

Chapter 2

Writer's Tools and Recommended Reading

I use three dictionaries almost every day.

— JAMES A. MICHENER, *Writer's Handbook* (1992)

*The purpose of an ordinary dictionary is simply
to explain the meaning of the words*

*The object aimed at in the present undertaking is exactly the converse of this:
namely,—The idea being given, to find the word, or words,
by which that idea may be most fitly and aptly expressed.*

— PETER MARK ROGET, *Thesaurus of English Words and Phrases* (1852)

*The dictionary and thesaurus interruptions are usually
not about meaning in the gross sense
(what's the correct use of "oppugn"),
but about precision, and about finding the right word. . .*

*What did the examples that von Neumann and I constructed
do to the conjugacy conjecture for shifts. . .
did they contradict, contravene, gainsay, dispute,
disaffirm, disallow, abnegate, or repudiate it? . . .
Writing can stop for 10 or 15 minutes while I search and weigh.*

— PAUL R. HALMOS, *I Want to be a Mathematician:
An Automathography in Three Parts* (1985)

Mathematician. One that is skilled in Augurie, Geometrie, and Astronomie.

— HENRY COCKERAM¹, *English Dictionarie* (1623)

¹Quoted in [255].

2.1. Dictionaries and Thesauruses

Apart from pen, paper and keyboard, the most valuable tool for a writer in any subject is a dictionary. Writing or reading in the mathematical sciences you will come across questions such as the following:

1. What is the plural of modulus: moduli or moduluses?
2. Which of parameterize and parametrize is the correct spelling?
3. What is a gigaflop?
4. When was the mathematician Abel born and what was his nationality?
5. What is the meaning of mutatis mutandis?
6. Who was Procrustes (as in the “orthogonal Procrustes problem”)?
7. When should you use “special” and when “especial”?
8. What are the differences between mind-bending, mind-blowing and mind-boggling?

All the answers can be found in general-purpose dictionaries (and are given at the end of this chapter). As these questions illustrate, dictionaries are invaluable for choosing a word with just the right shade of meaning, checking on spelling and usage, and even finding encyclopedic information. Furthermore, the information about a word's history provided in a dictionary etymology can make it easier to use the word precisely.

The most authoritative dictionary is the *Oxford English Dictionary* (OED) [215]. It was originally published in parts between 1884 and 1928, and a four volume supplement was produced from 1972–1986. A twenty volume second edition of the dictionary was published in 1989; it defines more than half a million words, using 2.4 million illustrative quotations. The OED traces the history of words from around 1150. In 1992 a compact disc (CD-ROM) version of the OED was published. It contains the full text of the printed version (at about a third of the price) and the accompanying software includes powerful search facilities. Other large dictionaries are *Webster's Third New International Dictionary* [294], which was published in the United States in 1961 and has had three supplements, *The American Heritage Dictionary of the English Language* [7], the *Random House Unabridged Dictionary* [233], and *The New Shorter Oxford English Dictionary*, in two volumes [214].

For everyday use the large dictionaries are too unwieldy and too thorough, so a more concise dictionary is needed. *The Concise Oxford Dictionary* (COD) [213] is now in its ninth edition (1995). It is the favourite of many, and is suitable for American use, as American spellings and usages are included. (The COD was my main dictionary of reference in writing this book.) Other dictionaries suitable for regular use by the writer include, from the United States:

- *The American Heritage College Dictionary* [6].
- *The Random House Webster's College Dictionary* [234].
- *Merriam-Webster's Collegiate Dictionary* [203]. Most main entries state the date of first recorded use of the word. Contains usage and synonym notes and appendices "Biographical Names" and "Geographical Names".
- *Webster's New World College Dictionary* [293].

From Britain:

- *The Chambers Dictionary* [54]. Renowned for its rich vocabulary, which includes literary terms, Scottish words and many archaic and obsolete words. Also contains some humorous entries: *éclair* is defined as "a cake, long in shape but short in duration ...".
- *The Collins English Dictionary* [60]. Contains extensive encyclopedic entries, both biographical and geographical, strong coverage of scientific and technical vocabulary, and usage notes.
- *The Longman Dictionary of the English Language* [182]. The same comments apply as for the Collins. Has an extensive collection of notes on usage, synonyms and word history.

