Ordinance’. Wharton was one of the signatories of the certificate accompanying Moxon’s petition to Charles II to be made hydrographer. This is followed by a preface entitled ‘To The Reader’ which begins ‘To Expatiate in Encomiums on the Mathematicks were to Gild Gold; an Undertaking vain and impertinent.’ He explains that when he began to learn about mathematics about thirty years previously, i.e. about the time when he began studying the making of globes, maps and mathematical instruments, he felt the lack of a dictionary and started to collect hard words together with references that explained them so as later to ‘digest them into an Alphabetical Method’. In turning all this into a book he has had the assistance of ‘my good Friend Mr. H. C.’ From later printings we learn that he is ‘Hen.Coley, Teacher of the Mathematicks in Baldwin Gardens’. Moxon’s intention is to reach the ‘young student’ with a book ‘for Beginners, not Accomplished Artists’. The scope of the book is wide for he has ‘… taken the pains to Collect and Explain the Hard Words, Difficult Terms, and Abstruse Phrases used by Authors, in all the several Mathematical Sciences and Branches depending thereon; …’. The style of the entries is ‘adapted to the meanest Capacities; preferring sometimes a plain, Familiar and Intelligible Description, before a Rigid, Abstruse (though Exact) Definition: Nay, rather (though rarely) venturing upon a Repetition, than running the hazard of not being understood.’

The first edition of the dictionary contains about 750 headwords. The headwords are in bold fractur. Within an entry Moxon applies italics quite freely, sometimes to terms that have a separate entry. He uses ‘See’ to cross reference to
another entry, and sometimes ‘See also’ to refer the reader to a related entry. Most of the entries are of arithmetic, geometric, astronomical and astrological terms. But, true to his preface, the scope is wide and the work contains terms from mechanics, navigation, surveying, architecture as well as units of measurement.

[Insert page; Figure 2]

For example, he ends letter H with an entry for Hypothesis that ends ‘So the several Models of the World conceited and delivered by Ptolomy, Copernicus, Tycho, etc are called such an one’s Hypothesis’. Then the first five entries for the section headed with letter I, which also contains all the entries for letter J as well, are Jacob’s Staff, Ichnography, Icosahedron, Ides, and Ignis Fatuus (which we would call ‘will o’ the wisp’ but Moxon calls ‘Jack with a Lantern or Will with the Wisp’). The longest entry by far is ‘Moveable Feasts’. This is one of several calendrical entries and he includes it ‘Since, if all the Almanack makers themselves can well understand the reasons thereof, I am sure not one in a thousand of their Readers understand it.’

Terms from trigonometry are included and amongst them we have ‘Almagest, The Title of an excellent Book, written by Ptolomy, of the Sphere, etc.’

Bearing in mind that the introduction of symbolic notation for algebra only began in England in 1631 through Thomas Harriot’s Artis analyticae praxis [33] and the works of William Oughtred popularly known as Clavis mathematicae [34, 35] it is not surprising that Moxon confines algebra to one entry

‘Algebra, is an Arabick word, and signifies an abstruse sort of Arithmetick, the Art of Equation, or a certain Rule for the finding out the hidden powers of numbers, as well absolute and respective. See the derivation in Dee’s Mathematical Preface to Euclid.’

[Insert Figure 3]
However in the appendices he has a table of algebraical ‘signs, or symbols’ and here we see Harriot’s inequality signs and Oughtred’s cross sign for multiplication and his sign with four dots for proportions. Johnsonian asides come to Moxon easily as we have seen in the entry on moveable feasts. In the entry on Mercury, having disposed of the necessary astronomy, he embarks on a lengthy passage describing the appearance and listing the professions of those of a mercurial nature. The professions include ‘…all Letter’d men, Philosophers, Mathematicians, …and sometimes, Thieves, Taylors, Carriers, …, and they unlearned, but talkative; Conceited School-masters, etc.’ One of the choicest of his comments occurs in ‘Squaring the Circle’. Here ‘the great Archimedes, and others’, having squared the parabola, are chided for not going on to square the circle whose circumference he erroneously considers to be composed of two parabolas.

