Chapter Four

Pencils, Pens, and Ink

"Every pencil has a story."
—Caroline Weaver, Pencil Connoisseur

PENCILS

Nuremberg, Germany, is infamous for its role in Nazism. The site of fanatical public gatherings orchestrated to support Adolf Hitler, it was also the place where notorious war criminals were tried following World War II. Yet Nuremberg also holds a less horrific title: "Pencil Capital of the World."[1] It is home to three family-owned and -operated pencil factories: Faber-Castell, Staedtler, and Stablio. The latter is fewer than 200 years old, but the others trace their origins to the seventeenth and eighteenth centuries (see Figure 4.1).

The pencil that we know today—at least in the United States—is a shaft of graphite encased in wood to which an eraser *plug* is often attached by a metal *ferrule*. In other parts of the world, rarely is an eraser integrated in the design. Although erroneously referred to as *lead*, a holdover from Roman pens, the pencil's core of graphite is a marvel that came about by accident. A storm near Borrowdale in Cumbria, England, toppled a tree, revealing a large deposit of graphite, notable for its "pure" state that could be sliced. Shepherds used it to mark their sheep, but people began seeing other uses for

1 The fictitious town of Stanleyville is termed the "pencil capital of the world" in the film *The Odd Life of Timothy Green* (2012). Shelbyville, Tennessee, terms itself "Pencil City," but only one of several pencil manufacturers survives: Musgrave Pencil Company.

this marvel. Wrapped in string, the graphite sticks made quite good writing instruments. In fact, this high-quality graphite became an exceedingly valued commodity. Smugglers traded it, but the graphite left incriminating marks on their hands, leading to the term *black market*.

German engineers were invited to help find further deposits but returned home to suggest that their own country might enter the burgeoning pencil market. Friedrich Staedtler applied to the Nuremberg Council in 1662 for permission to manufacture pencils using an innovative process: encasing the graphite in a wooden core. The council rejected his proposal, noting that the production would cross guilds, which owned exclusive rights to professions like carpentry. Undeterred, Staedtler proceeded anyway. Each pencil was constructed of a square-shaped graphite core, two wooden slats, and glue. The pencil maker inserted the graphite between the two grooved wooden parts, glued it, and then tied it with string and wax until the pencil dried. The end result looked something like the square carpenter's pencil of today. Without the pure graphite of England, Ger-

Figure 4.1
Pencil-making workshop.

man production innovated, crushing the inferior but available graphite and mixing it with clay.

The Nuremberg Council realized its error when the lucrative pencil business started to gain traction. In 1675, Staedtler was granted citizen rights for his accomplishments. Staedtler was joined by Faber-Castell, which terms itself the "world's oldest pencil manufacturer." Kaspar Faber (1730–84) was a cabinetmaker (i.e., a member of the carpenter guild), who produced pencils on the side, but the enterprise proved so successful that he established a company that took off in the late eighteenth century and continues to be successful today.

The quest for good-quality graphite for the core of the pencil continued. The French, specifically Nicholas-Jacques Conté (1755–1805), refined the formula for graphite mixed with clay in 1795, although it would never come up to the standard of the "rare English pencils." Faber pencils acquired mineral rights to Siberian graphite in 1856. Transported by reindeer from the mountains, the graphite made a long journey via the Pacific, Indian, and Atlantic Oceans before arriving in Hamburg. The wooden shafts came

Figure 4.2
Pencil seller, 1810.

from Florida trees—truly an international product. The fourth generation of Fabers not only outsourced materials but also instituted the modernization of production and developed a marketing scheme with an iconic illustration of two knights jousting—one with a Castell pencil and one with a broken inferior brand (see Figure 4.3).

Figure 4.3 Jousting Knights Logo of Faber-Castell.

The company was modern in its thinking for the mid-nineteenth century. Working conditions included light and airy buildings for healthier employees. Male employees focused on more strenuous duties, while women oversaw end processes of engraving and packaging. Children attended a kindergarten; a company health insurance program was established, as was a pension program; comfortable housing, a library, and a grocery store provided a standard of living unusual for the time.

Faber's international reach extended to the United States. Although theirs was not the first pencil factory in the country when it was established during the Civil War in Brooklyn, Faber had a significant global reputation. The pencil industry in the United States was centered in New England, where in 1812, William Munroe (1778–1861) invented a machine to cut and groove wooden slats. A graphite paste filled the wooden hollow. Unfortunately, the quality of these pencils was below standard. That changed when, a few years

later, the J. Thoreau Company (see Figure 4.4) produced "Best Quality Pencils, for drawing or writing, and all the purposes required of a good pencil." The son of the Thoreau Company family, Henry David Thoreau (1817–62), researched possible formulas for better pencils in the Harvard Library. The inferior mix of graphite with wax and other components was replaced by the formula of graphite and clay—the recipe that Conté had discovered. The Thoreau pencil became the standard, with a harder, darker core than others. He also designed a graphite grinding machine and a boring machine to drill the core in the wooden casing so that the lead slipped inside. The success of the Thoreau Pencil reaped financial awards for the family—and allowed Henry David to take time off and live at Walden Pond.

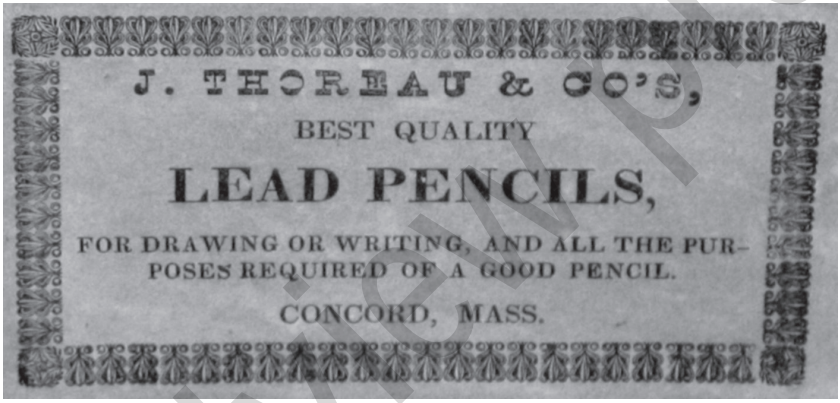

Figure 4.4 Thoreau Pencil Company packaging.