The American dictionaries listed, but not the British ones, show allowable places to divide words when they must be broken and hyphenated at the end of a line.

To make good use of dictionaries, it helps to be aware of some of their characteristics.

Order of definitions. For words with several meanings, most dictionaries give the most common or current meanings first, but some give meanings in their historical sequence. The historical order is the one used by the *Oxford English Dictionary*, since its purpose is to trace the development of words from their first use to the present day. The *Merriam-Webster's Collegiate* also uses the historical order, but for a desk dictionary intended

for quick reference this order can be disorienting. For example, under the headword *nice*, *Merriam-Webster's Collegiate* lists "showing fastidious or finicky tastes" before "pleasing, agreeable".

Etymologies. Etymologies vary in their location within an entry, in the style in which they are presented (for example, the symbol < may be used for "from"), and in their depth and amount of detail. Some words with interesting etymologies are *diploma*, *OK*, *shambles*, *symposium*, and *sine*.

Scientific and technical vocabulary. Since there are vastly more scientific and technical terms than any general dictionary can accommodate, there is much variation in the coverage provided by different dictionaries.

Up-to-date vocabulary. The constantly changing English language is monitored by lexicographers (Johnson's "harmless drudges"), who add new words and meanings to each new edition of their dictionaries. Coverage of modern vocabulary varies between dictionaries, depending on the year of publication and the compilers' tastes and citation files (which usually include material submitted by the general public).

British versus American spelling and usage. Since much mathematical science is written for an international audience it is useful to be able to check differences in British and American spelling and usage. Most British and American dictionaries are good in this respect.

General-purpose dictionaries do not always give correct definitions of mathematical terms. In a comparison of eight major British and American dictionaries I found errors in definitions of terms such as *determinant*, *eigenvector*², *polynomial*, and *power series* [141].

Annotated lists of dictionaries and usage guides are given by Stainton [253], [254]. Comparisons and analyses of dictionaries are also given by Quirk and Stein [232, Chap. 11] and Burchfield [43].

Specialized dictionaries can also be useful to the mathematical writer. There are many dictionaries of mathematics, one example being the Penguin dictionary [206], which is small and inexpensive yet surprisingly thorough. Schwartzman's *The Words of Mathematics* [247] explains the etymology of words used in mathematics (see also [248]).

The synonyms provided in a thesaurus can be helpful in your search for an elusive word or a word with the right connotation. *Roget's Thesaurus*, first published in 1852, is the classic one. The words in *Roget's Thesaurus* are traditionally arranged according to the ideas they express, instead of alphabetically, though versions are now available in dictionary form. The *Bloomsbury Thesaurus* [32] is arranged according to a new classification

²One dictionary offers this definition of eigenvector: a vector that in one dimension under a given rotational, reflectional, expanding, or shrinking operation becomes a number that is a multiple of itself.

designed to be more appropriate for modern English than that of Roget, and it has a very detailed index. Rodale's *The Synonym Finder* [236] is a large thesaurus arranged alphabetically. Thesauruses are produced by all the major publishers of dictionaries.

2.2. Usage and Style Guides

Every writer should own and read a guide to English usage. One of the most accessible is *The Elements of Style* by Strunk and White [263]. Zinsser [304] says this is "a book that every writer should read at least once a year", and, as if following this advice, Luey [185] says "I read it once a year without fail." An even shorter, but equally readable, guide is Lambuth et al.'s *The Golden Book on Writing* [170]. Fowler's *Dictionary of Modern English Usage* [83] is a much longer and more detailed work, as is its predecessor, *The King's English*, by the Fowler brothers [84]. A favourite of mine is the revision [298] by Flavell and Flavell of the 1962 *Current English Usage* by Wood. Gowers's influential *Complete Plain Words* [115] stems from his *Plain Words* of 1948, which was written to improve the use of English in the British civil service. Partridge's *Usage and Abusage* [218] is another valuable guide, this one in dictionary form.

Excellent advice on punctuation is given by Carey in *Mind the Stop* [52] and by Bernstein [28]. For a whimsical treatment, see *The New Well-Tempered Sentence* by Gordon [112].