The dictionary ends with an appendix ‘of Weights, Measures, etc’, tables of astronomical signs and of algebraic symbols, and concludes with ‘A Catalogue of GLOBES, Celestial and Terrestrial, Spheres, Maps, Sea-Plats, Mathematical Instruments, and Books, made and sold by Joseph Moxon, on Ludgate Hill, at the sign of Atlas.’

The second and subsequent editions were brought out by his son James, a map engraver, the second ‘corrected and much enlarged’ by Henry Coley, and the other two with ‘Tho. Tuttell, Mathematical Instrument maker to the KING’S Most Excellent Majesty’. For the second edition of 1692, James added to the title page a portrait of his late father by the Dutch engraver Frederick Hendrick van Hove.

[Insert portrait here; Figure 4]

In the bookshelf above his head the spines of many of his books carry easily read titles. James opens this edition with a long and florid dedication to ‘The Honourable
Christopher Seaton’, concluding that with the dedicatee’s protection he may ‘… boldly adventure this little Bark into the wide Ocean of the World, …’ Joseph Moxon’s ‘To the Reader’ is retained exactly as before. Then they introduce two substantial sections entitled ‘Of the Mathematicks in General, etc. By way of Introduction.’ and ‘Mathematical Definitions.’ Thus the work has indeed been considerably enlarged. Parts of the first section, e.g. the discussions of Opticks and of what is called ‘Mixt Mathematics’, suggest they have drawn on those of ‘l’Optique’ and ‘la Mathematique Mixte’ in the preface to Jacques Ozanam’s *Dictionnaire Mathématique* published the previous year and this book is indeed acknowledged as a source in the third and fourth editions from 1701 onwards. However the dictionary proper is almost the same as before. The frontispiece claims to have corrected and enlarged the first edition but it is easier to find errors coming in than going out. For example ‘Height of a Figure’ has become ‘Heighth of a Figure’, ‘The Sign of Division is…’ has become ‘The Signs of Division is…’ and nothing has been done to correct the failures in alphabetic ordering that occur, for example in letter I.

However, though the entry for ‘Squaring the Circle’ misspells Archimedes, the entry for ‘Spiral Line’ has been made even more picturesque, with ‘the making up of Ropes’ becoming ‘the Coyling of Ropes’, the serpent’s ‘Rings’ becoming ‘Turns’, and the new term ‘Serpentine Line’ rounding off the entry.

Some Recent Dictionaries of Mathematics in English

The first dictionaries published after 1940 seems to be those of Glenn James in 1943 and Cuthbert Macdowell in 1947 [36, 37]. Shortly after this, James, in partnership with his son, the mathematician Robert C James, produced the college
level *Dictionary of Mathematics* published by Van Nostrand [38]. Primarily a
dictionary of pure mathematics, this proved very successful and ran through
successive editions from 1949 onwards. Together with A G Howson’s *Handbook of
Terms in Algebra and Analysis* published by CUP in 1972 [39], these seemed to be
the only college level dictionaries until, in quick succession, three paperback
dictionaries came out, firstly from Collins in 1988 [40], then Penguin in 1989 [41],
and finally OUP in 1990 [42]. Since all these works included short biographies of
prominent mathematicians, mention must be made of the monumental *Dictionary of
Scientific Biography* published in 18 volumes by Scribners in 1970 and 1980, and
edited by Charles C Gillispie and Frederic C Holmes [43].

The Penguin Dictionary of Mathematics

In an entertaining SIAM review of a recent work of reference, *The Oxford
Users’ Guide to Mathematics* (2004) [44], Jonathan Borwein, one of the two authors
of the Collins Dictionary, spent much of the article describing the genesis,
construction, publication and subsequent maintenance and enlargement of the Collins
dictionary. When describing the start of work in 1985 with his co-author E J
Borowski he asserts ‘News of our impending Collins volume immediately triggered a
similar slimmer dictionary from Penguin (1989) and Chris Clapham’s *Concise Oxford
Dictionary of Mathematics* (1990)’. From the Penguin point of view it is hard to
imagine anything more plausible that could be further from the truth (Johnsonian
scenes come to mind, e.g. out of work hacks passing the word along Grub Street to
the printers at the Sign of the Penguin). In fact when the present author joined
Penguin in 1971 as Advisory Editor for Mathematics, one of the 12 new titles he
proposed as projects was a dictionary of mathematics! This was to contain ‘All the
terms (and mathematicians?) you might meet when reading Penguins, at school, or in
the first year of university or college, e.g. Riemann hypothesis, median, hypergeometric function, differential coefficient, perfect number, tautology, latent root, astrolabe, bending moment, tensor’. In the event, other projects took preference, e.g. [45], and it was not until 1981 that the book was commissioned. The first edition had two editors, the highly experienced scientific lexicographer John Daintith and the present author, and ten specialist contributors. Progress was slow for a variety of reasons and the book was not published until 1989. The author contributed to and edited all subsequent editions, retaining three of the original contributors, Derek Gjertsen, Terence Jackson and Peter Sprent, and bringing in three new ones, Elmer Rees, Nick Higham and Mark Pollicott [46]. On each occasion the text was revised, updated and enlarged so that by the fourth edition in 2008 the number of headwords had increased from about 2800 to nearly 3800. The dictionary became available as an e-book in 2010.

