Technical Writing for Engineers & Scientists

Fourth Edition

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TECHNICAL WRITING FOR ENGINEERS & SCIENTISTS, FOURTH EDITION

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Dedication

In memory of Dr. Leo Finkelstein, Jr. We are honored to continue his legacy.

This has been one of my favorite projects of all time due, in no small part, to the support of and collaboration with some of my favorite people. It is dedicated to Siggi for unwavering support, to my children for just being, to my pets and pony for the cuddles and chances to recharge my soul, to my mom for being my cheerleader, to my siblings for their wit and humor, and to the legendary Grandma Glenna for showing me the way to teaching and about not letting one's standards slip. And last but not least, to Leslie, for her creativity, enthusiasm, and for keeping my nose to the grindstone.

–Jenny

I have always loved language: it was difficult for me to choose between a career in engineering and a career in English. I am grateful for the opportunity to combine both interests in this book and couldn't have asked for a better writing partner–thank you, Jenny! I dedicate it to John, for all that he has done these past 30 years to make it possible for me to tackle this project; as well as to our three boys for their never-ending good humor, generosity of spirit, and willing assistance; to my parents for giving me the best of each of themselves, including my mom's amazing editing skills and my dad's spot-on advice; to my brother who supports me always; and to my in-laws whom I love dearly. Shout-out to my dogs, too, who keep me grounded.

–Leslie

Preface

Purpose

The purpose of this book is to succinctly explain the content and structure of concepts and genres common to communication in engineering and science disciplines. Much like Dr. Finkelstein did in the first three editions, we aim to avoid "the sterile, encyclopedic treatment of writing concepts" that exists in many textbooks about writing. While such textbooks can be helpful for writing instructors who want to cover all of the ins and outs of technical writing theory, concepts, strategies, and genres in writing classes, such comprehensive textbooks might not be the most useful for instructors looking to incorporate writing assignments into their already-packed classes, or for students looking for the nitty-gritty details about what they need to do to get the writing project done in their engineering and science classes.

Approach

Our approach to revising this textbook was based on our combined 50+ years of teaching experience. We have endeavored to bring our approach to teaching to *Technical Writing for Engineers and Scientists*, 4th edition.

Theoretical Foundation

Technical communication is most effective when it considers audience, purpose, and context. Audiences can be categorized in many ways, but one of the most utilitarian methods is to think of them as decision-makers, advisors, and implementors. For example, when you are writing an abstract or summary, you are typically writing for decision-makers and/or advisors. When you are researching and writing a feasibility or recommendation report, you are writing for decision-makers and advisors. When you are writing descriptions or instructions, you are most likely writing for implementors. We have considered these three categories of audience as we have revised the content in this book.

In addition to audience, technical communication is most effective when it considers purpose and context. If we have been hired by the CEO and founder of a major pasta producer to write a report on the feasibility of moving a pasta factory to the upper Midwest, and we write a description of a pasta factory and its components, we will have singularly failed in understanding our purpose. The CEO is already familiar with a pasta factory; they need an evaluation of a solution based on a set of criteria, like proximity to rail lines for shipping raw ingredients. As technical writers, we must anticipate how our communication will be used and in what context. For example, electronic instructions for an executive in their corner office have an entirely different context than those required by a worker standing underneath a molten iron transfer line in a foundry.

Restructured for Easier Understanding

Over the years, we have learned that our students do best when they can see a finished example before we get into the details—much like assembly instructions and recipes, it helps the implementor to look at a picture of the final product before they begin crafting it. Therefore, we restructured the textbook's genre chapter content to provide a definition first, followed by an overview, a basic general outline, a complete example, that example broken down into the logical moves that the writer needs to make, and if relevant, additional examples illustrating the range of that technical writing genre. The intent is that students see the overall document to "get a feel" for it before they examine the breakdown of the components in that example document.

We have also incorporated references to other chapters along with small excerpts of copied-and-pasted text throughout most of the book. We did this to facilitate the use of individual chapters rather than expecting a student to read and remember the entire book. Bonus: repetition is how we move knowledge into our long-term memory.

Analogies

Over our years of teaching, we have developed the tendency to explain new concepts and ideas to students using analogies (lightbulb moments!). In this revision, we also tried to connect technical writing concepts and genres to a

framework with which (we hope!) students are familiar. While not everyone loves dogs, and some may be allergic or even avoid canines for religious reasons, we anticipate that most everyone will at least be familiar with the concept of the dog, its multiple variations and roles in society, and purposes behind those variations. We hope that our readers find the analogies helpful, if somewhat wacky, in learning about technical writing concepts and genres.

