

# Chapter 1

## Leonardo: The Big Picture

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### *In This Chapter*

- ▶ Gaining an overview of Leonardo's career
  - ▶ Understanding his limitations
  - ▶ Putting Leonardo and his accomplishments in perspective today
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**L**eonardo da Vinci (1452–1519) enjoys mythical status as the genius of all geniuses, yet people know precious little about him. He was handsome, charming, and kind. He saw patterns in nature and revered all forms of life. He believed in the power of human endeavor and thought that people in his lifetime might fly as high as the heavens, if they so chose.

Despite his faith in people and progress, Leonardo questioned everything around him, from religion to standards of beauty. He distrusted human nature, expected the worst from friend and foe, and fell headlong into existential despair on a few occasions. Though well liked and recognized as the genius that he was, he remained generally aloof to the world around him.

To deepen the paradox, Leonardo possessed unsurpassed artistic skill, but left fewer than two-dozen paintings, half of them unfinished. Artistic patrons from dukes, popes, and kings to murderous despots wooed him into their courts, yet he never found lasting security with them. His insatiable curiosity led him to constantly observe, experiment, theorize, and invent. He made immense strides in many fields: art, anatomy, engineering, geology, and physics. Yet, his scientific studies had relatively little impact during his lifetime.

In short, Leonardo is a study in opposites.

For all his genius, Leonardo was, in many ways, a tragic figure. Like so many 20th-century creative geniuses, from John Nash to Sylvia Plath, his life was filled with great contradiction. Unlike Nash or Plath, he attempted so much in so many areas. But he left his notebooks a mess and never published the treatises that could've modernized science during his lifetime.

Still, during his time, people revered Leonardo as the embodiment of Renaissance ideals. If a few scholars today call him a failure for his almost absent-minded, dilettante behavior, you can still call him a peerless genius,

both of and ahead of his time. In this chapter, I give you a taste of all the reasons why. If you find yourself hungry for more at the end of the chapter, you have this whole book to satisfy your cravings.

## *Knock, Knock. Who's There? Leonardo . . .*

No doubt about it — Leonardo was a genius. If you give only superficial consideration to his paintings and ignore all his other bodies of work, you have to credit him with redefining the artistic standards and techniques of the Renaissance and producing works with unparalleled beauty and composition (an amazing feat considering that he didn't even finish many of them!). Look a little closer, and you can see evidence of the talent that gave viewers, for the first time in history, a glimpse into the personality or soul of the person being painted.

Ignore the paintings (the things for which he's probably best known) and focus solely on his mechanical drawings, and you can't help but be astounded at the prescient inventions and mechanical gadgets from a man who lived in a time of superstition and religious zeal. Focus on his civil engineering projects, and you can see at work the mind of a man who believed that nature itself could be redirected to benefit humankind. Throw out his contributions in the fields of art and civil and military engineering so that you can devote all your attention to his anatomical studies, and you notice an advanced understanding of the systems in the body and a (usually) correct representation of how they work.

What makes Leonardo so astounding, and what separates him from the other greats of his time, is that his genius wasn't limited to one field. True, he was an artist without parallel, but he was also an inventor, an anatomist, a mathematician, an engineer, a musician, a mapmaker, and — if you consider that he sought to understand the underlying causes and principles of reality — a philosopher.

### *From humble beginnings*

For a man who attained such fame, hobnobbed with dukes, popes, and kings, and whose name today is synonymous with unrivaled genius and accomplishment, Leonardo's birth was inauspicious, to say the least. No stars aligned in the heavens, and people probably didn't make much fanfare when an unmarried peasant girl (probably named Caterina, who's mentioned in his notebooks) gave birth to her illegitimate son.

Leonardo, most likely born in Anchiano, Italy, spent his childhood in Vinci, a small town west of Florence. When Leonardo was a teenager, his biological father arranged for him to apprentice with the Florentine painter and sculptor Andrea del Verrocchio, known as “True Eye” for his artistic talent. (Chapter 4 discusses the apprenticeship system in greater detail; for the details on Leonardo’s life, go to Chapter 3.)