Aims of the Dictionary

The main aim was to provide students at school and university with concise explanations of mathematical terms. But it was anticipated that it would be useful for people who use mathematics in the course of their work as well as a reference resource for the general reader.

The first edition covered pure mathematics, mechanics, probability and statistics. In addition there were batches of entries for logic, topology, numerical analysis and operational research. Historical material was worked in sparingly and there were over 200 short biographies of important mathematicians. There being no Penguin dictionary of astronomy we included some astronomical entries. Terms in computer science were excluded unless they were of mathematical interest. An appendix contained tables of standard derivatives, integrals and reduction formulae.
Apart from revising or correcting existing entries, the work of preparing subsequent editions had a number of objectives. Firstly we tried to ensure that we were covering every term in the England and Wales National Curriculum and in one of the national A-level syllabuses for mathematics. Secondly we introduced or expanded coding theory, geometry, graph theory, linear algebra and numerical analysis. Finally we added further tables to the appendix including a table of signs and symbols.

Constructing the dictionary

The foundations of the dictionary are the fields of entries, i.e. the headwords for each area. These were usually built up by comparing lists of possible entries for the area independently prepared by the specialist contributor and the editor who drew on his reading of journals, syllabuses and sometimes university course descriptions. We also took note of comments and suggestions of reviewers and correspondents. Once a list was agreed, drafts of entries were exchanged until the editor, playing the part of the ‘numerate layman’, could understand each entry and the contributor was content. The editor’s own drafts of entries, diagrams and appendices were checked by at least one of the team. Though most of the biographies were written by Derek Gjertsen, the decision as to who to include was only taken after everyone had been consulted.

Some features and issues

Biographies. From the start we included non-Western figures, e.g. al-Khwarizmi and Brahmagupta. Bearing in mind that readers might also be consulting one of the older histories of mathematics, Chinese names were given in both the modern Pinyin and the older Wade-Giles form. After some debate we have come round to excluding living mathematicians.
Types of entry. The standard entry consists of the headword followed by its definition and an example of its use or occurrence. Sometimes this is followed by a further comment or usage. What might be called a ‘gradual entry’ consists of an easy or informal introduction to the term followed by ‘In general…’ or ‘More formally…’.

For example, *convex function* has a gradual entry. Another form is the ‘basket entry’: a device to cover related headwords within a single entry. An example of this type is the entry for *magic square* in which *magic constant*, *pandiagonal square* and *diabolic square* are also defined. Lastly there are a few ‘encyclopaedic entries’ giving an historical overview for entries such as *calculus* or *geometry*.

Conjecture v. theorem. The Catalan conjecture has been proved by Mihailescu. Do we include this information in an entry for *Catalan’s conjecture* or in one for *Mihailescu’s theorem*? Similar problems arise with other conjectures, e.g. those of Bieberbach and Mordell. We opted for having entries for the conjectures.

Concluding remarks

Like Moxon’s dictionary this has taken about twenty years to reach its fourth edition. Comparing the two works one can see similarities of aim, style, method of cross-referencing and intended scope. On the other hand the modern work records on almost every page, concepts, symbolisms and mathematical developments that were unknown three hundred years ago.

The author is grateful to Graham Jagger and Nick Higham for commenting on a draft of this paper. The errors that remain are the author’s responsibility.