Although we do assume that most everyone is familiar with dogs in general, we do not assume that everyone knows all of the various dog species by name, and here we took our own advice from Chapter 4 on Technical Definitions:

> **In some situations, you might need to sacrifice desired precision in your definition to achieve the required level of communication.**

To ensure that our readers clearly recognize our references to specific dog breeds and their connection to genres, we have treated dog breed names as proper nouns despite generally accepted capitalization guidelines for dog breeds. For example, in most writing situations, "border collie" would not be capitalized, nor would the "pinscher" in "Doberman pinscher." However, we have capitalized all words in each dog breed name so that readers will know we are talking about Border Collies and Doberman Pinschers as dog genres, analogous to writing genres.

Embraced Our Inner Goofy

Finally, we have tried to incorporate the same Goofy (dog pun intended) sense of humor that we try to share in our courses to make writing as fun and interesting for our students as we can. It was Finkelstein's light-heartedness and willingness to poke fun at himself that initially attracted us to his textbook, and we are more than happy to continue the tradition.

Disclaimers

As part of our attempts to be light-hearted, we have used numerous fictitious names in examples throughout the book. Any similarity to actual humans, towns, or organizations is completely coincidental.

Also, just as many sources for students writing technical reports have moved online in the past decade, so have they migrated online for authors writing textbooks. We have cited numerous websites throughout the text, including access dates, but understand that these addresses might change over time. Our intent was to provide enough information for readers to be able to search the topics successfully even if the websites change.

Organization

We organized the fourth edition around three major sections: the first one discusses fundamental material, the second describes how to write the most common technical documents, and the third provides useful information that, frankly, does not fit neatly in the first two sections.

Section I: Fundamentals

Chapters 1 through 6 deal with basic considerations, including the component skills you will need to produce effective technical writing. Expanding on the successful approach used in the first three editions, this section includes

- **Chapter 1: Introduction** explains what technical writing is and the basic concepts needed in technical writing.
- **Chapter 2: Ethical Considerations** focuses on ethics in technical writing and includes a general discussion of ethical considerations for technical writers.
- **Chapter 3: Note-taking** provides both the "why" and the "how" of taking notes, including techniques and legal/ethical considerations.
- **Chapter 4: Technical Definitions** explains the "nuts and bolts" of writing effective technical definitions because the ability to define is one of the primary skills needed for most technical writing.
- **Chapter 5: Description of a Mechanism** explains another primary skill needed for technical writing, which is being able to describe mechanisms precisely, accurately, and at a level the audience can understand.
- **Chapter 6: Description of a Process** explains how to describe processes, that is, third-person descriptions of events that do not directly involve the reader.

Section II: Technical Documents

- **Chapter 7: Instructions and Manuals** explains how to write instructions, or second-person descriptions for human involvement that provide specific directions so that the reader can perform a task or series of tasks.
- **Chapter 8: Proposals** explains the three necessary things that all proposals must include, provides multiple examples of informal proposals, and parses the "why" and "how" for each section.
- **Chapter 9: Progress Reports** builds on the proposals in Chapter 8, explaining the necessary elements of a progress report and showing how to construct an effective progress report.
- **Chapter 10: Feasibility and Recommendation Reports** explains how to develop objective documents that identify and evaluate solutions to problems and explains the difference between a feasibility and a recommendation report.
- **Chapter 11: Laboratory and Project Reports** explains the difference between and the purpose of laboratory and project reports, as well as their various elements.
- **Chapter 12: Research Reports** explains the focused, objective nature of research reports, the general structure, and the wide variety of content based on audience need.
- **Chapter 13: A3 Reports** shares the history of the document, templates and examples, and an understanding of the usefulness in business.
- **Chapter 14: Abstracts and Summaries** explains the purpose of abstracts and summaries and provides examples of four different kinds of summations with a focus on both academic and business situations.

Section III: Other Useful Stuff

- **Chapter 15: Style and Mechanics** highlights common issues with basic building blocks, including how style is related to mechanics (spelling, punctuation, and grammar).
- **Chapter 16: Documentation** shows examples of how to cite many different kinds of online, print, and in-person sources.
- **Chapter 17: Visuals** includes basic guidelines for when to use what kinds of visuals, as well as tips for constructing them as accurately and effectively as possible.
- **Chapter 18: Presentations** provides in-person and online presentation tips, including an example set of slides for an update presentation.
- **Chapter 19: Business Communication** provides some general guidelines, outlines, and examples for business communication.
- **Chapter 20: Communication with Future Employers** details six specific kinds of job-seeking communication, including both written (e.g., resumes) and oral (e.g., interviews).
- **Chapter 21: Team Writing** addresses important considerations for accomplishing a collectively written document, both as a student and as a professional.

