Reflection of Archimedes' Law in Art

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When forty people were shown the pictures that appear on the back page, only one indicated that they demonstrate Archimedes' Law and only four emphasized the floating effect. It is the aim of this Art & Science page to accustom people to "see" science in works of art along with aesthetics, usually observed.

Archimedes, one of the greatest mathematicians of all times, was born in Syracuse, Sicily in 287 BC. Unfortunately he was killed in 212 BC by a Roman soldier when the Romans invaded Sicily during the Second Punic War. He was solving a mathematical problem when a Roman soldier confronted him. He refused to move until his problem was finished so the soldier ran a sword through him. Among Archimedes' achievements we can mention the following: He anticipated many discoveries of modern Science, such as Integral Calculus; he defined π as $3\ 10/71 < \pi < 3\ 1/7$; he invented the so-called Archimedes' screw and the burning mirrors, which were a kind of weapon; he proved that the volume of a sphere is two-thirds the volume of a circumscribed cylinder. He also had a fascination with levers, and is quoted for saying: "Give me a place to stand, and I will move the Earth." By this he meant he could lift the Earth with a lever if there was somewhere he could stand.

Archimedes' Law, about 2200 years old, states that on a body immersed in a fluid a force acts in opposite direction to gravity force. The magnitude of this force, designated "buoyancy force", is equal to the weight of the displaced fluid by the immersed body. This force is always present, excluding one case - absolute vacuum. Archimedes' Law applies to all fluids, liquids, and gases, as well as to submerged and floating bodies. It explains the apparent loss of weight of objects underwater, the rise of a balloon in the air, and the buoyancy of ships in water. The phenomenon of floating bodies is not new; it runs back to Biblical time, and is first described in Genesis 7 as follows: When God decided that the land was totally corrupted and should be destroyed, he told Noah to build an ark. Being familiar with Archimedes' Law, God gave him detailed dimensions of the ark and indeed, the God's design was so successful that when "the waters rose and increased greatly on the earth, the ark floated on the surface of the water." Another fascinating example is described in 2 Kings 6:5-7: The man of God asked, "Where did it fall?" When he showed him the place, Elisha cut a stick and threw it there, and *made the iron float*. The only explanation to this phenomenon is it's being a miracle.

A rather interesting story is the way Archimedes discovered his Law. He did it by helping his friend, King Hireon II of Syracuse, who was trying to solve the Golden Crown Mystery. The King had sent a certain amount of gold to a goldsmith for a new crown. When the crown was returned, the king thought that not all the gold was in his crown and he told Archimedes of his problem. Archimedes went home and filled up his tub to the top, and got in it. He realized that the mass of the water that fell out of the tub was equal to the mass of his body. By realizing this, he must have assumed that his density equals that of the water and under these conditions he must have been floating, which is a particular case of his general law as stated above. The next day he did the same thing with the crown, assuming that the original amount of gold was in the crown. However, Archimedes found that the original gold had more mass than the crown, thus not all the gold was in the crown! An interesting fact about this story is that when Archimedes discovered buoyancy, he ran through the Syracuse streets yelling "eureka", meaning I have found it.