Leonardo spent about six years apprenticing with Verrocchio. While there, he drew the attention of Verrocchio’s prime patron, Lorenzo de’ Medici (Lorenzo the Magnificent; you can read more about the Medici rulers in Chapter 2). This valuable contact put Leonardo in touch with the movers of the Florentine Renaissance, VIP philosophers, mathematicians, and artists that greatly influenced his intellectual development.

But alas, Leonardo’s time in Florence eventually came to an end, and in 1482 he sent a cover letter and résumé of sorts to Ludovico Sforza, duke of Milan. Sforza needed someone to design weapons, not paint pretty portraits. (During the Renaissance, war was the most important of all the arts; for details on how the Italian Wars influenced Leonardo’s career path, head to Chapter 2.) So Leonardo reinvented himself as a military engineer. He found Sforza’s court more to his liking than the Medicean court and gathered around him a brilliant set of astrologers, musicians, mathematicians, and scientists. But in 1499, the French drove Sforza into exile, and Leonardo was left without a patron and had to move on again.

He spent a brief time in Venice, which was at war with the Turks, but returned to Florence around 1500, after an absence of nearly 20 years. He left Florence in 1502 to take up an appointment as chief engineer to the bloodthirsty commander of the papal armies, Cesare Borgia. They traipsed around Italy while Leonardo produced defense maps and designed military machines.

When Borgia met his downfall, Leonardo returned to Florence. But in 1506, Milan came a-calling again, and back he went. Ludovico was gone, replaced by the French, and Leo stayed in Milan until Ludovico’s son, Maximilian, came and kicked out the French. Leonardo, by then 60, fled to Rome, where he sought the patronage of Giuliano de’ Medici, son of Lorenzo the Magnificent and brother of Giovanni, the new Medicean pope also known as Leo X. But Michelangelo and Raphael, both younger competitors, had beaten the aging Leonardo to the Vatican, and he found no permanent home there.

When Giuliano died, Leonardo and his small entourage of students and servants traveled to the Loire Valley, where François I, the baby-faced king of France, had invited them to reside. François I was Leonardo’s last patron, and perhaps the only one among Leonardo’s many fans who fully appreciated the singular nature of his genius. Although a stroke rendered Leonardo unable to paint, he designed a mechanical lion, decorated the court, and spent hours philosophizing with the king. He died on May 2, 1519.

## *Jack-of-all-trades*

The saying goes, “He was a jack-of-all-trades, master of none.” Well, the remarkable thing about Leonardo was that he wasn’t just a master of one trade, but of many. Although he probably never left the European continent, Leonardo’s career was extraordinarily diverse and included some pretty different occupations — painter and portraitist, anatomist, civil and military engineer, botanist, and mapmaker, to name a few.

### *Artist*

Throughout his career and in every court save the last one (when a stroke left him unable to paint), Leonardo created or worked on the pieces for which he is best known. His works include religious paintings, such as *Virgin of the Rocks*, *The Virgin and Child with St. Anne*, *Adoration of the Magi*, *St. John the Baptist*, and the unparalleled *The Last Supper*, along with portraits, including everyone’s favorite girl, *Mona Lisa*, and others, like *Ginevra de’ Benci*. The fact that some of his paintings are only half-finished or that one, *The Last Supper*, started to deteriorate as soon as it was finished, is irrelevant; they’re still superior to those rendered by his colleagues around the same time. Chapters 11, 13, and 14 offer more details on these paintings’ unique subjects and styles.

Although Leonardo’s paintings were few and far between, he left abundant and magnificent drawings. Many served as understudies for his paintings. These sketches include human poses, plants and flowers, horses and other animals, human anatomy, water, and machines. Many of his drawings, especially his anatomical ones (as you see in Chapter 5), were ahead of his time. In others, including his car, scuba gear, and military weapons (discussed in Chapters 7, 8, and 9), Leonardo put together old parts in new ways.

