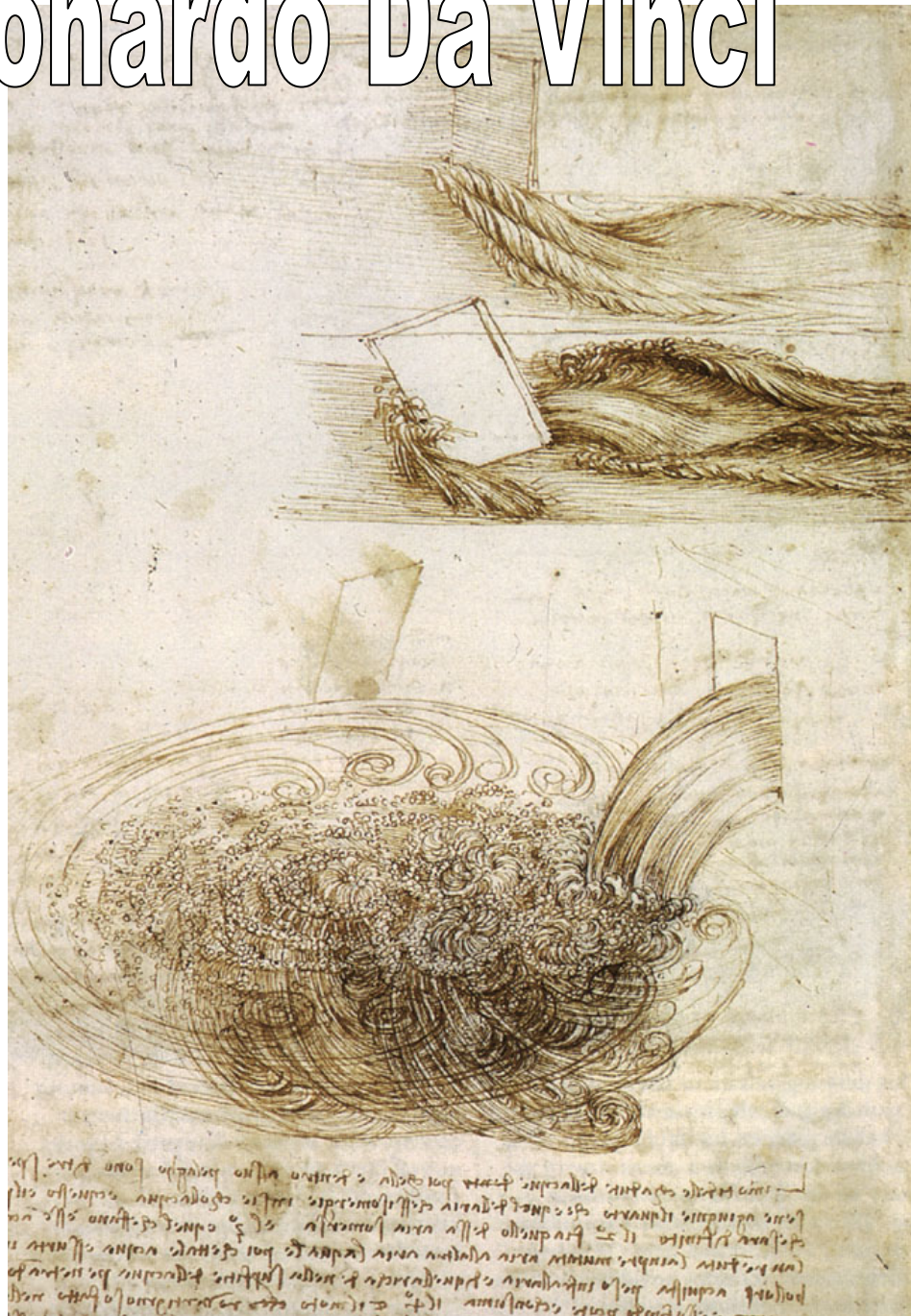


Leonardo Da Vinci



"The Master of Water"

Over 500 years ago a very talented man said “Water is the driving force of all nature.” You may know him as the mastermind of the first flying machine. Or maybe you remember a painting that we have all admired named the Mona Lisa. His name is Leonardo Da Vinci. Many don’t know him with the title of The Master of Water, or maybe one of the most influential engineers throughout history. He was a pure genius and a perfectionist in many fields and a revolutionary of his time. He created ideas and explore the realms of making things that were deemed impossible at the time as an achievable dream. He became an inventor of many water based designs, and a master of hydraulics. I consider him one of the best Civil Engineers in history.

Leonardo described “Water is to the world as blood is to our bodies.”. (2) pg 334 He was said to be obsessed with water. Many say that the obsession was driven by a childhood experience when he was only 4 years old. A large hurricane struck the Vinci District in the spring of 1446, and for the rest of his life he would try to recreate the visions and sights of that experience by writing and drawing them. (2) His drawings in his notebooks were all very intense. Every detail of the water was included. The flow of the water would ripple with thousands of pencil strokes and would seem to flow off the page. His drawings came to life with accuracy. It is hard to tell the difference between his scientific diagrams and his works of art. The scientific portion of the diagrams was so precise and so smooth that they actually became his art work. In his note book he drew “Water Flowing Past Obstacles, around 1507.” (1) In the drawing the complexity of flow can be seen. Water pours into a pool and natural patterns of swirling waves come to life. The Circling water particles and bubbles that are created show his understanding of how water moved. The sluice gates in the top of the sketch shows he understood what

happened when flow was sheered by a stiff structure. You can tell that he must have sat in one spot for hours studying how water flowed. He related the flow of water in his art work. The pen and ink, "The star of Bethlehem" is one of the closest resemblances of water in his works. The drawing consists of a couple of flowers with a large bush type object in the center. He made thousands of pen strokes that created this bush which looks like the individual flow of thousands of particles. (1) pg 78

