Preface
to the Second Edition

Five years have elapsed from the first printing of this book in 2019. The first edition of this book has been received very favorably by its readers, and many people have sent us very encouraging comments. We have therefore decided to revise the book and enrich the set of recommendations. We also have corrected minor typographical errors, and we have enhanced clarity in formulations, particularly in the first part of the book.

Since the publication of the first edition, we had the chance to continue supporting authors in writing scientific texts. In preparation of the second edition, we have analyzed thousands of recommendations we have given throughout the last years in scientific texts, drafted by authors of all academic levels, such as undergraduate and graduate students, doctoral students, postdocs, and professors. As a result, through the morphosyntactic cues contained in the scientific texts, the nuances in writing, and the combination of mistakes, i.e. the recommendations being overlooked, we are able to almost certainly identify the native language of the authors, solely based on their texts. An analysis of the most common mistakes, arranged according to the native language of the authors, has been added to the introduction, in an attempt to further support our readership in writing scientific texts. The most common mistakes, except for English native speakers, can largely be attributed to the main differences of the respective native language compared to the English language.

With the changes implemented in the second edition, our goal was to meet the needs of our readers as effectively as possible. Reflecting our observations collected over the past years, we have, in the first part of the book, provided more detailed guidance on structuring scientific texts, particularly regarding

structuring the introduction of scientific texts. In the second part of the book, we have extended existing recommendations, for example, on enhancing clarity of textual units by avoiding vagueness, on ensuring the correct meaning of terms in the English language, and on limiting the use of personal pronouns. We also have added new recommendations, for example on using auxiliary verbs and on using the comparative degree correctly, e.g. “the system is faster”, but “faster” than what?

We were asked multiple times to explain referencing in more detail, with particular focus on bibliographic information. Indeed, it was not uncommon to find 50 (or more) mistakes in a list of 10 references, regardless of whether manual referencing was conducted or reference management software was used; and the crucial question remains how to efficiently support researchers who struggle to properly assemble bibliographic information, which is essential for properly conducting research. We do recognize the need for further explanations regarding bibliographic information. However, it is important to note that this book is not intended to serve as a comprehensive guide on referencing. Our aim, also in the second edition, is to keep the book concise and affordable. Nevertheless, although there are numerous online resources, free video tutorials, and extensive books dedicated solely to referencing, we have addressed the requests of our readers by adding additional insights on referencing.

In recent years, the academic community has witnessed remarkable advancements in digitalization and in using artificial intelligence to support – or even to automate – scientific writing tasks, particularly with the emergence of large language models. We firmly believe that a deep understanding of scientific language is essential for effective communication in science. In today’s fast-paced world, respect and diligence in scientific communication are more crucial than ever. Therefore, we have extended the number of real-world examples added to the second edition of this book.

Finally, we would like to express our sincere gratitude to our readers for your continued support and look forward to accompanying you on your academic journey.

Hamburg, August 2024

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Introduction

Poor writing can deface brilliant ideas. The pressure of producing presentable research results frequently leads to a research focus misbalance between "doing the work" and "disseminating the work", or between "scientific working" and "scientific writing". However, scientific working is inextricably intertwined with scientific writing. Scientific research projects generally comprise several stages, each characterized by its own complexity. Tasks such as theoretical investigation, literature review, development of methodologies, implementation of methodologies, design of experiments, laboratory or field experimentation, data processing, and results interpretation usually occupy the bulk of efforts made by researchers towards meeting the objectives of scientific research projects.

Publishing research project results is the only legitimate outlet for "letting the public know" what has been achieved within research projects. Therefore, ensuring high-quality scientific writing in research projects is of equal importance as, e.g., experimenting in the laboratory. Nevertheless, many researchers still focus solely on improving research project results and overlook scientific writing as a matter of secondary importance, counting on the quality of the results to compensate for poor writing quality.

Scientific writing encompasses all scientific disciplines, and literature on scientific writing is both excessive and diverse, with guidelines case-specifically developed for different disciplines. The diversity in scientific writing guidelines comes as a result of the diverse nature of scientific disciplines, which calls for variability in the extent of theoretical investigation, in the rigor of mathematical formulations, and in experimentation among different disciplines. In engineering, producing quality scientific writing entails providing a clear, yet concise and plain, flow of arguments explaining the research motivation and the set of ac-

tions taken to meet the research objectives. Due to the typically complex methods developed within engineering research projects, presenting results requires particular attention to ensure the comprehensibility of research project outcomes. For example, engineering research projects with computationally expensive implementations may generate extensive results, only part of which should be presented for serving the purpose of disseminating research findings. Evidently, organizing the presentation of engineering research project outcomes requires considerable attention.