Unfortunately, Leonardo left no pieces of sculpture that historians can definitely attribute to him (save for designs for some equestrian monuments and tombs), even though he mastered this craft, as well, in Verrocchio’s studio.

### *Military and civil engineer*

Leonardo first sold himself to the Milanese duke Ludovico Sforza as a military engineer and thereafter dabbled in the design and creation of defense tools and weapons of war. He applied mechanics and physics to the study of war machines. Though the militia used few (if none) during his lifetime, many, such as the submarine and armored tank, were deployed hundreds of years later.

Closely, but not solely, tied to his military designs, Leonardo often contemplated how natural forces and structures could be altered to suit human purposes. One of his most ambitious plans was the rerouting of the Arno River. Although it ostensibly served a military purpose (to reduce the risk of an invasion of Florence from rival city-state Pisa), it promised a more navigable

river, a reduced risk of flood, and more reliable irrigation of the surrounding farmland.

Leonardo took on smaller, more pedestrian public works projects as well, such as maintaining and expanding Lombardy's canal system. To find out more about Leonardo's stint as a military engineer and his water projects, march to Chapter 8.

### ***Scientist***

There are few areas of Renaissance science that Leonardo didn't engage in. Anatomy, astronomy, botany, geology, paleontology — you name it — Leonardo probably had a few thoughts and a number of sketches about the subject.

Through observation and experimentation, Leonardo was able to uncover — if not always accurately understand — the workings of natural systems. His anatomical drawings, based primarily on his own observations of dissected cadavers, were far superior to anything else produced at the time, and in fact are still a model for modern anatomical drawings. His ideas about the stars and heavens prefigured later great thinkers, like Copernicus and Galileo. And his studies of fossils and the resulting theories (for example, that fossils are actually the remains of once-living creatures rather than the skeletal remains of God's mistakes — a common theory of the time) foreshadowed later observations from the likes of Charles Darwin and others.

Had Leonardo organized and published his papers on these myriad subjects, he would've greatly influenced Renaissance science and beyond. As it was, his musings remained in the dark until centuries later, and the fields advanced without him. You can read more about Leonardo's world-class scientific thinking in Chapters 5 and 6.

### ***Mechanical engineer and inventor***

Leonardo sketched a flying machine, helicopter, parachute, three-speed gear shift, snorkel, hydraulic jack, the world's first revolving stage, canal locks, olive press, water-powered alarm clock, a crane for clearing ditches, and thousands of other designs. Oh, and a robot, too, though he most likely did *not* invent the bicycle.

Although some of his designs were entirely unique for the time, others made use of common tools or principles in a new way, which was, in itself, revolutionary. Leonardo's inventions, most undiscovered during his lifetime, foreshadowed principles and designs of the Industrial Revolution. Chapters 7 and 9 examine his inventions and machines.

### ***Architect and city planner***

Though we don't view him as primarily an architect, Leonardo mastered this field. He focused on general principles of designs and consulted on some cathedrals in Milan and Pavia. He also designed defense fortifications and

palaces for kings. He even created the ideal city — an innovative city plan for Milan, discussed in Chapter 12 — which was never built, but utopian in principle.

To find out more about his architectural plans, head to Chapter 12.

### *Philosopher and thinker*

Despite the myriad subjects he studied, all Leonardo's endeavors were connected by his never-ending quest to discover and understand the underlying principle, or design, of the universe. Leonardo, who himself may have been a *synasthete* (one who experiences a concurrent sensory perception other than the one being stimulated; for example, literally seeing musical sounds as a symphony of colorful images), observed an integrated, universal design in unrelated objects and natural phenomena.