Bryson's *Dictionary of Troublesome Words* [41] offers practical, witty advice on usage, while Safire [243] presents fifty "fumblerules" (mistakes that call attention to the rules) accompanied by pithy explanatory essays. The books *On Newspaper Style* and *English our English* by Waterhouse [287], [288] make fascinating and informative reading, though they are hard to use for reference since they lack an index; [287] is a standard handbook for journalists, but is of much wider interest. Baker's *The Practical Stylist* [13] is a widely used course text on writing; it has thorough discussions of usage, style and revision and gives many illustrative examples. Day's *Scientific English* [69] contains general advice on grammar and usage, with particular reference to English in scientific writing. Perry's *The Fine Art of Technical Writing* [221] offers selective, practical advice on the psychology, artistry and technique of technical writing, which the author defines as "all writing other than fiction". In *Miss Thistlebottom's Hobgoblins* [26] Bernstein provides an antidote for those brainwashed by over-prescriptive usage guides, in the form of letters to his (fictional) English schoolteacher. Two other books by Bernstein, *The Careful Writer* [25] and *Dos, Don'ts and Maybes of English Usage* [27], are also useful guides. Gordon's *The Transitive Vampire* [111] is a grammar guide in the same fanciful vein as [112].

The Chicago Manual of Style [58], first published in 1906, is a long and comprehensive guide to book production, style and printing. It is the standard reference for authors and editors in many organizations. It includes chapters on typesetting mathematics and preparing bibliographies and indexes. Turabian's *A Manual for Writers of Term Papers, Theses, and Dissertations* [278], first published in 1937, is based on the guidelines in *The Chicago Manual of Style* but its aim is more limited, as defined in the title, so it does not discuss bookmaking and copy editing. *Words into Type* [249] is another thorough guide for authors and editors, covering manuscript and index preparation, copy editing style, grammar, typographical style and the printing process. Other valuable references on editing, copy editing and proofreading are *Hart's Rules* [131], which describes the house style of Oxford University Press; Butcher's *Copy-Editing* [45], which is regarded as the standard British work on copy editing; Eisenberg's *Guide to Technical Editing* [77]; O'Connor's *How to Copyedit Scientific Books and Journals* [208]; Stainton's *The Fine Art of Copyediting* [254]; and Tarutz's *Technical Editing* [270].

Some interesting techniques for revising a sentence by analysing its structure are presented by Lanham in *Revising Prose* [175].

2.3. Technical Writing Guides

Several guides to mathematical writing are available. Halmos's essay "How to Write Mathematics" [121] is essential reading for every mathematician; it contains much sound advice not found elsewhere. Halmos's "automathography" [127] includes insight into mathematical writing, editing and refereeing; it begins with the sentence "I like words more than numbers, and I always did." Transcripts of a lecture course called "Mathematical Writing" that was given by Knuth in 1987 at Stanford are collected in *Mathematical Writing* [164], which I highly recommend. This manual contains many anecdotes and insights related by Knuth and his guest lecturers, including Knuth's battle with the copy editors at *Scientific American* and his experiences in writing the book *Concrete Mathematics* [116]. Other very useful guides are Flanders's article [80] for authors who write in the journal *American Mathematical Monthly*; Gillman's booklet *Writing Mathematics Well* [104] on preparing manuscripts for Mathematical Association of America journals; Steenrod's essay "How to Write Mathematics" [256]; Krantz's wide-ranging *A Primer of Mathematical Writing* [167]; and Swanson's guide *Mathematics into Type* [267] for mathematical copy editors and authors. Knuth's book on T_EX [161] contains much general advice on how to typeset mathematics, and an old guide to this subject is *The Printing of Mathematics* [55].

Most books and papers on mathematical writing, including this one, are aimed primarily at graduate students and advanced undergraduate students. Maurer [197] gives advice on mathematical writing aimed specifically at undergraduate students, covering a number of basic issues omitted elsewhere.

Guides to writing in other scientific disciplines often contain much that is relevant to the mathematical writer; an example is the book by Pechenik [219], which is aimed at biology students. General guides to scientific writing that I recommend are those by Barrass [14], [15], Cooper [62], Ebel, Bliefert and Russey [76], Kirkman [153], O'Connor [209] (this is a revised and extended version of an earlier book by O'Connor and Woodford [210]), and Turk and Kirkman [280]. The book edited by Woodford [300] contains three examples of short papers in both original and revised forms, with detailed annotations. Particularly informative and pleasant to read are Booth's *Communicating in Science* [36] and Day's *How to Write and Publish a Scientific Paper* [68].