Colored pencils were pioneered by Faber-Castell (a Castell having married into the founding pencil family). Even when the pencil industry suffered losses, as when the ballpoint pen rage took hold after World War II, the line of colored pencils has held up its end. The popularity of adult coloring books in the twenty-first century, for instance, has revived an interest in the pencil. Another innovation was the mechanical pencil, which offered the possibility of replacing the graphite when it ran out and did not require sharpening. Its point could be extended with just a click.

In Europe, Faber-Castell and Staedtler shops cleverly market their products, particularly for gifts, using packaging that appeals to children or that celebrates birthdays, holidays, and other events.

In the days of electric pencil sharpeners, perhaps the notion of artisanal-crafted pencil sharpening seems outlandish (see Figure 4.5). But no: David Rees practices manual pencil sharpening. A former cartoonist, Rees

approaches the task of American-made pencil sharpening with deadpan humor with his manual on pencil sharpening, which includes a chapter on—for experts only—a behind-the-head technique. If pencil satire is appealing, then Rees's book is a must-buy.

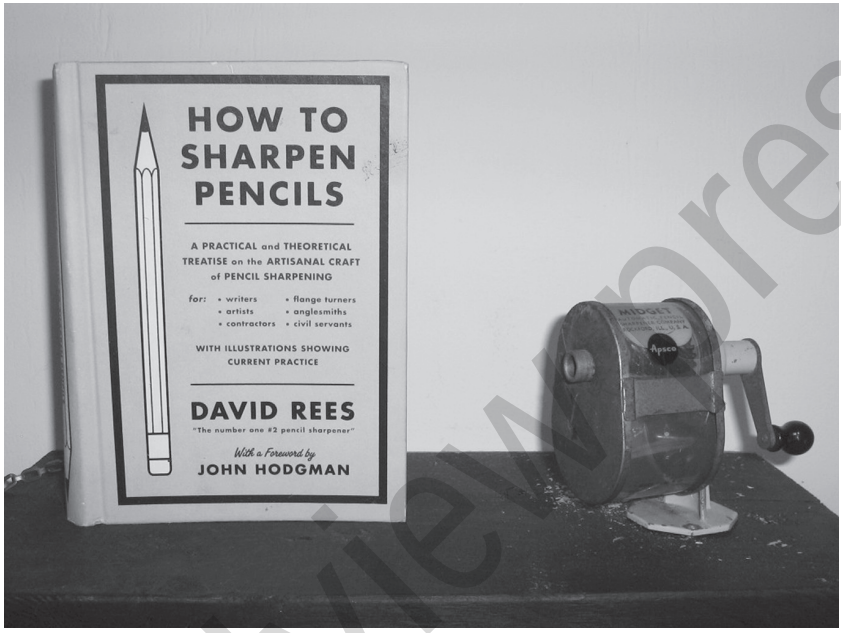

Figure 4.5 How to Sharpen Pencils (2012) by David Rees.

FROM PENCILS TO PENS

People often refer to the *lead* in pencils; however, as mentioned above, the core is graphite, not lead. Why, then, do people continue to call it lead? It's a holdover from ancient Rome, where the stylus used for writing was made of lead. The Romans used lead for several products, including cooking vessels and water pipes. The lead stylus may have left marks on parchment or be used to record on wax tablets. The wax tablet was generally made of two pieces bound together with rope or string so that it closed like a book, the wooden frame being filled with wax. Perhaps the most famous depiction of the wax tablet and stylus is the fresco housed in the National Archeological Museum of Naples, "Woman with wax tablets and stylus" from Pompeii, Italy (50–79 CE), which was unearthed in 1760 when the buried city had been discovered and was being excavated (see Figure 4.6).

Figure 4.6
"Woman with wax tablets and stylus" from Pompeii, Italy (50-79 CE).

In *Empire of Letters: Writing in Roman Literature and Thought from Lucretius to Ovid*, author Stephanie Frampton puts forward the idea that writing technologies influenced how Romans "thought about thought." Students practiced writing the alphabet and syllables using wax tablets. Unlike paper, the information on wax tablets had to be erased each time to make way for the next lesson. This drove an emphasis on memory. In classifying the aspects of writing, Aristotle (fourth century BCE) included invention (what is often termed *prewriting* by contemporary rhetoricians), style, arrangement, audience, memory, and delivery. It should be noted that rhetoric originally focused almost exclusively on oratory. These were the times of great speeches and speech-makers. Much later, even as late as the twentieth century, rhetoric began to shift to a focus on writing rather than oratory. The contemporary technique of memory palaces that help people through mnemonic[2] devices draws on the relationship between concepts and locations. Cicero (first century BCE), one of the greatest orators and writers of all time, used the memory palace technique to commit his speeches to memory. Frampton writes that tablets became a metaphor for how our minds work: "The mind is like a wax tablet where you can write and erase and rewrite."