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Captions

Figure 1 The title page of the first edition

Figure 2 The start of letter I

Figure 3 Moxon’s table of signs and symbols in the second edition

Figure 4 Portrait of Joseph Moxon in the second edition

Figure 5 Part of letter S in the second edition

David Nelson  University of Manchester
Mathematicks made Easie:
Or, a Mathematical
DICTIONARY,
EXPLAINING
The Terms of Art, and Difficult Phrases used in Arithmetick, Geometry, Astronomy, Astrology, and other Mathematical Sciences.
Wherein the true Meaning of the Word is Rendred, the Nature of Things signified Discussed, and (where Need requires) Illustrated with apt Figures and Diagrams.

With an APPENDIX, exactly containing the Quantities of all sorts of Weights and Measures: The Characters and Meaning of the Marks, Symbols, or Abbreviations commonly used in Algebra. And sundry other Observables.

By Joseph Moxon, a Member of the Royal Society, and Hydrographer to the King’s most Excellent Majesty.

LONDON.
Printed for Joseph Moxon, at the Sign of Atlas on Ludgate-Hill. M. DC. LXXIX.
or great Waters; teaching how they may be Sailed, or past over with greatest conveniency; the Nature of Bays, Rocks, Shelves, Counter-Tides, Soundings, and other Remarkables on the Coasts; what Winds they lie obnoxious to, how far in a Right Line one Port is from another, &c.

Hyleg, or Hylech. An Arabick word, signifying, The Giver of Life; A Planet, or part of Heaven, which in a Man's Nativity, becomes, in an Astrological Sense, the Moderator or Significator of his Life. Hence

Hylegialical Places, Are such, as when a Planet happens to be posited therein, he may be said to be Hyleg, or fit to have the Government of Life attributed to him; which places are generally reckoned five, viz. The Ascendent, the Mid-Heaven, the 7th House, the 9th and the 11th House.

Hygrogon, [under the Earth, from the Greek Preposition, Hypo, under, and Ge, the Earth] but especially the 4th House, or Innum Calis is so called.

Hypotenuse, [a Greek word, properly signifying, A Line drawn under] but used by Geometricians, when a Right Line is drawn under two Right Lines, that make a Right Angle, and of which, one is bigger than the other, then the Line subtended (or Hypotenuse) must needs exceed each of them in length. As in Fig. 4, the Line BC is the Hypotenuse to the Lines A B and A C.

Hypothesis, Gr. A Supposition, a Sentence laid down, and taken up for granted for Arguments sake, or to be discurse of. So the several Models of the World conceited and delivered by Ptolemy, Copernicus, Tycho, &c. are called such an one's Hypothesis.

I

Jacobs Staff, A Mathematical Instrument for taking Heights and Distances. See Cross-staff.

Ichnography, [from the Gr. Ichnos, a Pattern, and Grahesto Write] The Art of making of Models of Building, a Flat-form, the Plot of a House to be built, drawn out on a Paper, describing the form of all the Rooms, Lights, Chimneys, &c. according to which form the Workman goes to work. See Vignola's Compleat Architect, in the Preface.

Icosaedron, Gr. A Solid Figure, contained under twenty Equal and Equilateral Triangles. 'Tis one of the five Solids of Regular Bodies; so called, because all the Plains wherein they are contained are Equal, Equilateral, and Equiangular. They are by some term'd Platonical Bodies, because Plato in Timeo, compares the Simple Bodies of the World, Fire, Air, Water, Earth, and Sky, to these. The other four are, Cube, Tetraedron, (or four Triangles) Oktaedron, (or eight Triangles) and Dodecaedron, (or twelve Triangles.)

Ideo. See Calends.

Ignis Fatuus, [Lat. A foolish Fire] A Jack with a Lantern, or Well with the Wits. An Exhalation or Light, frequently seen in Meadows, Church-yards, &c. supposed to lead people out of the way; by reason of its irregular skipping up and down, (as Fools use to do) according as the Air is agitated, 'tis called Fataius.
Signs, or Symbols now commonly used by some Algebraical Writers.

= Is the Sign of Equation, and signifies Equal to. As A = B. Is A, equal to B.

> Is the Sign of Majority, and signifies Greater than. As A > B. Is A greater than B.

< Is the Sign of Minority, or Lesser than. As A < B. Is A lesser than B.