We believe that our revisions will be useful to students and instructors who choose to use this book. However, we acknowledge (and appreciate!) that language and communication are always evolving and what is considered acceptable today might be adapted by tomorrow. We have done our best to capture generally accepted formulations and long-lived rules.

Being an effective technical writer continues to increase in importance. In fact, we have heard from some employers that they would rather hire good writers with average technical skills (because they can teach the technical skills themselves), than hire someone with high technical skills who communicates poorly. We would be delighted if our textbook could help students gain the communication skills that employers want.

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Contents

About the Authors

Leo Finkelstein, Jr., received a bachelor's degree from the University of North Carolina at Chapel Hill in 1968; a master's from the University of Tennessee at Knoxville in 1969; and a Ph.D. from Rensselaer Polytechnic Institute at Troy, New York, in 1978. He was Lecturer and Director of Technical Communication for the College of Engineering and Computer Science, Wright State University, Dayton, Ohio. He directed the technical writing program at the U.S. Air Force Academy while also serving as adjunct faculty for the University of Colorado at Colorado Springs. He wrote, produced, and directed technical films in Southern California and commanded a combat-documentation, photographic unit in Southeast Asia during the Vietnam War, flying combat missions as an aerial photographer. In addition, his military service included experience in both space and logistics systems. He held FCC commercial and amateur radio licenses, had a black belt in tae kwon do, and was an avid user of all types of gadgets.

Jeanine Elise Aune

Jeanine (Jenny) Elise Aune is a Teaching Professor and the Director of ISUComm Advanced Communication (AdvComm) program at Iowa State University (ISU). She has an M.A. and Ph.D. from the University of Wisconsin-Madison and has been teaching writing in the Department of English at Iowa State University since 1999. She was the Coordinator of ISU's Learning Community (LC) English links for 11 years. Her responsibilities included helping linked discipline faculty communicate their expectations for students' communication skills to English instructors, and helping English instructors re-design writing classes to help students develop those skills. The number of LC-linked English sections more than doubled during her tenure. She has been directing or co-directing the Advanced Communication program since 2011. She has worked with stakeholders across campus to build standardized curricula for the program's four courses—business communication, proposal and report writing, biological communication, and technical communication—in both face-to-face and online mediums. These four courses are taught by ~40 instructors in ~200 sections and enroll ~4,800 students every academic year. Most recently, the online business communication course earned QM certification[1] at 97%, and the online technical communication course earned QM certification at 98%.

Leslie A. Potter

Leslie A. Potter is a Teaching Professor in the Industrial and Manufacturing Systems Engineering (IMSE) department at Iowa State University (ISU). She has a B.S. in industrial engineering from ISU and an M.S. in industrial engineering with an emphasis in manufacturing from The Pennsylvania State University. She worked as an engineer and supervisor for John Deere for seven years before joining IMSE at ISU, where she has taught undergraduate courses across the curriculum for the past 20+ years, ranging from freshman problem-solving and programming to capstone design. As part of her research at ISU, she co-developed a professional communications course within the industrial engineering curriculum. From those efforts, she has developed and incorporated substantial writing and speaking curricula that are used by many of her peers. She was the co-founder in 2013 as well as the co-chair for the IMSE Undergraduate Research program for seven years, supporting hundreds of students with writing and presenting their research. She regularly requires writing and presentation assignments in her engineering courses, and has collaborated with faculty in the Iowa State University Department of English since 2007.

[1]https://www.qualitymatters.org/reviews-certifications

Email to a Technical Writer

Technical writers must consider their audience, purpose, and situational context. The following is an example of an email that the authors of this textbook could send to potential users of this textbook.

From: JennyandLeslie@Finkelstein
Sent: Monday, June 14, 2021 1:32 PM
To: Student
Subject: Email to a Technical Writer

Dear Student,

Your decision to study a technical field is most admirable, and we applaud your fortitude and motivation in dedicating your time and effort to learning a subject that has the power to change the world. However, your knowledge and expertise can only be understood by others if you can communicate your ideas, thoughts, findings, recommendations, and preferences with both technical and non-technical audiences. It is there, at the point of communicating ideas as non-abstractly as possible, that we can support you. We hope that after reading a few pages of our not-typically-super-serious textbook, having a conversation or two with others about it, and allowing yourself to enjoy the relatively formulaic processes of technical writing, you will come to appreciate the power of audience, purpose, and context. With this note, we offer two thoughts.

First: Writing in the real world is very different from the writing you have likely done to date.