The stylus used in Rome was a descendent of the earlier Mesopotamian version, which depended on reeds that grew alongside rivers. They were

2 Mnemonic (the "m" is silent) is derived from Mnemosyne, the Greek goddess of memory. A mnemonic device helps remember a concept or fact. For instance, in grade school, I learned to spell *arithmetic* by this mnemonic device: **a r**at **i**n **t**he **h**ouse **m**ay **e**at **t**he **i**ce **c**ream.

sliced, and the ends were made into sharp points. The cut end made a wedge-shaped mark on the clay tablets used to record cuneiform. In fact, the name cuneiform is derived from the word *wedge*. The instructions for making a pen out of a reed—such as a cattail—are fairly simple. Once the reed is cut, remove any detritus and cut to about an eight-inch length. The end that will function as the *nib*—the writing end—is soaked in water. The goal is to have a square end. This requires slicing the reed to a tapered end. The interior of the reed is scraped so that only the tube is left. The tricky part is getting the nib shape by cutting at an angle while still leaving a flat end. This flat, square end is trimmed across its width with a sharp knife (like a box cutter). Finally, the tip is split, again with a very sharp knife. The purpose is to allow ink to flow from the hollow part of the reed. Shaving the tip smoothly ensures a finer line of writing. Once the pen is dry, it can be refined further with scraping. Then ink is put in the reed channel carefully. This is not a large reservoir, so the reed pen needs to be re-inked often. The actual writing requires a light touch, not the hard pressure that writers tend to use with ballpoint pens.

The Roman lead stylus did not use ink at all. This made it more attractive to some writers, as a secondary source was not needed. Instead, its sharp point was used to write on wax tablets, or the lead itself could leave a mark on papyrus, particularly useful for drawing lines for the text. Because of its design, the stylus drew straight lines, not the curves typical of cursive. The look of the Roman alphabet was thus influenced by the writing tool. The top of the stylus was usually blunted so that it could be used to "erase" the writing on tablets by rubbing across the text, creating friction, which literally melted the wax.

Note that in digital writing, the electronic writing instrument is named a *stylus*, developed for touch-screen *tablets*. This kind of stylus looks familiar, as it is typically shaped like a very small ink pen, but no ink flows from it. It is a throwback to the Roman lead stylus. Instead, the pressure of touching the stylus to a flat surface such as a monitor, mobile device, or tablet allows the person to write or draw. No longer a wax tablet, the digital tablet provides a more mobile tool than a desktop or laptop computer, and, frankly, the stylus may not be needed at all, as a person's finger can swipe right or left, or can write or sign.

Quill Pens

The rise of the quill pen was due to its ability to hold more ink so that writers had to "dip" less. The hollow of the feather held the ink. Whether the writer was left-handed or right-handed determined the side of the goose,

swan, turkey, or even peacock from which feathers were drawn for pens. Quill pens were used for a very long time. Egyptian scribes are shown with these instruments, and Romans used quill pens to write on vellum around 200 BCE. In fact, the word *pen* itself comes from a Latin word meaning feather. These writing implements and an accompanying vial of ink were commonplace until the nineteenth century, when steel nibs replaced them. Until that time, the feather pen had outperformed other metal nibs, even though that latter had been used as early as the days of Pompeii.

Producing quill pens became an important industry. One successful site was Auvillar, France, a quaint medieval town in the southwest region of the country that produced hundreds of thousands of *plumes d'oie* (goose feathers) at its height. The village had an accessible port on the Garonne River, crucial to exporting its products. It also sits on the pilgrimage route, known as the *Chemin de Saint Jacques Compostelle*. The region is also famous for its *foie gras*, goose liver, a delicacy that dates back to ancient Egyptians and Romans. In addition to harvested birds, feathers were often obtained when the birds molted. The supply of feathers provided the stuff needed for the village to become famous for its writing implements.

The complex process of transitioning from the feather or quill to a writing instrument changed over the centuries but had the goal of creating a more rigid shaft, which would last longer. The primary feathers made the best pens, and goose feathers were preferred, although crow feathers were used at times for the more delicate handwriting of ladies. In the thirteenth century, according to the Auvillar museum, quills were *clarified*. They were bound together in a bundle and placed in a stew pot to steam for one hour. Then the feathers were dried by a fire. The second day, the quill was scraped with the back of a knife and smoothed with a woolen cloth. After several days, these feathers hardened for cutting the ends to form the nib. The Dutch apparently preferred dipping quills into hot sand to harden the barrel and dry the inner membrane so it could be extracted (see Figure 4.7).

In the seventeenth-century version of clarification, the craftsperson started by removing the outer skin of the feather by scratching and then cutting off its end. Then it was immersed in boiling water containing alum and salt. After 15 minutes, it was dried in a pan of hot sand and then in an oven. In the eighteenth century, the preferred process was called *quenching*, that is, moistening the feathers for some hours or days prior to heating the feather or a flame, which helped in removing the membrane covering what would become the reservoir. The feather was rubbed, polished, and filed. Pens were bundled and shipped to stationers' stores, where finishers might complete the work on the tip so that they were ready to use and sell.

If a person found an appropriate feather and wanted to make a quill pen

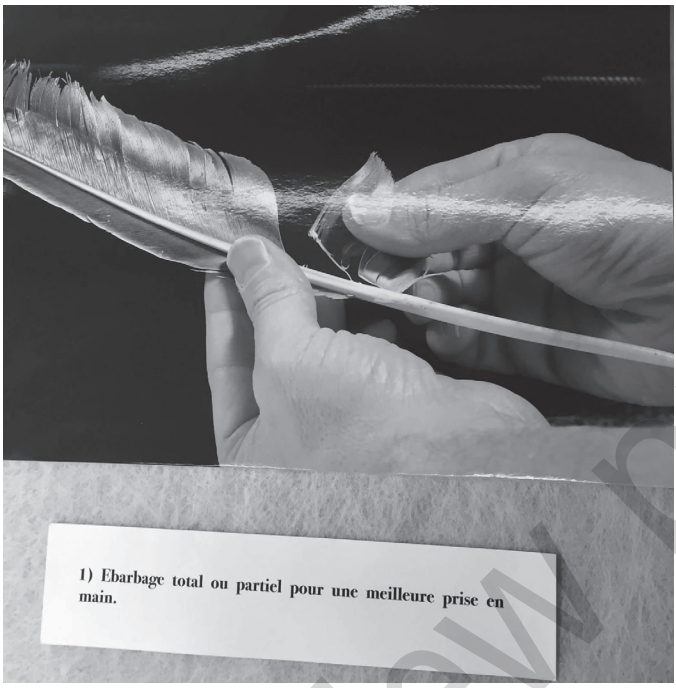

Figure 4.7 Explanatory illustration on quill making, Pencil Museum, Auvillar, France. [Translation: For better handling, remove all or some of the feathers.]