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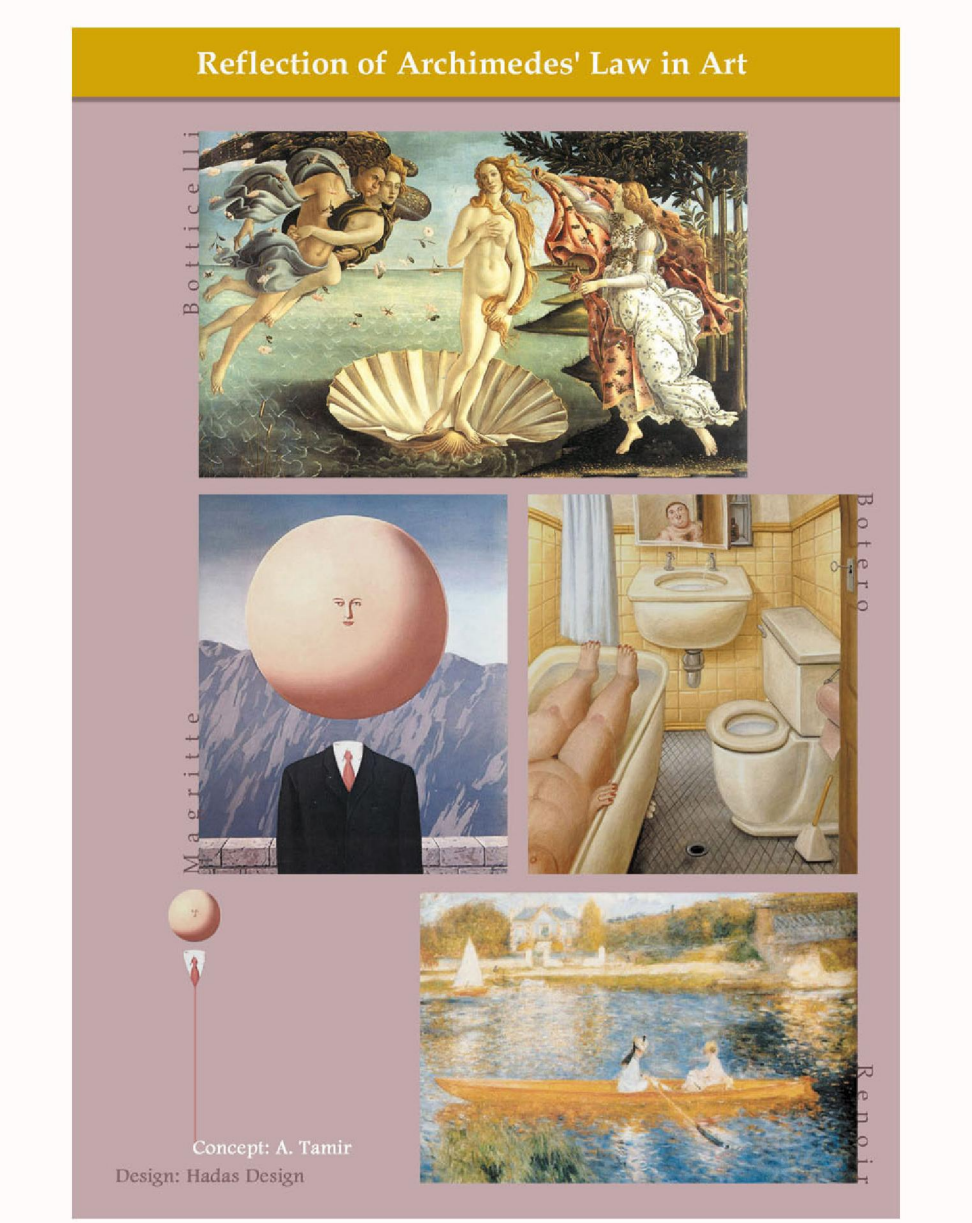
We will now elaborate on the relation between the pictures on the back page and Archimedes' Law. "The Birth of Venus" was painted at about 1485 by Sandro Botticelli (1455-1510) who was born in Florence, a Renaissance painter who revived classical mythology in his allegorical paintings. We see Venus - the goddess of beauty and love - born from the foam of the waves, standing on a scallop shell. The major question is, however, whether the standing position of Venus on the shell is stable, or why does not she sink? Simple calculations indicate that the volume of water displaced by the shell is approximately 150 liters bearing in mind that the size of the picture in the Gallery delgi Uffizi in Florence is 1.72×2.85 m. In other words the buoyancy force is 150 kg-force; assuming that Venus weighs about 60 kg-force indicates that she is standing safe enough.

The other picture is "The Bathroom" painted in 1993 by Fernando Botero, a painter and sculptor, born in 1932 in Medellín, Colombia. Botero, one of today's preeminent artists, is marked by unique qualities and a distinct figurative style that includes a wide repertoire of themes such as self-portraits, nudes, lovers, bullfights, nuns, prostitutes and saints. However, his nudes, although being fat and monumental, bear much aesthetics. In "The Bathroom" one should note that the woman in the bath is holding the wall of the bath with her hand. This indicates that Botero was, probably, familiar with Archimedes' Law, namely, that such a fat woman might sink in the water if not holding the bath because buoyancy force was not sufficient to keep her floating or balancing her weight.

René Magritte (1898-1967), a Belgian, is a representative of Surrealism who questioned the reality of the image in his puzzle-paintings. In the picture "The Art of Living", painted in 1967, an enormous balloon seems floating above a decapitated body, and the balloon is the head. It is pink, a color representing the charm of good life where inside the balloon a strange face is painted. The major question here related to Archimedes' Law, bearing the impression that the balloon in the picture is floating, is with what gas is the balloon filled. If it is air, then the balloon must sink. If it is a lighter gas it will then move upwards. Not surprisingly, Magritte does not provide any clue to this question, either because he did not pay attention to Archimedes' Law when he painted the picture, or as he used to do in his paintings, he left the observer questioning reality.

The last picture "Banks of the Seine at Asnieres" was painted at about 1879 by Pierre-Auguste Renoir (1841-1919), French, born in Limoges, and the co-founder of impressionism. Undoubtedly, it is a typical example of the impressionistic style and not less of Archimedes' Law.

In conclusion, the four pictures demonstrated here, of different artists and artistic styles, have a single denominator in common. They all demonstrate one of the most important and ancient laws in science, the Archimedes' Law.



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