He saw the world as interconnected, with things at the micro level mirroring designs at the macro level (for example, human arms and legs functioning sort of like tree branches do). For some reason, Leonardo abandoned this micro-macro analogy late in life, as he delved further into his scientific studies and realized that the universe held greater mysteries than he originally thought. But if he eventually found these analogies inadequate, another concept guided his thinking: the importance of human perception, sight in particular. He studied everything relating to optics, in the belief that people, by using their own little eyes, hands, ears, and whatever other body part, could ferret out the universe's secrets. Human perception and experience, then, rather than religious teaching, mysticism, superstition, alchemy, or even Aristotelian logic, provided the real core of understanding of the universe.

## *Inspiring Leonardo's genius*

If historians knew exactly what made Leonardo tick, they'd have copyrighted the formula years ago. Many factors contributed to his genius. Most of all, he seems to have possessed certain qualities that thrived in Renaissance Italy.

### *Creating the man, the myth, the legend*

In *How to Think Like Leonardo da Vinci: Seven Steps to Genius Every Day* (Delacorte, 1998), author Michael J. Gelb dissects Leonardo's genius to show how others can cultivate the qualities that lifted this man head and shoulders above his peers. Whether or not you succeed, the idea is helpful because it catalogues the characteristics Leonardo possessed:

- ✓ **An insatiable curiosity and quest for knowledge:** Leonardo's passion differed from others around him. As Daniel Boorstin described Leonardo's genius in *The Creators*, Leonardo, unlike Florentine poet Dante Alighieri (1265–1331), who was inspired by his idealized love for a woman named Beatrice, didn't love women. Nor did he exhibit the same civic loyalty as

the Florentine fresco painter Giotto di Bondone (1266–1337) or architect and goldsmith Filippo Brunelleschi (1377–1446). Leonardo's commissions from the warring Medici, Sforzas, Borgia, and French kings showed him to be quite fickle, nationalistically speaking. Nor did Leonardo funnel all his energy into the church, like his notorious competitor, Michelangelo. Instead, he searched for beauty and truth in life, from the human body to mathematical perspective. This quest for truth freed him from medieval scientific convention, though in some instances he unthinkingly accepted the statements of ancient and medieval thinkers. Overall, his endless search led him to develop a rudimentary version of the modern scientific method, as shown in Chapters 5 and 6.

- ✔ **Questioning and repeated testing of conventional knowledge through experience:** Leonardo repeatedly tested, then corrected, his vast body of knowledge. Such testing started in Verrocchio's studio, which emphasized experience (like preparing canvases or casting bronze) over art theory. Leonardo's desire to test accepted theories went far beyond the studio, for example, to the relationship of fossils to the Bible's Great Flood story. With constant testing, he developed new ideas and theories (and, of course, recognized his mistakes, from his disastrous *Last Supper* to his heavier-than-air flying machines). He wasn't always right, but who is?
- ✔ **Using and sharpening the senses to learn from experience:** Leonardo believed that firsthand experience unlocks the key to nature's secrets. (This point is where he diverged from the humanists, who generally believed that knowledge derives from reason and logic.) He thought that human perception, especially vision, allows people to design principles explaining perspective in art, for example, or the placement of the stars. Sight, compounded with the other senses (Leonardo was an excellent musician), dictates experience.
- ✔ **The willingness to deal with ambiguity and uncertainty:** Leonardo, a paradox himself, embraced incongruities. He searched for beauty, but painted grotesque caricatures. He loved riddles and puzzles, yet learned math on an abacus. As he researched the universe, he discovered some unifying principles — and put a big question mark over others. Leonardo embraced this ambiguity in his artwork. His use of *sfumato* ("going up in smoke") creates the hazy, mysterious characteristic of his painting style, and the famous questioning, pointing gesture in *St. John the Baptist*, shown in Chapter 13, perfectly reflects Leonardo's approach to the world.
- ✔ **Whole-brain thinking:** No doubt, Leonardo was both a right- and left-brain thinker, artistic *and* logical. In fact, scholars beg people not to understand Leonardo's artistic and scientific studies separately, as each informed the other. His anatomical drawings are logically rendered *and* beautiful. And he applied mathematical principles, such as perspective and pyramidal compositions, to his paintings.
- ✔ **Grace and poise, with a balance of mind and body:** Leonardo was beautiful — really. He had a full head of hair, an impressive physique, a sweet-as-honey singing voice, athletic prowess, moral vigor, and