today, the steps are fairly straightforward. (Craft shops often carry such feathers.) The pen maker begins by *dressing* the quill, which means removing the lower feathers for an easier handhold (see Figure 4.7). Then a *pen knife* (or a box cutter) is used to scrape off the membrane covering this surface. The first cut slices the tip at an acute angle, opening up the shaft so that the interior *quick* can be extracted. A second cut is made similar to the first but shorter and at a blunter angle. Just as with a reed pen, a slit must be cut into the center of the tip to allow ink to flow. Depending on the desired width of line to be written, the pen is trimmed to a fine point or a broader one for calligraphy. Over the life of the quill pen—which is admittedly limited—the tip can be trimmed and sharpened.

Many paintings of the era depict writers using the quill pen, and some show a scholar sharpening one, a particularly popular subject with seventeenth-century painter Gerrit Dou (see Figure 4.8). The act of sharpening the pen could be a metaphor for sharpening the intellect, preparing to move thoughts to words. For well-off writers, a boy assistant most likely kept the supply of pens sharpened for consistent writing.

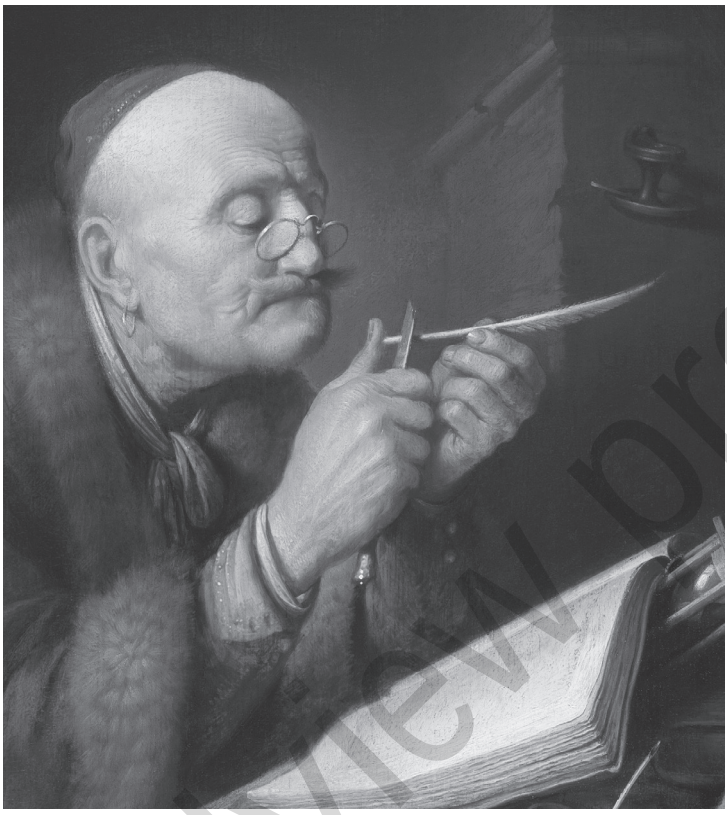

Figure 4.8 "The Scholar Sharpening a Quill Pen" by Gerrit Dou (1633).

The material on which the writing implement is employed determines in part what tool is used. The quill pen had a natural affinity for vellum and parchment. As wood-based paper came into mass production in the late nineteenth century, the quill did not perform nearly as well on this surface, but the metal nib did. The fineness of the line also determined the writing tool. Asian characters and calligraphy called for a brush or a broad-tipped pen, while other scripts required a finer point.

The quill pen had a long period of use from approximately 600 to 1900 CE. A real drawback of the feathered writing tool and the metal nib that followed, however, was its lack of portability and efficiency: It had to be accompanied by a bottle of ink. The *dip pen*, as its name implies, had to be dipped into ink, as it typically did not have an ink reservoir. How could the two components become one in a more effectual package? The fountain pen was the answer.

Fountain Pens

Although Leonardo da Vinci's (1452–1519) drawings include a pen with a reservoir and various instances followed that Renaissance invention, the fountain pen did not become mass produced until the mid-nineteenth century. Designers had to overcome issues with the corrosive nature of iron gall ink and understand the physics of air and gravity for an even flow. Fountain pens rely upon the same capillary action that made reed and quill pens function.

The people who can be credited for the development of the fountain pen resided in various places around the world. Petrache Poenaru (1799–1875), a Romanian, received a patent in 1827 for a pen that used the barrel of a large swan quill. In North America, Azel Storrs Lyman (1815–85) got a patent in 1848 for a pen with an ink reservoir. The Waterman Company of New York City, which still exists, began to dominate the field with its refined pen in the 1880s. Even with the combined pen and ink, filling the reservoir could be messy, so an eyedropper was used to make the transfer. Clearly, a pen that could be self-filling was needed. These began around the turn of the twentieth century, with the Sheaffer and Parker models out in front. Eventually, no-mess ink cartridges that could be easily inserted into the pen's core were developed.

The fountain pen—even with leakage issues—dominated until the 1960s and is still used by many. By that point, though, the ballpoint pen had cornered the market as the preferred everyday writing instrument.

Ballpoint Pens

Elizabeth Wein's popular novel *Code Name Verity* (2012) integrates the story of how the ballpoint pen achieved success. The book focuses on two young British women in World War II, one—Queenie—a spy who is captured in France by the Gestapo, interrogated, and tortured. She is given a pencil as well as an inkwell and dip pen to write her story, spinning out tales like Scheherazade to delay her execution. Her friend Maddie, a civilian pilot who transports planes for the Royal Air Force, desperately tries to rescue Queenie. She is also behind enemy lines but hidden in a barn, where she, too, is writing—but with a ballpoint pen. She says of the writing instrument: "It's called an Eterpen, a truly wonderful thing, no messy ink to refill and it dries instantly. He said they have ordered 30,000 of them for the RAF to use in the air.… Maddie was ridiculously pleased with her pen" (49–50).

