Leonardo da Vinci was indisputably one of history's great painters—but also one of the greatest scientists?

Centuries Ahead of His Time

By Kristi Birch

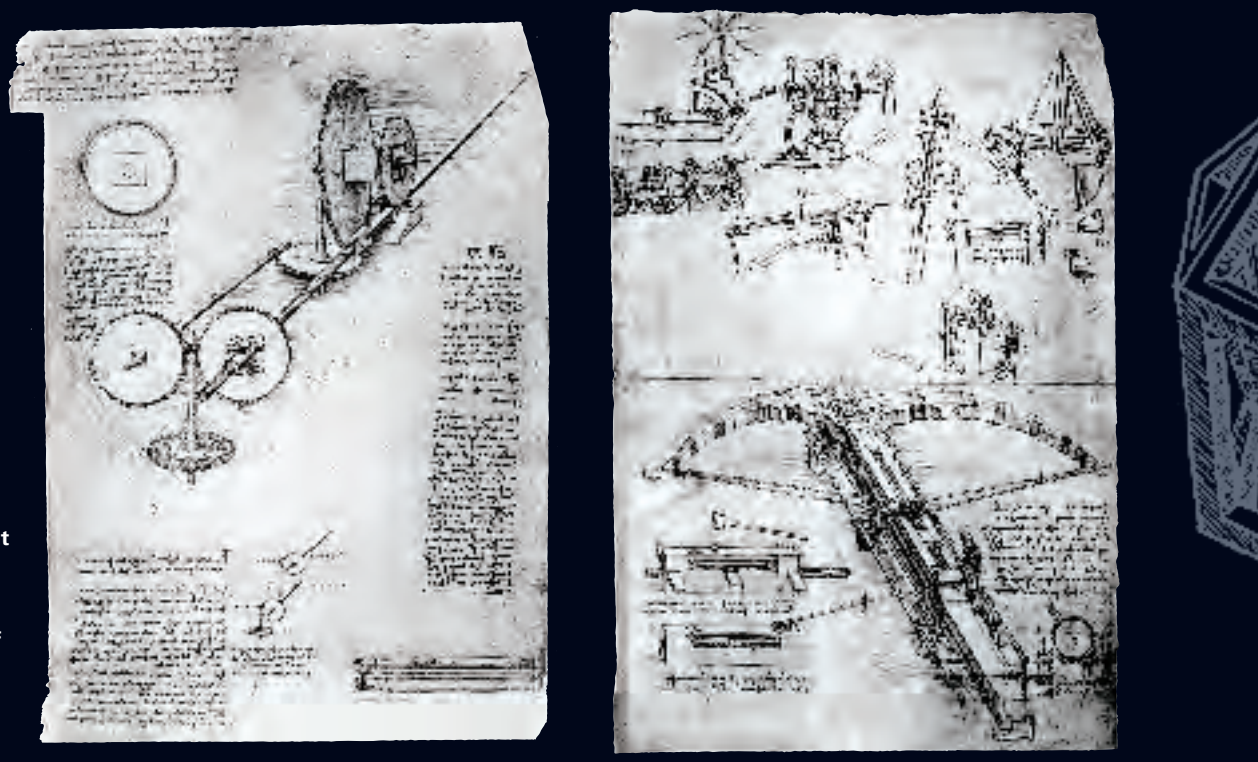
His ideas were centuries ahead of their time. In 1478, he created a blueprint for a self-propelled car. In 1487, he drew up plans for an armored tank lined with guns. In the early 1500s, he conceived of the idea for industrial solar power, using concave mirrors to heat water. He also drafted architectural plans for churches and other buildings, and drew complicated illustrations of human anatomy based on the many corpses he dissected for study. He's even been credited with inventing scissors.

He was Leonardo da Vinci, the quintessential Renaissance man. The Renaissance, the rebirth of culture following the Middle Ages, saw a transformation in math, science, arts and the humanities. Da Vinci seems to have mastered every discipline—from astronomy, architecture and engineering, to hydrodynamics, geology, even optics. Sixteenth-century da Vinci biographer Giorgio Vasari said the artist was also extremely handsome, kind, generous, and was said to be a musical prodigy.

And then there was the "Mona Lisa." Most remembered for his masterpiece paintings, da Vinci's "Mona Lisa" and "The Last Supper" are the most famous paintings in Western culture, perhaps in the world.

Not bad for the illegitimate son of a notary, Ser Piero, and a peasant girl named Caterina. Leonardo da Vinci was born in 1452 near the town of Vinci outside Florence, Italy. Because he was born out of wedlock, he did not inherit his father's surname—"da Vinci" means "of Vinci"—and he always signed his works simply "Leonardo." Da Vinci did not receive much formal education and, because he was illegitimate, he wasn't allowed to attend a university.

At the age of 14, when he demonstrated a talent for drawing and design, his father apprenticed da Vinci to the workshop of the renowned painter and sculptor Andrea del Verrocchio in Florence. The artists Verrocchio employed were considered craftsmen, producing dowry chests, christening platters, small portraits, altarpieces and statues. But da Vinci also would have been exposed to a vast range of technical skills and would have learned drafting, chemistry, metallurgy, metalworking, plaster casting, leather working, mechanics and carpentry, as well as the obvious artistic skills of drawing, painting, sculpting and modeling. Da Vinci relied on the skills he learned with Verrocchio for the rest of his career.



Da Vinci was a diligent note taker, producing some 4,000 pages of notes of every kind. Right: his drawings of a geared device and a giant crossbow.

Renaissance painters strived to make their painting as realistic as possible and, to that end, Verrocchio insisted that his pupils study human anatomy. Da Vinci learned to make sketches first of what he was going to paint, often from many angles, and became quite skilled in creating realistic figures. He worked with Verrocchio on one painting, the "Baptism of Christ," and legend has it that Verrocchio was so overwhelmed by da Vinci's work, particularly the sweet expression on the face of the angel he painted, that he put down his own brush and never picked it up again.