+ Is the Sign of Addition, and signifies more As + A + B. Is more A + B. Yet sometimes the Sign of the foremost Quantity is left out, As A + B = A + B, That is more A. more B. Is equal to more A more B.

− Is the Sign of Subtraction, and signifies Less, As A − B. Is A less B.

× Is the Sign of Multiplication, and signifies Multiplied by. As A × B. Is A multiplied by B.

The Signs of Division is a Line drawn Level between two or more Quantities, As

A ÷ B = C

which is thus to be read,

D

A more B. less C. Divided by D. or sometimes times thus D) A ÷ B = C. that is, D. Dividing A more B. less C.

:: Is the Sign of Continuation, As A, B, C, D, E, ⋯ shows that these Quantities are in Continual Proportion.

:: Is the Sign of Interruption, and denotes the middle of 4. Proportionals interrupted, As A. B. :: Y. Z. Is thus read As A. to B. so is Y. to Z.

(1) A Parenthesis, with a power note in it, signifies Involution: As A, − B. (2) Is the square of A. less B. or A − B. (3) Is the Cube of A. less B.

√ A Radical Sign with an Index in it, signifies Evolution, as √ A − B. Is the Square Root of A. less B. or, √ A − B. Is the Cube Root of A. less B. But through an Irregular Custome √, is usually taken for a Square Root.

A Cata
Joseph Moxon.
Born at Wakefield August the 8th. Anno 1627.
word is likewise used for the Sphere of a Planet's Activity, and that extension of Light and Vertue, so far as any Planet is capable of making or receiving a Spheric Aspect; and how far that is respectively in each, see Spheric. See also Atmosphere.

Spheroids, Is a solid Figure made from the Plain of an Ellipsoid turned about upon its Axis, and Explain'd in most Geometrical Authors.

Spiral Line, [Lat.] A Tortuous or crooked Line, unequally distant from the midst of the space, howsoever inclosed, which seems to be almost a Circle, only it does not meet, and like that, run again into itself, but keeps on at a proportionate distance or deviation, like the Coiling of Ropes, or the folding of a Serpent, when she lies close in so many Turns with her Body, and is therefore sometimes called a Serpentine Line.

Square, In Geometry, is a Figure that is Equilateral and Right Angled; that is to say, which hath the four sides equal, and the Angles Right. But in Astrology, a Square in an Aspect between two Planets that are distant a fourth part of the Circle, or 90 Degrees, from those Points, Lines drawn to one another, will make a perfect Equilateral Rect-Angled Square. This is an unfortunate Aspect, but not so prejudicial as an Opposition.

Square Number, A Number equally even, or contained under two equal Numbers; as 25, which rises equally even by the mutual multiplication of 5 into or by 5.

Square Root, Is any Number, which being multiplied into itself, makes a Square Number. So 5 is the Square of the Side or Root 5.

Square, Called in Latin Norma, Gnomon, or Canon, is an Instrument consisting of two Shanks, including a Right Angle, commonly known to, and used by Carpenters, &c.

Squaring the Circle, Is a contriving to any Circle a Square equal thereunto, and exactly correspondent: A thing that has puzzled the ablest Mathematicians, being in truth, to find out the Area of some Square that shall be exactly equal to the Area of some Circle, so that the Area of both Figures shall be alike capacities. This, though the great Archimedes, and others, have not exactly done, yet they have come near enough for any use, and taught those things, which, if fully understood and pursued, the Circle may come to be Squared: For if they have Squared a Parabola (which is an Area intercepted between two Lines, one Right, and the other Arcular, or bowing) why should not the Circle it self, which consists of two Parabola's be as well Squared?

Spagyres, [from the Greek Sporos, scattered up and down, or in several places] Are those Stars dispersed in the Firmament, which were never yet rank'd in any particular Constellation, nor had peculiar names asigned. They are called thus by way of Analogy, from the Islands called Sporades near Crete in the Carpathian Sea, which were not described by Ptolomy, nor inserted in the old Maps.

Stade, A Measure or Term in Geography and in Architecture, also in use among the Ancients, and in Foreign Countrys,

Stationary, [From Steo, Lat. to stand] The and Confluence of the Planets in their Eclipses, when they are further;
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