The story behind the ballpoint pen almost sounds like fiction, but it's true. Who would imagine that the invention of the ballpoint pen features

the Nazis, the Royal Air Force, and Argentina? László Bíró (1899–1985) was a Hungarian journalist who invented the ballpoint pen out of frustration from having to refill his fountain pen so often. Because he worked at a newspaper, he noticed that the ink used on newsprint dried quickly with no smudges. He enlisted the help of his brother, Georg, a chemist, to create a pen that used this same ink in a cartridge feeding it to a rotating ball (bearing) on its tip, replacing the traditional nib. The invention was patented on June 15, 1938. But the brothers were Jewish. They escaped Hitler and fled to South America in 1941, where they set up their company Bíró Pens of Argentina, marketing the pens under the brand name *Birome* (a term still used in Argentina for pens).

The British Air Command had difficulty with fountain pens at high altitudes and was searching for a better tool. They invested in the upstart company, which made the Bíró Company's future. The Bíró pens were immediately popular and gained appeal beyond the flying squads. Not surprisingly, other companies wanted in on this attractive tool; some paid for rights while others simply copied the design. Notably, Frenchman Michel Bich (1914–94) paid a royalty to the Bíró company in 1950 and brought out his own pens in 1952, shortening the name of the brand to Bic, which continues to dominate the market. The era of the disposable ink pen had arrived.

Two other innovations in pens are felt-tip and gel pens. The former traded the metal ball for felt, which is porous. Marker pens, so-called "magic markers," which had thicker tips for wider marks, came out on the market in 1953. These evolved into specific uses for highlighting, writing on whiteboards, and creating permanent labels. The fine-tip felt pen was developed in 1962 by Yukio Horie of the Tokyo Stationery Company, and the *Pentel* (a pen to tell a story) became the standard. The *Fude Pen* is an example of how the type of writing determines the instrument. A brush or fiber tip makes the Fude appropriate for calligraphy, but it looks much like a regular pen. The *Sign Pen* has a cult following in Japan, as that felt-tipped pen is designed more for writing, particularly Japanese characters, but offers more flair, like an artist's pen. The pen uses ink that is gel-based, offering permanence yet smoothness.

HANDWRITING

When I was asked during the writing of this book what the subject was and answered, "It's about the history of writing," almost every person assumed it was about *handwriting*. The intensity of learning to write by hand is still uppermost in some people's minds. Handwriting continues to be under scrutiny even in a digital world. Admittedly having a vested interest in handwriting, the Bic pen company launched a campaign to promote handwriting.

Studies have shown that handwriting does promote cognitive development, motor skills, writing skills, and comprehension. Researchers Mueller and Oppenheimer found that students taking notes by hand as opposed to typing had to process the information and condense it, and that thinking was useful to learning the material. Note-taking involves "summarizing, paraphrasing, and concept mapping" as opposed to transcribing.

Another debated topic is whether cursive handwriting should be taught to schoolchildren, or if print is sufficient. Although not being able to decode cursive script seems a liability, others may be happy to do away with the Palmer Method, the laborious drills to master letters.[3] Likewise, *penmanship* is no longer in a golden age. When I was in grade school, the students in my class competed to see whose thank you notes were the most elegant—to send to the parents (read: mothers) who brought treats to the class for their child's birthday. It was a rite of passage to move from print to cursive. Florey writes a history of the rise and fall of handwriting in her *Script and Scribble*. She argues that handwriting is "beautiful, useful, and historically important." Truly beautiful handwriting was the art of the engraver, such as George Bickham (1684–1758), renowned "penman," whose book *The Universal Penman* popularized the English Round Hand, full of flourishes and panache. This kind of penmanship was featured on official documents, and a twentieth-century college in Zanesville, Ohio taught its students—primarily male—how to achieve these beautiful results until the widespread use of typewriters and then computers.

The removal of cursive from the school curriculum is sometimes blamed on the need to have time for keyboarding skills or the national core curriculum, which does not include handwriting in its standards. Some schools and even lawmakers have reacted negatively to the loss. One outgrowth of the lack of training in cursive in schools is the rise in private instruction—often by teachers—for those students who, by their own choice or that of their parents, want to continue the script tradition. Handwriting without Tears, which is part of a larger curriculum termed "Learning without Tears" (see www.lwtears.com/), offers instructional materials for both print and cursive. This may be the ticket for those who find learning to write script a bit masochistic.

Josh Giesbrecht, a teacher, believes he knows what killed cursive, and it wasn't standards but the ballpoint pen itself. In an article in *The Atlantic*, he cites the less fluid ink of the ballpoint pen—in contrast to the fountain

3 Named for the famous American "penman" Austin Palmer (1860–1927), who authored a guide on writing for business (1894), the Palmer Method sought to replace the more elaborate Spencerian Method of writing, particularly for business letters. Palmer's approach was plainer and thus more efficient. By this time, handwriting was beginning to compete with typewriting. The Palmer Method was very popular and remained in vogue until the 1950s.

pen—and the grip needed to move the pen across the page. He recommends revisiting the "historical use of ordinary technologies as a way to understand contemporary ones."

INK

When my husband, David, was in fourth grade in a small-town school in Pennsylvania, he had a reputation as a mischievous lad. The old-fashioned desks were bolted to the floor in straight lines, pupils sitting in a row. Attached to the front of the desk was the folding seat for the next pupil. Each wooden desk could be lifted for storage, and the surface featured a shallow depression for pencil and pen as well as a place for the inkwell. These young scholars had to dip their pens in the ink to practice forming the alphabet, as illustrated in a border above the blackboard. Almost every school and classroom featured the ABC's posted in this manner, and students learned to write in cursive through the Palmer Method.