You will need to change your mindset. No longer will you write for an audience of one. No longer will you write to a teacher to show them how much you know or have learned. We must now ask you to put aside the unintended mindset you might have of, "I will write what my instructor wants." To become an effective technical writer, you must anticipate who your audience will be, recognizing that you might have multiple audience types, and why you will write for each of them. Do you wish to inform, persuade, or simply create goodwill? Ask yourself: what outcome do I need? And how can I make it happen? Then write with this at the front of your mind.

Second: While technical writing is a serious endeavor, one (and by that we include you) should not take oneself too seriously.

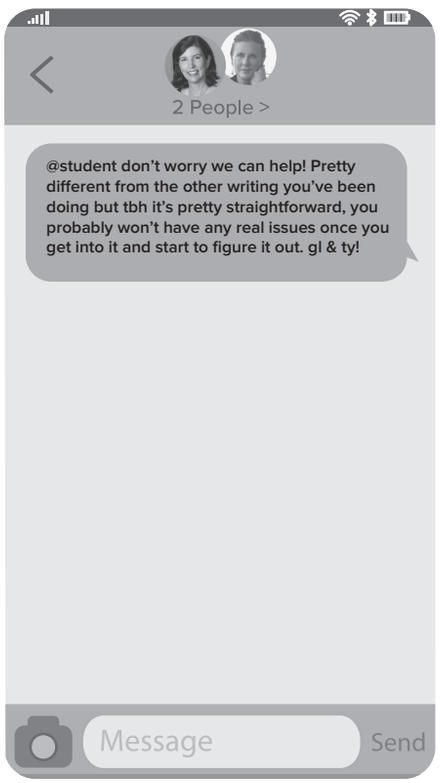
Accomplishment is one of life's greatest rewards. Perhaps you have already been successful in calculus, soccer, robotics, speech, origami, research, baking, dance, or gaming. You sit in our classroom—we know how amazing you are! And we know that you can be an accomplished technical writer, too. As with your other successes, it requires only a willingness to improve through practice and reflection, but this is ever-so-much-more enjoyable with a quick laugh and permission to enjoy the sometimes painfully iterative improvement process. Somewhat related, we thank you for indulging our, shall we say "quirky," sense of humor (some will say "bad"—we happily accept that). In short, we say lighten up! Enjoy the ride. And the write!

We thank you for the confidence you will place in our ability to communicate about communication, knowing full well that the initial decision was not your own, but your instructor's.

Yours very truly,
Jenny and Leslie

IM to a Technical Writer

The same information can be presented in different ways. For example, the authors of this textbook could also choose to send an IM to potential users of this textbook. The basic idea is the same, but much detail has been removed and the language is much more informal.



Acknowledgements

Acknowledging those who have helped us with the 4th edition of *Technical Writing for Engineers and Scientists* is a daunting task. While our names are listed as authors, they are only listed there due to the opportunity provided to us by McGraw Hill and the support of our families, friends, and colleagues.

Thank you to McGraw Hill for accepting our proposal for revising the textbook and giving us the opportunity to teach on a broader scale than our classrooms allow. Thank you to Shannon O'Donnell for the preliminary conversation a couple of years back about the potential for a revision of the textbook and supporting our authorship, Theresa Collins for getting us started on the process, and Erin Kamm for guiding us through to the end. In addition, thank you to Beth Bettcher for supporting our endeavor; Beth Cray for helping gain permissions; and Maria McGreal, Dheeraj Kumar, and team for getting our image plans to paper. There are so many elements, tiny details, and untold hours of work that go into creating a published textbook from a text document; hopefully, we have not missed anyone involved in that monumental task.

Thank you to our families for both their general support and specific feedback. They graciously tolerated our late nights uploading and re-uploading documents, working on laptops while watching family movies, and phone calls while out walking our dogs. They patiently listened to ideas for, and drafts of, our dog analogies. They provided honest feedback and even managed to find our excited texting back-and-forth over dinners amusing. Both Siggi (Jenny's husband) and John (Leslie's husband) provided helpful technical confirmation in their own areas of expertise, as well as IT support when needed. Thank you to Kathy Baker (Leslie's mom) for proofreading our drafts with an eagle eye. We also especially thank our oldest children, Sunneva Sigurðsdóttir (Jenny's) and Jack (Leslie's), for reviewing and commenting on sections of the textbook which, frankly, required the expertise of college-age students to appropriately address the advances of online communication platforms made since the last edition (you know, like, 'cuz we're "boomers" . . .).

Several colleagues helped inform our revision of this textbook; thank you to them for providing another level of expertise and for always being willing to help when asked: Sarah Ryan, Frank Peters, Michael Helwig, Dave Sly, Christopher Proskey, Valerie Boelman, and Joseph Schneider. Thank you, also, to our students who provided their actual resumes for us to adapt and use in examples and exercises.