The journal *IEEE Transactions on Professional Communication* publishes papers on many aspects of technical communication, including how to write papers and give talks. A selection of 63 papers from this and other journals is collected in *Writing and Speaking in the Technology Professions: A Practical Guide* [18].

How to Do It [180] contains 47 chapters that give advice for medical doctors, but many of them are of general interest to scientists. Chapter titles include "Write a Paper", "Referee a Paper", "Attract the Reader", "Review a Book", "Use an Overhead Projector", and "Apply for a Research Grant". Many of the chapters originally appeared in the *British Medical Journal*.

Van Leunen's *A Handbook for Scholars* [283] is a unique and indispensable guide to the mechanics of scholarly writing, covering reference lists, quotations, citations, footnotes and style. This is the place to look if you want to know how to prepare a difficult reference or quotation (what date to list for a reprint of a work from a previous century, or how to punctuate a quotation placed in mid-sentence). There is also an appendix on how to prepare a CV. Luey's *Handbook for Academic Authors* [185] offers much useful advice to the writer of an academic book.

O'Connor has written a book about how to edit and manage scientific books and journals [207].

Thirty-one essays discussing how writing is being used to teach mathematics in undergraduate courses are contained in *Using Writing to Teach Mathematics* [259].

A useful source for examples of expository mathematical writing is the annotated bibliography of Gaffney and Steen [87], which contains more

than 1100 entries.

Finally, Pemberton's book *How to Find Out in Mathematics* [220] tells you precisely what the title suggests. It includes information on mathematical dictionaries (including interlingual ones) and encyclopedias, mathematical histories and biographies, and mathematical societies, periodicals and abstracts. Although it appeared in 1969, the book is still worth consulting.

2.4. General Reading

The three books by Zinsser [302], [303], [304] are highly recommended; all are informative and beautifully written. In *Writing with a Word Processor* [302] Zinsser summarizes his experience in moving to a computer from his trusty typewriter. His book *Writing to Learn* contains chapters on "Writing Mathematics" and "Writing Physics and Chemistry"; they explain how writing can be used in the teaching of these subjects and give examples of good writing. Michener's *Writer's Handbook* [204] provides insight into how this prodigious writer worked. The reader is led through the development of parts of two of Michener's books (one fiction, one non-fiction), from early drafts to proofs to the published versions.

Mitchell [205] gives hints on writing with a computer, with good examples of how to revise drafts.

Valuable insight into the English language—its history, its eccentricities, and its uses—is provided by Bryson [42], Crystal [66] and Potter [229].

Answers to the Questions at the Start of the Chapter

1. The plural of modulus is *moduli*.
2. The *Concise Oxford Dictionary* gives only the spelling *parametrize*, but the *Longman Dictionary of the English Language*, *Merriam-Webster's Collegiate Dictionary* and *Oxford English Dictionary* give both *parameterize* and *parametrize*.
3. From the *Collins English Dictionary*: "**gigaflop** . . . *n.* *Computer technology.* a measure of processing speed, consisting of a thousand million floating-point operations a second. [C20 . . .]".
4. From the entry for *Abelian group* in the *Collins English Dictionary*: "Niels Henrik Abel (1802–29), Norwegian mathematician".
5. *Mutatis mutandis* means "with necessary changes" (*The Chambers Dictionary*).

6. Procrustes was “a villainous son of Poseidon in Greek mythology who forces travelers to fit into his bed by stretching their bodies or cutting off their legs” (*Merriam-Webster’s Collegiate Dictionary*).
7. From the *Collins English Dictionary* (usage note after *especial*): “*Especial* and *especially* have a more limited use than *special* and *specially*. *Special* is always used in preference to *especial* when the sense is one of being out of the ordinary . . . Where an idea of pre-eminence or individuality is involved, either *especial* or *special* may be used.”
8. From the *Longman Dictionary of the English Language*, all three words being labelled *adj, informal*:

mind-bending means “at the limits of understanding or credibility”,

mind-blowing means “1 of or causing a psychic state similar to that produced by a psychedelic drug 2 mentally or emotionally exhilarating; overwhelming”,

mind-boggling means “causing great surprise or wonder”.