Mensa-quality intelligence. Leonardo even devised certain rules for living, which included monitoring his moods, exercising, eating well (in accordance with his respect for all life, he was a vegetarian), and not visiting the doctor *too* often. Sound like anyone you know?

- ✓ **Recognizing how the small and large things in life all interconnect in one unified system:** For most of his life, Leonardo developed theories about the micro- and macrocosmos. He compared the circulation of the Earth, for example, to the circulation of the human body; both living systems seemed to operate according to similar rules. He saw patterns in everything (correctly or not); swirling waters resembled the Star of Bethlehem's curly petals and a woman's braided hair.

### *Living with history*

As Karl Marx once wrote about the French Revolution and its aftermath, men make their history, but not as they please. Instead, they work with traditions handed down from the past. Let's face it: History never disappears, does it?

Leonardo was the quintessential Renaissance man. As most scholars would have it, he was the ultimate man, too, a Superman hero. But had he not lived during a specific junction in history, when firsthand experience, knowledge, and logic were beginning to replace the superstition of medieval times (and when people revived the Greek concept of the globe and then sailed around it), who knows what course his genius may have taken?

Chapter 2 discusses the culture and economics of the Renaissance in greater detail, but it's worth noting here that many factors cloaked Leonardo in a culture that embraced (for the most part, anyway) his creative genius:

- ✓ The Black Plague broke down traditional patterns of wealth, opening the door for self-made aristocrats (like Milan's Sforzas, for example) to emerge. These men (and a few women), in turn, became great patrons of the arts.
- ✓ When Leonardo was born, artists were small craftsmen; by the time he died, the great ones had become superstars.
- ✓ Technical innovations facilitated the spread of new knowledge. The printing press, large sailing ship, astrolabe, and discovery of the New World spurred new scientific knowledge and international trade.
- ✓ An emerging worldview privileged human power and rationality over superstition and all-encompassing religion.
- ✓ The ideals of classical antiquity, combined with humanism, created a new culture of innovation, particularly in Florence.

These factors, among many, many others, helped usher in the Renaissance. No doubt Leonardo would've found other ways to apply his genius had the Renaissance never occurred, but in this perfect milieu for his talents, his genius thrived.

## Lost in Time: Leo's Limitations



For a man with so much talent and brainpower, the world should've been his oyster. Yet the historical circumstances that encouraged Leonardo's genius to flourish also built some walls between him and endless opportunity. And for a man who approached everything with so much curiosity (perhaps his defining feature), he lacked certain other qualities that may have ensured greater success during his lifetime.

### *The agony and the ecstasy (Or, the perfectionist and the procrastinator)*

Although religious fury and passionate love neither inspired nor tormented Leonardo in quite the same way they did Michelangelo (as Irving Stone argued in his biography of Michelangelo called *The Agony and the Ecstasy*), Leonardo had his own angels and demons. Could an artist embody any worse combination than the drive for perfection and an innate tendency toward procrastination? That dilemma was exactly what Leonardo had. It was this combination that stymied completion of his projects, but also enabled him to become the quintessential Renaissance man. Sure, Leonardo sometimes doodled for nothing; not *every* sketch or sentence deserves a gilt frame. But his distractibility and endless curiosity brought him to explore new subjects time and time again — even as he abandoned the one before him.