And, last but not least, we thank all the students with whom we have had the privilege to work over the years. Each and every exchange was an opportunity for us to learn how to explain concepts, provide feedback, and help motivate to improve their communication skills. We may not have always been successful, especially in those early years, but we were eager to improve ourselves, thought about how we could have done better, and to this day, still continue to learn.

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- Jordan Cunningham, Eastern Washington University

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CHAPTER ONE

Introduction

Technical writing is a fundamental skill for virtually everyone working in science and engineering—and that includes a broader range of people than just scientists and engineers. Most science and engineering activities require technical communication, whether in written, electronic, or some other form. Research, development, finance, manufacturing, and a host of technical commercial services rely on precise communication to relay complex information to a wide range of audiences for many purposes. Technical writing is the means by which such communication is produced.

What Is Technical Writing?

To define what technical writing is, it might be useful to first clarify what it is not. Technical writing is not what one does out in the meadow under an elm tree; that is creative writing (unless, of course, you are a meadow habitats specialist!). Creative writing, while challenging, is an artistic activity. It flourishes in a world of nuance, interpretation, and subtlety. Technical writing, however, is the opposite of artistic. Technical writing is writing with precision and eliminating the possibility of (mis)interpretation. Technical writing is not what most people commonly do for fun or relaxation.

Imagine, if you will, a learned, sophisticated person sipping fine wine, eating imported cheese, and watching the sunset. This person sounds like a creative writer who, with paper and pen in hand, might reflect on the nature of time as the last rays of sunlight slowly disappear over the horizon. Our creative writer might even develop a definition of **time** that goes something like this:

> **Time** is a river flowing from nowhere[1] through which everything and everyone move forward to meet their fate.

A creative, sensitive person sees an inspiring sunset, is moved to words, and writes the "river from nowhere" definition. Obviously, this approach is metaphorical. But what if someone inspired by that magnificent sunset were to write the following definition of **time**?

> **Time** is a convention of measurement based on the microwave spectral line emitted by cesium atoms with an atomic weight of 133 and an integral frequency of 9,192,631,770 hertz.

Perhaps not! It would certainly take a unique individual to be emotionally moved by a sunset and then come up with microwave spectral lines and cesium 133. The second definition of time is technical. It is designed to be objective, direct, and precise. Consequently, it lacks the emotional impact of the first definition because, as technical writing, it avoids the use of rich metaphors and figures of speech, substituting instead precise, empirical facts.

The difference between the two definitions shows the fundamental distinction between technical writing and creative writing (and all the other kinds of writing that fall in between). Technical writing is precise, objective, direct, and clearly defined.

Reducing Abstraction

In linguistic terms, technical writing is writing that displays a relatively low level of abstraction. To clarify the concept of abstraction, consider the funnel of abstraction in Figure 1.1. Here, various levels of abstraction are being used to refer to the specific merle pigmentation of your friend's new puppy, Sparky-the-Merle. Imagine that you are highly allergic and entirely unfamiliar with anything dog-related, but your friend is extremely excited about their puppy being a merle. They explain that merle is a **dog genetic mutation.** However, that does little to help you understand their excitement–"dog genetic mutation" is a high-level