By 1476, da Vinci, 24, had his own workshop in Florence and had begun studying a diverse list of subjects, recording his notes and ideas dutifully on paper. He made drawings of his animal and plant studies, rock formations, wheels and bridges, and more, all intermingled with personal items. On one page in his notebook, for example, there are some geometry problems, a plan for building canals and the note, "Tuesday: bread, meat, wine, fruit, vegetables, salad." His drawings were usually accompanied by text, but oddly, he wrote his notations in "mirror writing," with the letters backward and from right to left, so that the only way to read the words is by holding the page up to a mirror.

In 1483, da Vinci moved to Milan to work for Duke Ludovico Sforza and his family. When he applied for Sforza's patronage, da Vinci stressed his engineering knowledge as much as his artistic talent. He had drawn designs for submarines, catapults, armored tanks and various weapons. The designs were impressive, although they could not be realized because, as with most of his other inventions, the technology at the time was simply too crude to execute his often-detailed drawings. During his 17 years under the duke's patronage, not only did da Vinci paint and sculpt, but he also supervised the making of cannons, prepared floats and pageants for special occasions, and designed a dome for the Milan Cathedral and a heating system for the duchess' bath.

The Master of Invention

Da Vinci had a particular interest in locomotion, especially flight. He studied the movement of birds' wings and tails and tried to apply those principles to his many designs for flying machines. One was a wooden ornithopter, a one-person wooden aircraft powered by flapping wings. The aviator was to lie on a plank and move the wings using a hand lever, foot pedals and a pulley system. Da Vinci also designed a flying machine with a corkscrew-shaped propeller. The riders were to get into a basket made of wooden poles and stand with their feet on a platform that ended just before the blade of the propeller began. Da Vinci's notes called for a spring-loaded mechanism that would wind up the helicopter and release it, making the propeller spin fast enough to lift the machine off the ground. Many people consider this to be the world's first helicopter design.

Also fascinated with water, da Vinci watched pot lids jump when water boiled, and concluded that water must expand to become steam. He watched the waves form around a rock thrown into a pond, and realized that sound likely produces similar waves. Though these observations seem simple now, they were revolutionary for the time.

He designed water pumps and water wheels, and he even designed a water-powered clock. It was a stone jar from which water dripped into a second vessel. As the volume of water passed, people could see markings inside the second container to view how much time had elapsed, down to the minute.

After studying mathematics, da Vinci drew a series of geometric solids including the first published rhombicuboctahedron (left). The artist sketched a great deal before painting. Below, a sketch for "The Last Supper" is thought to be a self-portrait. The "Mona Lisa" (right).

Perfecting His Art

As a man of the Renaissance, da Vinci was obsessed with the natural world. He remained passionate about his anatomical studies and made detailed drawings of the heart and the brain based on the cadavers he dissected, which he did even after the bodies began to decompose. He wanted the natural world to be apparent in his art, and was determined to create realistic images that showed depth and distance and human expressions, unlike flat medieval paintings. He did this exquisitely in "The Last Supper," finished in 1498 when he was 46. Painted on the back wall of the dining hall in a convent in Milan, it depicts the last meal Jesus shared with his disciples, in particular the moment when Jesus declares that one of the disciples will betray him. What makes the painting a departure from earlier works is that the disciples are portrayed as real people, with identifiable emotions.

When the French army conquered Milan in 1499, da Vinci left the city to find a new patron. He spent the next 16 years working all over Italy, including a year spent as a military engineer for Gen. Cesare Borgia. Da Vinci traveled with him, making military maps, which laid the groundwork for modern cartography.

Around 1503, da Vinci began work on what is considered his masterpiece, the "Mona Lisa." The portrait is believed to be of Lisa Gherardini, the wife of wealthy Florentine businessman Francesco del Giocondo, hence the painting's other name, "La Gioconda." Renowned for its indistinguishable brush strokes and its use of light and shadow, the painting is perhaps most famous for the elusive smile worn by the subject. Using a technique he called "sfumato," which comes from the word "fumo" (smoke), da Vinci painted with translucent layers and shadowed the corners of his subject's mouth and eyes. If you look long enough, the smile seems to disappear.

Innovator Until the End

In 1516, after spending three years working in Rome, da Vinci left Italy for France, where he spent the rest of his life serving as premier painter, engineer and architect for Francis I. The king and da Vinci became great friends; Francis I paid him well and asked for very few paintings in return. Da Vinci spent the end of his life sketching what he wanted, including preliminary designs for scuba diving gear and movable bridges.

Da Vinci died in 1519 at the age of 67. His legacy today includes 17 surviving paintings, as well as some 4,000 pages of notes. Because da Vinci did not share his notebooks, the massive amounts of work in them did not really advance the science of his day. Had his notes been published, da Vinci's place as one of the great scientists of his day and in history would be certain. However, after his death, the notebooks were scattered and many were lost. It wasn't until the 19th century that some of them resurfaced, which is one reason da Vinci is remembered more as an artist than as an inventor or scientist.

In 2000, a British skydiver named Adrian Nicholas decided to test one of da Vinci's parachute designs. The design resembled a kite, with the rider hanging from a structure made of linen and held together by poles in a pyramid shape. Five hundred years after da Vinci invented it, Nicholas jumped out of a hot air balloon at 10,000 feet and opened up a da Vinci-designed parachute made of canvas. Nicholas flew "for ages and ages and ages," he said. Although he used a modern parachute for the final landing (da Vinci's design had no steering mechanism), Nicholas landed safely and the da Vinci parachute floated to the ground next to him—completely intact and unscathed.