During and after his lifetime, Leonardo's reputation as an artist surpassed all his peers, save for Michelangelo and Raphael, the other two High Renaissance giants. As Chapter 10 explains, Leonardo pioneered techniques that helped define the High Renaissance style — the epitome of painting to date. But his desire for perfection — to render each detail, from a petal to a finger, strikingly realistic — hindered his productivity. Rumor has it that as busy as he was working for Ludovico Sforza in Milan, he'd visit the refectory in Santa Maria delle Grazie, where he was painting *The Last Supper* (introduced in detail in Chapter 14). He'd stare at the wall for a few hours, perhaps fix one tiny little thing or make one small brush stroke, and then return home to work on other pressing projects. In fact, Leonardo worked so slowly that his patron threatened to cut off all funds (which delivered the well-needed kick in the pants).

Leonardo rarely finished a painting. His reputation as someone who couldn't finish a job hung like a cloud over him wherever he went. Some of this incapacity related to his inbred desire for perfection. But much of it also had to do with circumstance. Not to make too many excuses, but war, politics, and personal feuds impeded Leonardo's progress. He had a seven-month deadline to paint an altarpiece for a church, for example; two decades later, after some legal disagreements, Leonardo produced (a second) *Virgin of the Rocks*. And unlike some of his rivals, including Michelangelo, Leonardo experienced

some trouble with his patrons, which can also account for the irregularity with which he finished projects. He didn't choose patrons very well — they kept dying or getting ousted by enemy lines. Although wooed by other patrons such as François I toward the end of his life, Leonardo never found the type of security that Michelangelo or Raphael found in the Vatican courts.

## *A man without letters*

Leonardo was a love child, born to a respected notary (lawyer) and a woman of unknown origins named Caterina. As I discuss in Chapter 3, this uncertain status meant that certain professions — not to mention the prospect of attending the equivalent of an Ivy League institution — were closed to him. A few scholars claim that had Leonardo not been born out of wedlock, he may have become a doctor, not a painter.

Despite the limitations that a class-conscious Italian society imposed on him, Leonardo made the best of his situation. Throughout his life, he called himself an *uomo senza lettere*, a man without letters. But he was self-schooled and incredibly well read, describing himself as a *discepolo della esperienza*, or disciple of experience, as well. Being a man without letters, then, wasn't too shabby if you could lift yourself up by the bootstraps and apply yourself.



## Join the club . . . or, better wait a while

Leonardo was both a procrastinator and a perfectionist. Recently, psychologists have shown that these two qualities usually represent two sides of the same coin. Procrastination, which derives from the Latin *pro* (for) and *cras* (tomorrow), entails putting things off that require immediate action. (Do you ever wonder why you *must* clean the house or bake cookies when you have other, more important work to do?) And perfectionism is a condition in which fear about one's own abilities and judgment by others cause great anxiety. Leonardo was plagued by both. And he wasn't alone. Many great figures have suffered similarly:

✓ **St. Augustine:** He struggled between maintaining chastity now (well, in the fourth century AD) and going to heaven, or sleeping around and risking an eternity of hell. Original sin? There you have it.

✓ **Samuel Taylor Coleridge:** This British Romantic poet rarely finished anything. He never completed one of his most famous works, *Kubla Khan*, claiming that a fictitious "Person from Porlock" interrupted his opium-inspired dream.

✓ **Agatha Christie:** She wrote more than 80 books, yet feared starting each new one.

✓ **SpongeBob SquarePants:** Yes, even he didn't want to start an essay in a 2001 episode called "Procrastination."

Leonardo knew that time runs out. On his deathbed he reputedly begged to know if any of his inventions had been built. Clearly, he hadn't read Stephen Covey's bestselling book, *The Seven Habits of Highly Effective People*.