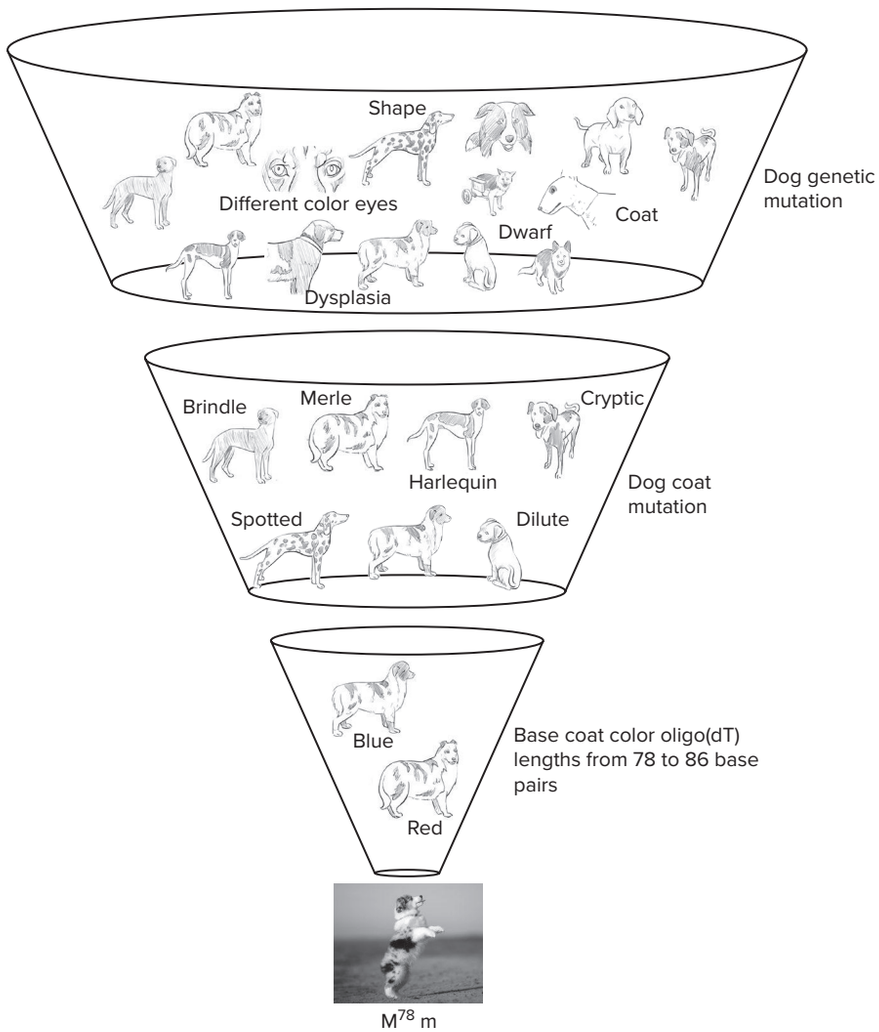

Figure 1.1
A funnel of abstraction. The high level of abstraction at the top of the funnel allows the audience to consider too many concepts or items. Abstraction is reduced through the use of non-abstract language. At the bottom of the funnel is the lowest level of abstraction, where only one concept or item is described by the language.
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abstraction and could be anything from all kinds of dog coat variations to unmatched eye color to hip dysplasia (as seen at the top of the funnel in Figure 1.1).

When you ask for more clarity, your friend explains that **merle** is a term used to describe a dog's splotchy coat, a type of **dog coat mutation,** which could mean any type of coat coloring with irregularly shaped spots. This description allows you to envision what merle means, and could include a dog with a coat that fits in many different categories of merle, such as cryptic, dilute, harlequin, or, in this case, standard. As we filter the level of abstraction, by adding some objective precision in our words, the reference becomes increasingly precise.

Imagine how lucky the happenstance that you and your friend are both geneticists, and you both quickly get to an even more filtered and precise description. Your friend refers to the pigmentation of a standard merle dog, which is described as those with **base coat color oligo(dT) lengths from 78 to 86 base pairs.** You can specifically describe the genetics of a dog's coat type by using words alone.

The lowest level of abstraction would be Sparky's actual DNA. However, we normally do not paste genetic material into technical documents; so to be precise, we must substitute something else, such as a photograph of his coat and a standard description of his genetics, which in this case is $M^{78}m$. That is why a photograph of Sparky the merle-coated dog has been placed at the narrow end of the abstraction funnel—because that is the most concrete way available to refer to it in a document.

Let's look at another example. Imagine that you need an explanation of a 33K, one-watt carbon resistor and you read that it's an **electrical device.** Not helpful. "An **electrical device**" could be anything that is electrical, from a fluorescent light, to a computer keyboard, to your phone's SIM card (see Figure 1.2). Of course, mixed in with all those electrical devices is the electrical device also referred to as a 33-kilohm, 1-watt carbon resistor, but it would be difficult to hone in on it with all the other noise of **electrical devices.**

You read on that it is a **circuit component.** That's certainly more precise, but it could mean any electrical device in the circuit, such as a capacitor, inductor, diode, or, in this case, a resistor. As the explanation becomes more precise, it includes the word **resistor,** which means any circuit component that impedes the flow of current.

The next most concrete way of describing the resistor by using words alone is to precisely label it—as we do when we give our newborn children distinctive names and government taxpayer identification numbers. In this case, the resistor is labeled a **33-kilohm 1-watt carbon resistor.**

As in the case of Sparky, the lowest level of abstraction would be the resistor itself, which we cannot paste into a technical document. We substitute the resistor with a photograph, which is why a photograph of the resistor has been placed at the bottom of the funnel. This precision, of course, assumes that the audience knows what a resistor looks like. If not, the photograph can be pretty abstract, and for that matter, so can the actual resistor.