To foster a culture of diligence in presenting research project results in engineering, it is important to start at an early stage of scientific working. To this end, this book aims at providing a practical guide to scientists, engineers, and engineering students engaging in scientific writing, assembled from the long-standing experience of the authors in advising students via teaching and supervision of theses as well as via writing research articles. The difficulties faced by engineering students in developing personal writing styles in English are substantial, particularly since, in doing so, the majority of scholars need to overcome linguistic barriers, some of which are exemplarily discussed below, drawing from the observations made by the authors of this book since its first edition was published.

- *English native speakers* often used different, i.e. inconsistent, terms to refer to the same thing (Recommendation 9) and did not explain terms at first appearance (Recommendation 7), hindering the comprehensibility of the scientific texts. Other common mistakes included ambiguous use of demonstrative pronouns (Recommendation 16) as well as wrong punctuation related to restrictive/non-restrictive relative clauses and incorrect use of the corresponding relative pronouns (Recommendation 26). English native speakers also inappropriately modified proper nouns by an article or by another determiner (Recommendation 29). Last, but not least, incorrect hyphenation in compound words was often

observed (Recommendation 22), rendering the scientific texts difficult to follow.

- *Mandarin native speakers* made mistakes primarily due to the differences between the main characteristics of Mandarin and English. Frequently, mistakes in article usage were unveiled, by confusing countable/uncountable nouns and definite/indefinite articles (Recommendation 21). In particular, countable nouns in singular form were used without an article.
- *German native speakers* often used the singular form to describe generic actions (Recommendation 21) and used nouns instead of gerunds to describe generic actions, resulting in text flow interruptions (Recommendation 14). Another common mistake, representing a typical phenomenon of the German language, was to put non-restrictive adjectives in the attributive position, resulting in awkward appearance of their texts (Recommendation 13). Also, verbs that are usually used as auxiliary verbs were misused as full verbs, which created an "unscientific" tone (Recommendation 32).
- *Spanish native speakers* essentially made mistakes similar to German native speakers. Owing to the grammatical nature of the Spanish language, Spanish native speakers also used prepositions incorrectly, and modal verbs were avoided in favor of alternative expressions, which was not incorrect, but sounded unnatural.
- *Hindi native speakers* commonly made mistakes related to article usage; in particular, countable nouns in singular form were used without an article (Recommendation 21), and incorrect use of prepositions was observed. Also, mistakes in tense usage (Recommendation 19) as well as mistakes in punctuation, related to restrictive/non-restrictive relative clauses (Recommendation 26) and to introductory subordinate clauses (Recommendation 24), were often unveiled, causing ambiguity in the scientific texts.

- *Arabic native speakers* made mistakes similar to Hindi native speakers, regarding article usage (Recommendation 21), grammatical tense (Recommendation 19), and punctuation (Recommendations 26 and 24). Furthermore, ambiguous use of demonstrative pronouns and demonstrative determiners was frequently observed (Recommendation 16).

Notwithstanding native or non-native speaker skills, the authors of this book have been observing recurring writing mistakes in several types of scientific texts, such as student reports, bachelor's and master's theses, doctoral theses, conference papers, research articles, research proposals, and fellowship applications. It is therefore envisaged that by grouping together mistakes systematically repeated in scientific texts, a practical guide can be assembled offering scientists, engineers, and engineering students a quasi "on-the-job" training session in scientific writing by providing working examples of actual scientific texts.

Having accumulated abundant examples of mistakes in scientific writing in engineering over many years, this book aims at helping scholars in the engineering domain avoid more than 90% of systematic writing mistakes in student scientific texts. The examples, taken from working versions of real scientific texts, offer scholars the chance to make an easy analogy between own scientific texts and the examples provided in this book.

This book ***aims at***:

- Providing recommendations for effective scientific writing in engineering.
- Offering examples of mistakes repeatedly encountered in scientific writing in engineering, to which scholars can easily relate.

- Helping scholars develop own writing styles by illuminating fundamental concepts of preparing scientific texts.

This book ***is not***:

- A comprehensive guide for scientific writing in engineering; the list of recommendations and examples focusing on the most common mistakes made by engineering students is by no means exhaustive.
- A handbook for self-teaching English; an independent-user level of understanding of the English language is a prerequisite for using this book.