Leonardo wasn't initially so great at math (he had trouble calculating square roots), but he studied it more formally after finishing his apprenticeship with Verrocchio. Failing to grasp some unproven mathematical principles, he also devised some of his own mathematical symbols. In an age that admired ancient Greece and Rome, a middle-aged Leonardo also taught himself Latin in order to read the classic texts (and to question some ancient assumptions about art, science, and life). He owned an extensive library, with works ranging from the Bible (though he wasn't religious) to Ovid, Pliny the Elder, Petrarch, and Renaissance texts on agriculture, anatomy, mathematics, and medicine — you name it. Basically, he studied all ancient and medieval texts on subjects that interested him. He was undoubtedly more well read than his peers who *had* attended university. He even befriended professors in different fields, like the famous mathematician Luca Pacioli and some anatomists. This focus on hands-on experience — a substitute for official schooling — led to some of Leonardo's most stunning inventions in art and science.

## *A product of history?*

Leonardo, like his colleagues, worked in a specific historical time that embraced logic and innovation, as you can see in Chapter 2. But the culture that gave him great freedom also circumscribed his projects.

- ✔ **The Church:** Although slowly waning in power, the Catholic Church still influenced people's lives on a daily basis. Religious themes dominated art, despite the slow intrusion of pagan themes derived from classical antiquity. And the Church still governed the production of knowledge. Different Renaissance popes embraced scientific progress to different degrees, but overall they frowned upon human dissection, for example — one of Leonardo's favorite pastimes.
- ✔ **The Italian Wars:** These regional wars — the ins and outs of gaining and then losing power for ruling Florentines, Milanese, and French — spelled disaster for Leonardo's patrons, and as a result eliminated any chance Leonardo had for security. The wars were the main reason for his turn-coat diplomacy and why he hopped from patron to patron. But they also provided Leonardo with new opportunities. For example, when Ludovico Sforza was ousted from Milan, Leonardo found his way to the Vatican — for a while, anyway. And in the French king François I's court, he experienced great intellectual and artistic freedom.

Leonardo overcame many of the obstacles that could've squelched his creativity. He still cut up humans, even if he worked alone, at night. And he always sniffed out new patrons, even if he had to reinvent himself, for say, the military industrial complex, in order to do so.

## ***Communicating effectively — or not***

Leonardo left thousands of drawings of his inventions: a helicopter, scythed chariot, scuba gear, parachute, 33-barrelled gun, lifting machines, and so on (and on and on and on). And he left just as many prescient observations about all fields of science. But he never communicated most of his ideas effectively.

### ***Deciphering the messy notebooks***

First, Leonardo didn't use standard notation or writing. Instead, he wrote backwards, from right to left, in a style called *mirror writing*. Making matters worse, he left his notebooks an absolute jumble. A stream-of-consciousness rather than synthetic thinker, he drew relationships among everything he observed, from blood vessels to rivers. He thus sketched seemingly incongruous stuff side by side. And because paper was expensive and scarce, he often tucked new ideas into any corner he could. (For more on Leonardo's notebooks, go to Chapter 16.)

Second, with few exceptions, Leonardo never built and tested most of his designs. If he had, people may have gloried in some modern machinery (and some pretty nifty toys, too) centuries earlier than they did. Many of his inventions, given the limitations of human power, would never have moved by themselves.

### ***It's publish or perish, baby***

Leonardo's colleagues universally heralded him as a genius during his lifetime, and many of his works, including the *Mona Lisa* and *The Last Supper*, attracted hordes of followers. But because he published nary a word during his lifetime, few of his colleagues knew about his scientific thoughts or mechanical inventions.

Evidently a few people looked at Leonardo's notebooks and copied some of his ideas and sketches during his lifetime, but had more people in Leonardo's day known about his designs, they may have tried to improve upon them. Instead, Leo's contributions remained undiscovered for years, and other scientists, inventors, and researchers had to reach their own conclusions and make their own discoveries without benefit of the ideas that predated their own "breakthroughs" by centuries.