In fact, when we write technical documents for our audience, we need to carefully consider our audience's familiarity with our topic and carefully calibrate the level of abstraction to the lowest level that will help them understand given their current knowledge of the topic. Technical writing is **not** about how well the writer understands the topic; technical writing is about **how well the writer can explain the topic to someone else.**

As one moves down the funnel of abstraction, the symbols become more precise and less vague. In effect, this reduced abstraction gives the reader less freedom to interpret meaning as they want and more like the writer intended. In creative writing, this lack of flexibility is probably not good; in technical writing, such lack of flexibility is good. The goal of technical writing is to eliminate abstraction. Simply speaking, successful technical writing restricts the reader's freedom of interpretation so that only one meaning can be concluded—the meaning intended by the writer.

What sets technical writing apart, then, is its precision. How it achieves this precision is, in fact, the art and craft of technical writing—an activity that involves definition and description; data and analysis; photographs, diagrams, and charts; and often specialized language. The goal of technical writing, then, is **not** to be creative, or interesting, or to employ rich imagery or powerful metaphors. The goal of technical writing,

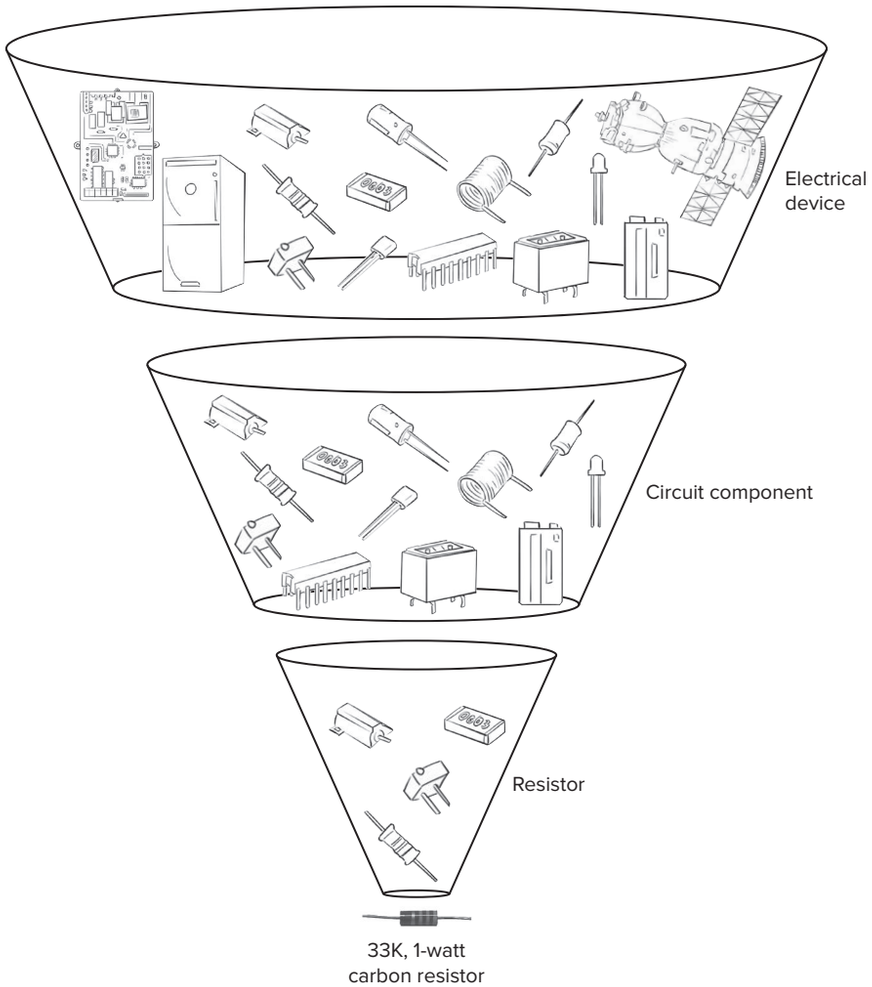

Figure 1.2
A funnel of abstraction. The high level of abstraction at the top of the funnel allows the audience to consider too many concepts or items. Abstraction is reduced through the use of non-abstract language. At the bottom of the funnel is the lowest level of abstraction, where only one concept or item is described by the language.

first and foremost, is to communicate complex information clearly and precisely for the audience and the purpose at hand. Clarity and precision are the overriding goals for any technical writer, and understanding the audience, purpose, and context is the primary consideration for achieving those goals.