He can be deemed the Master of Water through fluid mechanics. He dreamed of walking across water, traveling under water, and created a cleaner place to live by using water. He designed a pair of shoes that would allow you to walk across water. This idea involved the theory of buoyancy and surface tension in fluid dynamics. The shoes were very elongated which created a center of buoyancy and two large poles also would be used to help balance. This idea was never put to practice but was a dream of Leonardo's, to be able to walk on water like we walk on land. He also enhanced diving suits that were already currently invented before Leonardo came along. He placed a large steel plate on the chest of the suit to prevent the pressure on the chest of the diver to increase as depth increased. This relates to the function of a manometer in fluid dynamics that states as depth increases, pressure also increases. (4) Leonardo also sketched in his famous notebook a Hygrometer, which was a device that measures the amount of fluid in the air. The Hygrometer led to the prediction of weather, like the use of a barometer. (5)

Leonardo seems to be the first person to have discovered the principles of erosion. "Water gnaws at the mountains and fills the valleys. If it could it would reduce the earth to a perfect sphere." (2) pg 335 This shows that he understood the power of water and that it is a force that needed to be appreciated and understood. He said that it

circulates according to fix rules; it comes from the rains and snows, rises up from the grounds and returns to the reservoirs that surround us on all sides, the seas. He would become one of the world's best and first hydraulic engineers. (2)

Leonardo arrived in Milan in 1482, and the current water ways did not hold up to the standards of Leonardo. He wanted to create the ideal city off the basis of water flow. He wanted the streets to automatically wash themselves by the use of locks and paddle wheels to wash the plague away. Plague struck Milan in 1484 and water was seen by Da Vinci as the solution. The water systems in Milan were 200 years older than Leonardo. He invented a operating valve on a sluice gate that allowed the gate to be operated from above. The flow of water would be reduced, by balancing the pressures on either side of the gate it became easier to open and close the sluice gate. As a Civil engineer we dedicate our professional knowledge and skill, so that we can better living conditions and over all human welfare. This is what Leonardo was trying to do with his water system in Milan. Leonardo had conceived an idea of a new city with sanitation by using the natural dynamics of water. He began by designing roads and water ways for the best possible hygiene. And the beauty of the design is that the upper class got the same amount of water and sanitation as the lower class, reinforcing the over all improvement of all human welfare. It was organized by the individual function of his system instead of wealth, which was likely to take precedents in that time in history. By 1493 the building and expansion of Milan began to happen. He studied the cities canals and became an expert in hydraulics and water systems. In the 1490's he teamed up with two other respected engineers, Donato Bramante, and Giovanni Giagomo Dolcebuono. He had his hands in many projects in Milan. The science of hydraulics was growing rapidly and advanced the

way water was being used. They used irrigation and land drainage as a source of power through paddle wheels, and regulated water ways with locks and canals. He spent a total of 17 years total in Milan improving the city architecturally and its hydraulics. (3)

In Florence he had perused projects for 30 years. One of these projects was the deviation of the Arno River. The Arno River was prone to flooding and was a Florence's enemy's main supply of water. At the turn of the century Leonardo created a hydraulic system that would serve every town in Tuscany with water, drainage, irrigation and would make transportation and navigation of the water ways possible. Everything looked good on paper, but unfortunately Arno River flooding, bad timing and bad workers resulted in the plan never to be carried out. (3) Leonardo also had sketches in his notebooks for a canal bridge for Florence. The canal was operated by sluice gates and would change the level from one lock to another by opening and closing the sluice gates. He even included erosion plans in his sketches which strengthens his findings of erosion. He was interested in moving a heavy large ship from one side to another. He also stated "the heavy weight of the boat which crosses a river will not put a heavier load on the bridge's arches because the boat's weight equals exactly the weight of the water displaced by the boat." This shows his understanding of the weight of water per volume and shows that he understood what displacement was.

His plans in Florence fell through and he was not desired by Florence as an engineer any longer. He returned to Milan where he worked on painting the Mona Lisa, and at the same he turned back to Hydraulic engineering again. This demonstrates his obsession with water. He hoped to return to Milan with devises to measure flow. At that

time the government controlled water and sold it by the ounce. A hydraulic counter or meter was something never even heard of before Leonardo. (2)

When Leonardo began to grow old his activity of studying motion, weight, air and water didn't slow. He began to describe the flow of the sea to the rhythm of respiration. He also became interested in digging drainage canals to carry water away from swamps. The work started and stopped a few years later and wasn't completely finished to the end of the nineteenth century. (2)

Leonardo has been called an inventor, a revolutionary and a pure genius. I don't believe these titles give him justice. He thought of things that would not impact society until 100's of years later. He was a Civil Engineer by heart and a Master of Water by trade. Through his work you could tell he was a man of morals and talent. He used his talent for war but still used his talent for the greater good. These are only some of the examples of how he has impacted our world today and without his teachings and aid to engineering we may not be where we are today. Through his obsession of water he earned the title Master of Water.

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