Leonardo neither compiled his thousands of pages of musings nor published much of anything during his lifetime. (Some scholars even estimate that about two-thirds of his notebooks have been lost.) Sure, a few of his drawings, such as those of geometric solids, appeared in certain volumes, like Pacioli's *De divina proportione* in 1509. And some evidence suggests that

Leonardo influenced other scientists, artists, and inventors of his day. A few examples to whet your appetite:

- ✓ The Venetian painter Titian and German painter Albrecht Dürer looked at Leonardo's anatomical drawings and pirated some of them in their own work.
- ✓ The Italian clockmaker Lorenzo della Volpaia copied some of Leonardo's instruments in his own manuscripts.
- ✓ Leonardo's work on geometry in François I's court influenced Claude de Boissière, a mathematician to the king of France after Leonardo.
- ✓ Leonardo was interested in compasses and designed a specific proportional one that found its way to other European cities. Galileo eventually claimed to have invented a similar type of compass, though he likely studied a string of inventions that derived from Leonardo's original design.

The fact remains that the bulk of Leonardo's ideas essentially disappeared. Despite his best intentions to publish separate treatises on everything from anatomy to mathematics and hydraulics, he never did. That the heirs to Leonardo's manuscripts scattered them after his death sealed his fate: In the world of publish or perish, most of Leonardo's brilliant thoughts perished — for a few centuries, anyway.

## *Revisiting the Beloved Leo Today*

Leonardo lived 500 years ago, but his legacy seems as near and dear to people today as if the Renaissance happened only yesterday. Who can resist the *Mona Lisa's* allure — or, with all the hype, ever forget her? Who else invented models of a helicopter and car years before their time? And which other Renaissance man has become a pop culture icon, a modern symbol of ultrahuman intellect and achievement?

Although Leonardo lived generations and worlds away from today's society, his work still exerts a powerful hold over people in this day and age. Like Thomas Edison or Albert Einstein, who represented the inventor's spirit to perhaps lesser degrees, Leonardo surpassed human limits and changed the Western world's way of thinking in noticeable ways. His notes, diagrams, and drawings offer clues to his ceaseless search for truth. And his paintings, portrayed with a beauty never before or since paralleled, relate a timeless immediacy to artists and scientists today.

In a changing time, one that desperately tried to free itself from the shackles of medieval convention, Leonardo was an extraordinary thinker. In some ways he adhered to tradition, building on existing bodies of knowledge. But in other areas, he was a true explorer, a pioneer whose fertile imagination grasped and prophesied unheard-of possibilities.

In fact, many of Leonardo's inventions have greater value for their far-reaching implications to the Scientific or Industrial revolutions than to their own immediate applications. Most of Leonardo's dreams, including the great fantasy of flight, had to wait a few centuries to be realized. Some of his inventions were considered ludicrous or impractical at the time; others wouldn't have worked at all. Just imagine strapping on a pair of feathers and jumping off a roof, or running as fast as you can on a Renaissance-style treadmill to power a crossbow! Not surprisingly, 15th-century Italy, while ushering in a modern age, didn't readily embrace such advances.

Today you have the historical perspective to understand just how revolutionary Leonardo's ideas and inventions were, feasible or not, in his time. After all, the Leonardos of the world — those visionary, audacious thinkers — are the ones who break ties with an antiquated past and move the world forward one step at a time. Some are lauded during their lifetime, while others, like Galileo, are accused of heresy and imprisoned for contradicting established teachings. (Perhaps it's a good thing that Leonardo didn't publish his theory about the origin of fossils!)

If today's culture values one thing, it's progress — whether people recognize it at the time or not. Although Leonardo was recognized for his great artistic gifts, many of his scientific nuggets and mechanical inventions went unnoticed. But when they were rediscovered, the world came to understand Leonardo's great legacy as both pioneer and precursor to the modern world. As each part of the world (and universe) gets closer together through technology, markets, and scientific knowledge, Leonardo's accomplishments resound perhaps even louder than they did during his lifetime.