Audience, Purpose, and Context

The measure of how well a technical writer has written something depends on three things:

1. how well the **reader** understands, precisely, the writer's intended meaning,
2. how well that understanding fulfills the intended **purpose,** and
3. how well the communication fits into the broader situational **context.**

Consequently, technical writing must be geared directly to its audience, purpose, and context. Remember, there is always a specific requirement for technical writing: a scientist must write a grant proposal, a programmer must document software prior to distribution, a lab supervisor must justify new equipment with a feasibility report, and an industrial engineer must convince a business manager to change work practices for the long-term health of employees.

Relating audience, purpose, and context requires that the writer consider the potential reader's knowledge, skill level, and specialization. The writer must anticipate fully responding to the needs of the reader in terms of the requirements of the situation. Let us take a closer look at each of the three separate yet interrelated components.

Audience

Technical writing is only effective if the **audience** understands the communication. To ensure that our writing is understood by the audience, we must contemplate and often even research our audience. Some things to consider include the following questions.

- How much does my audience know about the topic?
- How much background information about the topic might my audience need to understand my communication?
- How motivated is my audience to read my communication?
- What level of detail does my audience need to understand or to accept my communication?
- What are my audience's primary, secondary, and tertiary concerns?
- What concepts in my message would be better and more quickly understood with supporting visuals?
- How much documentation will my audience want and/or require?
- What format does my audience expect?
- How much time will my audience have to read my communication?
- Where will my audience use my communication and how does that affect how I should structure and format my communication?
- Will my audience be resistant to my communication? (the idea, message, topic, etc.)
- Will my audience be resistant to the communication coming from me personally?

Consider the industrial engineer who must convince a business manager to change work practices for the long-term health of employees. How will they answer these questions about the audience? For example, if there have been employees missing work because of carpal tunnel injuries, the business manager might be very receptive to a plan for reducing absenteeism. But if the same manager is struggling with immediate warranty costs caused by quality issues in an assembly area, long-term concerns like carpal tunnel may seem less urgent in the moment.

Purpose

Technical writing must fit with the **purpose** of communication, which is why you are communicating in the first place. There are several things to consider, starting with what we want our audience to do after they have read our communication. Do we want them to

- know more facts?
- better understand how something works?
- know the status of a large project?

- provide money for a project?
- assemble something?
- accept a recommendation?
- change their position on an issue?
- make a decision?
- some combination of things?

Once we have determined what we want or need our audience to do after they have read our communication, we must determine how to get our desired result.

- Do I need to inform? If so, to what level of comprehension?
- Do I need to persuade? That is, do I need to change someone's position on a topic, their belief about something, or their behavior or actions? If so, is there information that I should emphasize or highlight?
- Do I need to build goodwill? Sometimes this is a necessary requirement by itself, but other times we incorporate this into our communication which informs and/or persuades.

Again, consider the industrial engineer who must convince a business manager to change work practices for the long-term health of employees. How will they answer these questions about purpose? For example, they might need to talk with machine operators to get more information, but that means overcoming a possible mistrust of management. Once the industrial engineer has the necessary facts, they must think about how to request money from their manager. Is goodwill already established? Can they move to considering how to persuade?

Context

In addition to relating to a specific audience and for a specific purpose, technical writing must fit within the broader situational context. Unfortunately, much of the broader context is outside our control as communicators, yet we must account for it nonetheless. Context includes things like history, language, geography, politics, culture, economics—basically anything in the world that affects how our communication is received by our audience. It could be something as specific as personality: maybe someone in management doesn't really like you, and you don't know why, but you know that they immediately respond negatively to anything you suggest. It could be something like company culture: perhaps you tend to write informally and use contractions, slang, and emoticons for emphasis ☺, but the company culture is formal. It could be something historical, like a chemical accident that killed an employee over 20 years ago—it is not a topic that is actively discussed, but it lingers deep in peoples' minds. Communication does not exist in a vacuum.

Let us go back to the industrial engineer. What contextual factors might affect the engineer's ability to convince their business manager to change work practices? Perhaps a recent OSHA law was passed that mandates regulations be implemented by a certain date or a company will be fined. Maybe a competitor in the industry had a lost-time accident occur and suddenly other companies take notice. What if there is a tight job market and employees care about safety and use it to decide where to go to work?

In technical communication, the audience and purpose are almost always well defined in advance—often by the supervisor, customer, or teacher. This is because technical writing is usually commissioned by someone else for a specific purpose and audience. Normally, technical communication aims to share objective information with an interested, educated audience. Technical communication is simply communication on technical subjects that shares information in a precise way.

However, the broader contextual situation, or context, is usually outside a technical writer's control. Remember our industrial engineer who wants to convince a business manager to change work practices for the long-term health of employees? Well, the engineer did their due diligence on researching the frequency and severity of injuries, the biomechanics of how the injuries happen, and the audience's concerns. They