The girl seated in front of David had long blond braids that dangled enticingly on his desktop. The temptation was too great: He uncapped the inkwell and dipped each of the braids into the black India ink. The punishment was swift, the teacher taking her paddle and giving him a wallop on the backside. The days of corporal punishment, cursive handwriting instruction, and young scholars seated in fixed desks may be gone, but India ink perseveres.

Although used primarily by artists and the medical profession at this time, India ink at one time ruled the writing world. Ironically, its source was not India but China, notable for so many of the innovations in early writing. Ink has been in use for over forty centuries, which is also the title of an important scholarly volume on the history of the substance (Carvalho). Two theories exist as to how India got credit for this important component of writing. One is that China obtained some of the ingredients for the manufacture of ink from India. A second is that the British interpreted ink as coming from India. Sometimes India or Indian ink is referred to as *Chinese ink*, but graphic artist David Lance Goines's poster of the iconic India ink bottle confirms that most give credit to India (see Figure 4.9).

Figure 4.9 David Lance Goines, "India Ink" (1974).

In fact, both China and Egypt were using ink by 2000 BCE or even earlier. These leading civilizations had a demand for both writing and drawing. The recipe for making ink included carbon black and a glue to bind; the carbon may have been lampblack or soot, while the glue was most likely from animal hides. In China, solid ink sticks were preferred; a wet brush rubbed against the stick liquefied it for use. Recall that the Chinese alphabet featured logographs, so a brush was the chosen instrument. In other words, the alphabet determined the form of the ink. It is important to note that the development of paper or paper-like material had to go hand-in-hand with the invention of ink. The type of ink had to be matched to the writing material, whether that was papyrus, bark, or rag-based paper.

Egyptian scribes used reeds to write, so fluid ink was essential. A scribe's writing tools are depicted in ancient sculptures, one way in which their craft was understood. The posture for scribes is famously depicted in museum pieces, sitting cross-legged with their linen skirt pulled tight across their lap. They might be said to be the first version of a "laptop" for composing. The motivation for developing this medium—as opposed to carving in stone or making marks in wet clay as in cuneiform—was an easier way to document government, legal, economic, and religious information. It was thought in countries that practiced Buddhism that producing these religious texts in itself was a form of worship. That philosophy is also true of medieval monks who were copying scriptures and other religious texts.

Eventually, two approaches to making ink evolved. One involved carbon, glue, and water, as developed by the Chinese. The second drew on tannin from gallnuts as an essential ingredient, along with iron sulfate, gum, and water. The latter became the standard for ink; however, the problem with this type was its interaction with paper. Its corrosiveness can actually damage paper over time. As a result, some medieval manuscripts that used the older recipe are still readable, while more recent texts may have faded.

As technologies for printing developed, new formulas for ink had to be developed. The standard ink of Gutenberg's time was inappropriate to his printing press. He continued to use soot or lampblack but added oil, varnish, and egg whites. Later, printer's ink evolved to include soot, turpentine, and walnut oil.

In his *Forty Centuries of Ink*, Carvalho includes numerous recipes, or "receipts" as he terms them, for ink. One of his favorites is made from pomegranates and comes from Persia:

> Of the dried Pommegranite (apple) rind take an ounce, boil it in a pint of water until 3/4 be gone; add 1/2 pint of small beer wort and once more boil it away so that only a 1/4 pint remain. After you shall

> have strained it, boiling hot through a linnen cloth and it comes cold, being then of a glutinous consistence, drop in a 'bit' of Sal Alkali and add as much warm water as will bring it to a due fluidity and a gold brown color for writing with a pen. (57)

A "green" approach to ink is made from soybeans, which are more environmentally friendly than petroleum-based ink. Soy ink came to the fore in the 1970s during the early days of the environmental movement, but it was also driven by high petroleum prices from oil-producing companies. Soy ink is said to produce brighter colors for advertisements and is especially useful in newspaper production, where its slower-drying properties are not a disadvantage due to the nature of the paper.

Although it might seem that ink has gone out of style, the US Secret Service doesn't think so. Its International Ink Laboratory, named in honor of Dr. Antonio A. Cantu—who would be to ink what Dard Hunter is to paper—has more than 15,000 samples dating back 85 years, used to help solve crimes. (Hunter makes a more extended appearance in Chapter Five.) The lab can date ink, even from the nineteenth century, and also determine authors of threatening letters (Voice of America).

One last note about ink: the pocket protector. Known as a nerd fashion accessory, pocket protectors to hold pens that have the potential to leak were invented during World War II by Hurley Smith. They became popular with college students, particularly engineers, as well as those in industries that needed quick access to pens. With the rise of computers, they became less necessary.

ERASURE

The father of author Saul Bellow (1915–2005) disapproved of Bellow's writerly aspirations, telling him, "It's just writing, then erasing. What kind of profession is that?"[4] Bellow won the Nobel Prize for Literature, the Pulitzer Prize, and the National Book Award—the latter an unprecedented three times.

How does a writer get rid of unwanted writing? Sure, now, we can hit the delete button, but what happened before computers? In early days, an *erasing knife* or sandstone scraped away unwanted text. Or it might have been washed off. This was not only to correct errors but also sometimes to re-use the parchment or vellum, given that these materials were costly. Paper on which the original writing shows through barely is termed a *palimpsest*.

4 Quoted in *The Writer's Almanac*, 10 June 2019. http://www.garrisonkeillor.com/radio/twa-the-writers-almanac-for-june-10-2019/.

Sometimes the original is more valuable than the new text, which has led modern scholars to seek ways to discover what was effaced, aided by modern technology such as digitized images.

