Two Dictionaries of Mathematics, 1679 and 1989

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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 exhilaterating (*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].]

[Insert title page of first edition about here; Figure 1]

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.

[Insert Figure 5]

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 Abreviations 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 Sail'd, or paſs'd 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 ſence, the Moderator or Significator of his Life. Hence

Hylegiacal 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 reckon'd five, *viz.* The Aſcendent, the Mid-Heaven, the *7th.* Houſe, the *9th.* and the *11th.* Houſe.

Hypogeon, [under the Earth, from the Greek Prepoſition, *Hypo*, under, and *Ge*, the Earth] but eſpecially the *4th.* Houſe, or *Imum Cœli* is ſo called.

Hypoteneuſa, [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 *Hypoteneuſa*) muſt needs exceed each of them in length. As in Fig. 4. the Line B C is the *Hypoteneuſa* 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 diſcourſed of. So the ſeveral Models of the World conceited and delivered by *Ptolomy*, *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 *Grapho* to Write] The Art of making of Models of Building, a Plat-form, the Plot of a Houſe to be built, drawn out on a Paper, deſcribing the form of all the Rooms, Lights, Chilmneys, &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 ſorts 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*, *Tetraêdron*, (or four *Triangles*) *Octaêdron*, (or eight *Triangles*) and *Dodecaêdron*, (or twelve *Triangles.*)

Ides. See *Calends.*

Ignis Fatuus, [Lat. A fooliſh Fire] A *Jack with a Lantern*, or *Will with the Wiſp.* 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 *Fatuus.*

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. more 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 Subſtraction, and ſignifies Leſs, As $A-B$. Is A leſs B

$\times$ Is the Sign of Multiplication, and ſignifies Multiplied by, As $A\times B$. Is A multiplied by B.

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

$$\frac{A+B-C}{D}$$ --which is thus to be read,

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.

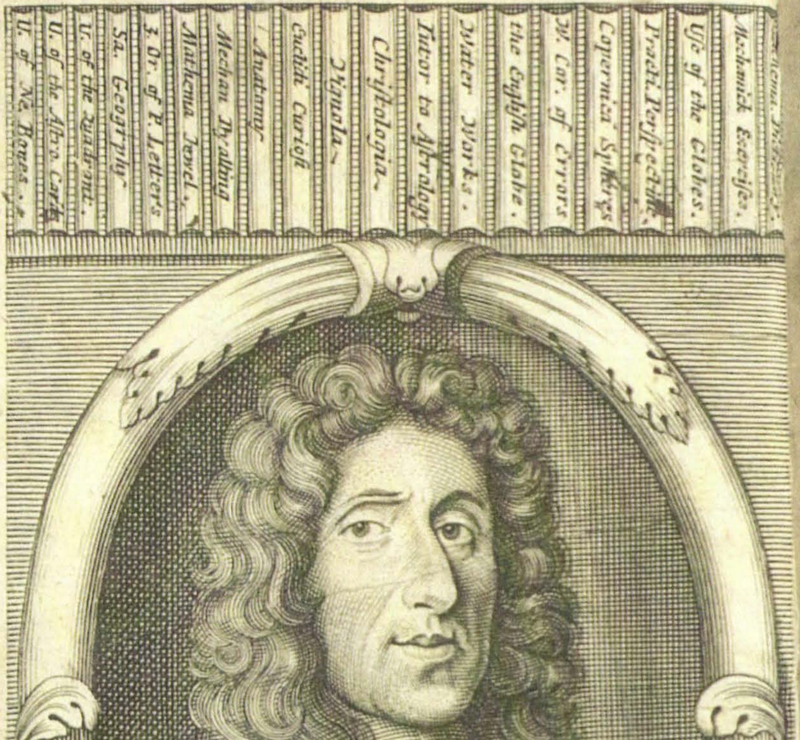
∺ Is the Sign of Continuation, As A, B, C, D, E, ∺. ſhows that theſe Quantities are in Continual Proportion.

:: 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.

() 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.

$\surd$ A Radical Sign with an Index in it, ſignifies Evolution, as $\sqrt[2]{\ }A-B$. Is the Square Root of A leſs B. or, $\sqrt[3]{\ }:A-B:$ Is the Cube Root of A leſs B. But through an Irregular Cuſtome $\surd$, is uſually taken for a Square Root.

A Cata-



Joseph Moxon.
Born at Wakefeild August
the 8th Anno 1627.

word is likewiſe uſed for the Sphere of a Planets Activity, and that extenſion of Light and Vertue, ſo far as any Planet is capable of making or receiving a Platick Aſpect; and how far that is reſpectively in each, ſee **Platick**. See alſo **Atmoſphere**.

Spheroides, Is a ſolid Figure made from the Plain of an *Elipſis* 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 it ſelf, but keeps on at a proportionate diſtance or deviation, like the Coyling 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, for 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 it Self, makes a Square Number. So 25 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 puzled 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's of both Figures ſhall be alike capacious. This, though the great *Archimides*, 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?

Sporades, [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 aſſigned. They are called thus by way of Analogy, from the Iſlands called *Sporades* near *Crete* in the *Carpathian* Sea, which were not deſcribed by *Ptolemy*, 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 Countreys.

Stationary, and **Station**, [From *Sto*, Lat. to ſtand] The Conſiſtence of the Planets in their Eclipſes, when they are

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