Elementary scientific writing rules, principles of composition, and elements of style are not covered in this book. The reader is expected to be familiar with the most basic rules, principles, and elements, for example:

- Keep related words together.
- The number of the subject determines the number of the verb.
- A participial phrase at the beginning of a sentence must refer to the grammatical subject.
- Do not explain too much.

It should be noted that the recommendations included in this book concern cases frequently encountered in scientific writing in engineering. Therefore, the discussion on grammatical rules and guidelines is accordingly limited in scope by eliminating cases of grammatical rules not directly applying to the examples provided in the book. Furthermore, grammatical rules may be characterized by ambiguity in application from different linguistic viewpoints. In cases of ambiguities, the authors formulate recommendations based on personal experience, while respecting standard practice in scientific writing. Finally, it should be emphasized that the recommendations included in this

book concern the usage of American English, whose use is widespread in scientific writing, and some recommendations may vary when applied to other forms of English, such as British English. This book, consisting of two parts, is intended to serve as a guide for efficient scientific writing for scientists and engineers as well as for engineering students at the undergraduate level (e.g. bachelor's students, diploma students) and at the postgraduate level (e.g. master's students, doctoral students, postdoctoral students).

Part A includes a brief discussion on the fundamentals of scientific text structuring, organized in five sections. In Section I, recommendations on how to structure an abstract are provided. The points of interest that need to be included in an abstract are outlined, and the succession of arguments is explained. Section II discusses the structure of an introduction, elaborating on how the scientific topic is introduced, how the problem statement is formulated, how the literature review is performed, how the own approach is presented, and how the scientific text is organized. Section III covers the main part of a scientific text, by providing recommendations on the contents and the succession of the textual units of the scientific text. In Section IV, the structure of summary and conclusions is discussed, and Section V provides recommendations on structuring the acknowledgments and the references of scientific texts.

Part B includes the list of recommendations on scientific writing, comprising seven sections. Principles of composition are discussed in Section I, essentially complementing the contents of Part A by providing detailed information on how to structure individual textual units that are clear and easy to follow. Section II discusses use of English in scientific writing with recommendations pertaining to grammar, syntax, vocabulary, and orthography. A set of useful tips in scientific writing are listed in Section III, and in Section IV recommendations on creating figures are provided. Section V includes recommendations on writing in mathematics and particularly on inserting mathematical formulas and equations. In Section VI, recommendations on referencing

according to styles frequently used in scientific writing in engineering are given. Finally, Section VII summarizes the minimum requirements expected in formal email correspondence.

Section I
Principles of Composition

Composing scientific texts is much more than merely putting together scientific research results with underlying theories and expecting readers to fully grasp research findings. Part A has covered the first important step on scientific writing, which is developing proper structures for scientific texts. However, if the content of textual units realizing the structures is poorly organized, scientific texts are at high risk of being overlooked or even discredited.

Following up on the general recommendations on paper structuring given in Part A, this section focuses on the next step towards preparing scientific texts. Specifically, the basic principles of composition are discussed, including the organization of content within textual units and the formulation of arguments using paragraphs. Authors are invited to take particular care to respect the principles of composition so as to avoid losing focus during writing, for example, to ensure that text flow within a paragraph is logical.

1. **State the message of scientific texts clearly.** Make sure the message of the scientific text is clear.

   1.1 Avoid redundant information. Inexperienced scholars tend to discuss too many aspects of a research problem to prove their broad knowledge to readers. Frequently, the aspects of the research problem involve material from different disciplines, and including too much information from some disciplines may be redundant for the research objective of the scientific text. Redundant information may obscure the message and create confusion to readers. Consider the following example, an extract of a student report.

Example (Student report)

"This paper presents *a comparative study of different dampers*. The dampers are designed following an optimization approach. *The optimization approach* builds on maximizing a cost function, which has been widely used in several engineering problems. Structural response data from a laboratory structure is collected using a wireless structural health monitoring (SHM) system. *Wireless SHM systems* have proven particularly efficient in performing structural assessment. The elimination of cabled connections significantly reduces the installation costs. Moreover, wireless sensor nodes offer ..."

"This paper presents *a comparative study of different dampers*. In this context, a series of dampers are designed *following an optimization approach* widely used in engineering. Next, each damper is mounted on a laboratory structure for conducting vibration tests. To investigate the effect of different dampers on the structural behavior, the laboratory structure is *equipped with a wireless structural health monitoring system*, which collects structural response data used for comparison purposes."