Another erasure method used bread. Yes, bread was moistened and wadded to remove writing. In 1770, Joseph Priestley (1733–1804) discovered a better eraser when he reached for a ball of moist bread and instead grabbed a ball of India gum. He found that it "rubbed" the text away much better than the bread. And, thus, the "rubber" was born, a term still preferred in the United Kingdom to the American term, eraser. While Priestley[5] made the discovery, British engineer Edward Nairne (1726–1806) is generally credited with developing and marketing the first rubber eraser in Europe. It took Charles Goodyear (1800–60)—think tires—to invent a method of curing the rubber, in a process termed vulcanization, to make it less crumbly and more sturdy. Meanwhile in America, why not be efficient and package the writing and erasing elements together? In 1858, Hymen Lipman (1817–93) patented the eraser *plug* that is attached to the wooden shaft with a *ferrule*.

The typewriter eraser wheel with an attached brush tried to do the same for the keyboard.[6] It was an awkward process to make corrections. In my day, when we used manual or electric typewriters, we turned to other erasure methods. In 1956, Bette Nesmith Graham (1924–80), a single mother who worked as a typist, sought a way to cover up her poor typing skills. She invented the first correction fluid (Liquid Paper) in her kitchen. Her fortune funded the music lessons and guitar for son Michael Nesmith (b. 1942)—a founding member of The Monkees, a popular 1960s band.

WRITING IMPLEMENTS, WAR, AND TRADE

Nuremberg's role as the "pencil capital of the world" was pushed aside during World War II, but throughout history, wars have had a deleterious effect on the production of writing implements. Napoleon's reign resulted in 20 years of war and political instability in Europe. At the same time, the stellar graphite deposits in England were being depleted. Coupled with reduced trade due to warring factions, the quality of German pencils suffered. The same result was felt in the young United States. The new technology of a graphite–clay mix invented near the end of the eighteenth century offered

5 Priestley may also have been the recipient of the first steel pen. Samuel Harrison, a manufacturer in Birmingham, England, made a pen for the chemist in 1780 (Daniels 313).

6 Claes Oldenburg (b. 1929) and Coosje van Bruggen (1942–2009), sculptors famous for large-scale versions of common objects, created a marvelous *Typewriter Eraser, Scale X* (1999), which is included in the National Gallery of Art Sculpture Garden. Ironically, its purpose may not be recognized by those who never had to roll the platen of a typewriter to make corrections.

gradations in hardness and softness for pencils, customizing the result. Think #2 pencil.

Likewise, the Civil War, with its Atlantic Ocean blockades, wreaked havoc on markets. German manufacturer Faber dispatched one brother, Eberhard (1822–79), to establish a pencil industry in New York. The trademark rights were lost to the Faber family as a result of World War I due to anti-German sentiment and not regained until 1994. Ironically, it was the same branch of this German family that brought the Bíró pen to the United States.

CONCLUDING THOUGHTS

Writing implements are tools that we take for granted. These inventions and innovations are not generally celebrated, but for millennia they have advanced communication and occupy an important place in our history, not only for their work but also for the documents produced as a result. Some contemporary authors continue to prefer analog to digital. Actress and writer Emma Thompson, responding to an interview question in *Parade* (July 2008), jested, "I'm a Luddite, and I write longhand with an old fountain pen" (qtd. in Reynolds). Stephen King concludes his novel *Dreamcatcher* (2001) with this author's note: "This book was written with the world's finest word processor, a Waterman cartridge fountain pen." The horror writer claims that a traditional pen and ink put him "in touch with language" (692).

QUESTIONS TO CONSIDER

1. The pencil is derived from the Latin *pencillum* for a fine brush. The word *crayon* is derived from the French term for pencil. What other word origins have surprised you as you have been reading this history of writing?
2. This chapter addresses several implements used to produce writing but not all. What is the history of blackboard chalk? When did it make an appearance? Are there other writing tools not mentioned?

DO-IT-YOURSELF HANDS-ON ACTIVITIES

Detailed directions and videos on these processes are readily accessible online.

1. Make a reed pen using a cattail or another appropriate plant.
2. Make a quill pen. While goose feathers can be rather pricey, turkey feathers are reasonably priced and often available at craft stores.
3. Follow one of the recipes and make ink, preferably to use with a quill pen.

INVITATION TO REFLECT AND WRITE

This is the first of several short essays inviting you to explore a topic about writing in more depth. This essay may be integrated into the writing autoethnography from Chapter One.

1. Writing implements—pencils, pens—are considered part of the *material culture* of writing. Material culture can be described as objects that humans use to survive, define social relationships, represent facets of identity, or benefit social or economic standing. For instance, some writers spend large amounts of money on fountain pens.

   Choose your favorite writing implement among pencils and pens for the focus of this essay. Why do you like it? What are the characteristics that make it valuable to you? If you are noncommittal on a favorite writing implement, then explain why that is. What do your choices say about you and your values? If you admire a certain writing implement, what is its history, its corporate identity? What is your history with this writing implement? When did you settle on a preferred writing implement?

   Research through primary and secondary sources can strengthen the narrative, for instance, information about the company that produces a particular writing instrument. It is possible, for instance, to locate the patent application for a particular pen and include its drawings in the essay.
2. The material culture of writing can inspire responses in a number of genres. Read the following ode to a pencil by Kimiko Hahn, which appeared in the Academy of American Poets' "Shelter in Place" program during the coronavirus pandemic and then later in the weekly "Teach This Poem" initiative.

   To a No. 2 Yellow Pencil on May 1, 2020
   —Kimiko Hahn

   To see you is to smell
   your wood and lead shavings
   that spill from the gray
   metal pencil sharpener
   nailed to the window sill
   in Mrs. Rote's classroom—
   all these decades ago. Today,
   my mechanical one, empty,

with no shopping in sight,
I declare I hold you dear.

The Teach This Poem instructions suggest that students take a closer look at their school supplies. What do you "hold dear" among those supplies or the objects that you use to write? Consider writing your own ode, a formal address to a thing, place, or person, such as Keats's famous poem "Ode on a Grecian Urn" or work by Sappho. What other genres might be useful in celebrating (or even lambasting in an ironic tone) an item of writing's material culture?