The extract aims to introduce the "own approach" of a scientific text. Unfortunately, in the course of the paragraph, three different messages are given, (i) the comparative study of different dampers, (ii) the optimization approach, and (iii) the wireless SHM system. The discussion within the extract should have been focused on the comparative study between the dampers as the paper objective and explain how items (ii) and (iii) are simply used as tools for meeting the objective.

process, the documentation, and the information exchange of SHM systems. (Smarsly & Theiler, 2018, p. 64)

26. Relative clauses and parentheses.

26.1 Use correct relative pronouns and correct punctuation when forming relative clauses. A relative clause is a clause connected to the main clause of a sentence by the relative pronouns *that* and *which* as well as *who* and its derived forms, such as *whom* and *whose*, where

- *who* and its derived forms are used only to refer to a person or to people, but never to (a) thing(s),
- *which* is used to refer to (a) thing(s), but never to a person/to people, and
- *that* is used to refer to a person/to people or to (a) thing(s).

Two types of relative clauses are used, restrictive (or defining or integrated) relative clauses and non-restrictive (or non-defining or supplementary) relative clauses. Focusing on things instead of persons or people, the following distinction concerns the use of *that* and *which* for introducing relative clauses and the placement of punctuation marks.

A restrictive relative clause provides essential information about the noun it refers to and cannot be left out of the sentence without affecting the meaning or structure of the sentence. A restrictive relative clause is not separated from the rest of the sentence by punctuation marks. While both *that* and *which* may be used to introduce a restrictive relative clause, it is recommended to use *that* rather than *which*.

- "The construction site that is located in Hamburg is closed." – The sentence implies that one specific construction site (probably out of many) is closed, namely the construction site located in Hamburg. Removing the restrictive relative clause would change the meaning of the sentence.

A non-restrictive relative clause provides information that can be left out without affecting the meaning or structure of the sentence. A non-restrictive relative clause is separated from the rest of the sentence by punctuation marks. Non-restrictive relative clauses must always be introduced by *which*:

- "The construction site, which is located in Hamburg, is closed." – The sentence implicitly states that only one construction site exists, which is located in Hamburg. The non-restrictive relative clause "which is located in Hamburg" provides additional information and could be removed without changing the meaning of the sentence.

Note that, in case a person or people are referred to, *who* and its derived forms may be used to introduce either restrictive relative clauses or non-restrictive relative clauses.

Relative pronoun	***Relative clause referring to a person/ to people***	***Relative clause referring to things***	***Restrictive relative clause***	***Non-restrictive relative clause***
that	✓	✓	✓	-
which	-	✓	(✓)	✓
who	✓	-	✓	✓

Example (Abstract of a conference paper)

"The holistic modeling of cyber-physical systems *that integrate computing, networking and physical processes of civil engineering systems* is of crucial importance in the design process of so-called "smart" structures."

"The holistic modeling of cyber-physical systems, *which integrate computing, networking and physical processes of civil engineering systems,* is of crucial importance in the design process of so-called "smart" structures."

All cyber-physical systems, not only the one out of many, integrate these processes, so the relative clause is non-restrictive and must be introduced by *which*.

Example (Journal article)

"The system, *which integrates the newly developed sensor nodes,* works efficiently."	"The system *that integrates the newly developed sensor nodes* works efficiently."

One system (probably out of many) is identified to work efficiently, namely the system with the new sensor nodes, i.e. the system is described by essential information contained in the relative clause. Removing the restrictive relative clause would change the meaning of the sentence.

26.2 When adding a parenthesis, choose the type of parenthetical punctuation marks depending on the intention pursued by the parenthesis. A parenthesis is a word, phrase, or clause – such as a non-restrictive relative clause – inserted into a sentence to set off extraneous content. Parentheses add non-essential information to the sentence. If a parenthesis is removed, the surrounding text is still grammatically sound. Parentheses are introduced with parenthetical punctuation marks, i.e. parentheses (round brackets), dashes, or commas:

- **Parentheses (round brackets)** enclose a parenthesis that diverges from the central idea of the sentence, such as a side note, an explanatory comment, background information, an explanation of circumstances, or an addition of an afterthought. Parentheses subordinate (de-emphasize) the explanatory element and should be used sparingly because parentheses can make formal texts look unorganized, if overused.
- **Dashes** set off a parenthesis that is loosely related to the central idea of the sentence and mark an interruption, a contrasting thought, or an emphasis. Similar to