FOR FURTHER READING

The British Royal Air Force found a solution in the Bíró pens produced during World War II. Another challenge for air travel was the one faced by astronauts. In addition to needing a writing tool that could work in weightless conditions, it had to be safe—unable to contribute to a fire in an oxygen-rich environment. This essay was authored by an intern at the Smithsonian and uncovers the process by which NASA found a solution. If you were to write an explanatory essay similar to this one that would shine a light on a piece of history, or on a Smithsonian or other museum artifact, what would it be?

Caleb Wong, "The Saga of Writing in Space"

Deconstructing a Myth

From dashing off a quick note to creating painstaking calligraphy, we often take writing for granted. But in space, where the stakes are high, how does one write? After all, the ink in pens isn't held down by gravity, so how do you write upside down?

This is a question that some have pondered since the United States and the Russians sought to reach space first. There's a rumor that the United States spent $12 billion developing a pen that would function in space because normal ballpoint pens were not reliable in zero gravity, while the Soviets used a pencil.

While it might make for a good parable—after all, simple solutions often work better than costly, high-tech ones—the story is false.

In fact, both the Soviets and the Americans used pencils on space-flights. Starting with Project Gemini, NASA's second human spaceflight program, pencils were attached via retractable strings to the walls of the

command module. The astronauts used these writing utensils in space to write mission reports, conduct post-mission analysis, or record anomalies on fireproof paper. The pencils were generally safe to use, but they came at a huge cost: NASA paid $4,382.50 for 34 mechanical pencils from Tycam Engineering Manufacturing in Houston, or $128.89 per pencil.

Inventing a Zero Gravity Pen

Inventor Paul Fisher would provide more options with standardized, innovative pens. Unsatisfied with the state of ballpoint pens in the 1950s, which all took different cartridges and often leaked, he decided to invent a universal refill that would fit in most pens. Then he took it a step further and created a refill using semisolid thixotropic ink to create a pen in which the ink would turn from a gel into a liquid when the writer applied pressure. The nitrogen in the pen pressurized the ink cartridge, enabling writing in any direction. It seemed like a perfect fit for astronauts who needed to write notes on flight logs while weightless in space, so Fisher offered to supply these pens to NASA in 1965.

Pens and Safety

When testing the pens, NASA had to keep in the mind the tragic Apollo 1 test mission in 1967, which killed three astronauts when a fire blazed through the command module. The space agency learned that even a single spark could cause a fire in a 100 percent oxygen environment. Every material object on a spacecraft, including seemingly mundane writing instruments, had to be retooled for travel into space.

"NASA made sure everything on board was not dangerous," said curator Jennifer Levasseur, who curates small astronaut equipment. "In that kind of atmosphere, anytime there's a spark, anything that could serve as a fuel would catch really quickly."

After rigorous tests, NASA decided to purchase 400 pens at a cost of $6 each (a 40 percent discount) for the 1967 Apollo 7 mission, fulfilling both cost and safety requirements. Modifying them for space, NASA wrapped them in Velcro so they could stick to the astronaut's suits or the walls for easy access. The Soviet Union also decided to upgrade their writing utensils. They purchased 100 Fisher pens and 1,000 ink cartridges for use on its Soyuz spaceflights; beforehand, the Soviet astronauts used grease pencils.

Possibly wanting even more variety, astronauts also brought felt-tip pens—they work much like Sharpies—from the Duro Space Company of Brooklyn, New York, on the Apollo missions.

How a Pen Saved the Apollo 11 Mission

Pens in space not only recorded information, they even helped astronauts get off the Moon. In his book *Magnificent Desolation,* Buzz Aldrin recounted that he couldn't turn on the ascent module to get off the Moon on the 1969 Apollo 11 mission. The circuit breaker that turned the engine on had broken. He had no idea what to do. Houston's mission control didn't either. But he had a felt tip pen made by the Duro Pen Company attached with a small piece of Velcro to the shoulder pocket in his coveralls. After a sleepless night, Aldrin had a eureka moment: he realized he could insert the pen where the small circuit breaker should have been. "We were going to get off the Moon, after all," wrote Aldrin. Even mundane objects can be used for extraordinary things.

The Future of Pens in Space

If you want a piece of history, mere earthbound mortals can buy an "Original Astronaut Space Pen" for $59 today. But in the future, will these pens become artifacts or will they remain vital tools in space? It's unclear. "They do use laptops extensively, so it's entirely possible that they are generating most their documentation electronically and sending them via email," Levesseur said of astronauts working at the International Space Station. Some are probably old fashioned, however, and still like to keep handwritten notes, or draw or sketch up there, she added.

Even if pens no longer go up in space, they will still have a special place in the heart of at least one astronaut. After all, you might say that the Buzz Aldrin's felt-tip pen may have saved the Apollo 11 mission.

INTERESTED IN LEARNING MORE?

Book Recommendations

Pencils

Allan Ahlberg, *The Pencil* (Candlewick, 2012). [Children's book.]

Adam Braun, *The Promise of a Pencil* (Scribner, 2015).

Henry Petroski, *The Pencil: A History of Design and Circumstance* (Knopf, 1992).

Caroline Weaver, *Pencils You Should Know: A History of the Ultimate Writing Utensil in 75 Anecdotes* (Chronicle Books, 2020).

———, *The Pencil Perfect: The Untold Story of a Cultural Icon* (Gestalten, 2017).

Writing Accessories

Ian Spellerberg, *Reading and Writing Accessories: A Study of Paper-Knives, Paper Folders, Letter Openers and Mythical Page Turners* (Oak Knoll, Press, 2016).

Ink

David Nunes Carvalho, *Forty Centuries of Ink* (1904).

Handwriting

George Bickham, *The Universal Penman* (1941). [A book about the beautiful handwriting done in business and government prior to typewriters; official documents had the "engraved" look of this eighteenth-century master of the art.]