

Interaction Between Engineering, Science and Art

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Abstract: This article is the beginning of a new section entitled Engineering and Science by Art where the emphasis will be on Chemical Engineering. It applies to an approach developed by the author where subjects related to engineering and sciences are demonstrated by artworks. This makes the subjects more understandable and easy to percept. After studying the articles written by the author, he believes that in the future the readers will also be able to write articles of this type.

INTRODUCION

The three cultures, Engineering, Science and Art are usually looked upon as three different entities. However, the interaction between Engineering and Science is well-known, whereas the interaction between Engineering and Art, and between Science and Art is not so obvious. However, according to Cheng-Dau Lee, a Nobel laureate in physics, there is an interaction between science and art; he said: "Both, science and art are not separated from each other. There is even a similarity between them as they help us observe nature. With the help of science we can find out routines of nature. On the other hand, by means of art we can describe the emotions of nature."

The major aim of the present article is to demonstrate the interaction between the above mentioned cultures for which a new section will be established in the magazine entitled "Engineering *via* Art". The author of this article will demonstrate this approach, and the readers are invited to contribute their own ideas by applying the above interactions. In the following, we elaborate the above interactions by demonstrating them through art.

WHAT IS SCIENCE?

Science to the layman is usually identified with something precise, such as mathematics or physics. However, science has an essential scope to reveal the laws of nature which govern our life every second. Science has many definitions. For example, the Oxford Advanced Learner's Dictionary (1989) and Even-Shoshan's New Hebrew Dictionary (1975) definitions are summarized as follows: "Science is a systematic research in a certain subject, such as in mathematics, physics, botany, and history, organized and based on facts, observations or experiments, and summarized into laws, rules and axioms." According to Dictionary of Science, science is defined as "the study of the physical universe and its contents by means of reproducible observations, measurements, and experiments to establish, verify, or modify general laws to explain its nature and behavior." Another definition based on Webster's New World Dictionary of the

American Language reads, (<http://www.aboundingjoy.com/define-fs.htm>): "Systemized knowledge derived from observation, study, and experimentation carried on in order to determine the nature or principles of what is being studied." In the Encyclopedia Britannica (1987), "Science is the knowledge of the world of nature". Campbell's [1] definition is very interesting, he says that nature means, practically, the part of the world that humans regard as external to them. Thus, "Science is that branch of pure learning which is concerned with the properties of the external world". A few artworks demonstrating science by art are presented in the following. Fig. (1) demonstrates Archimedes Law related to hydrodynamics. Archimedes of Syracuse (c.287 BC–c.212 BC) was a Greek mathematician, physicist, engineer, inventor, and astronomer. He formulated his law about 2200 years ago stating that: "On a body immersed in a fluid, a force acts in opposite direction to gravity force. The magnitude of this force, designated as 'buoyancy force' is equal to the weight of the displaced fluid by the immersed body". Fig. (1), "The skiff", painted by Pierre-Auguste Renoir (1841-1919), a French impressionist, demonstrates the law where due to the buoyancy force the boat with the two ladies could sail without sinking. Mathematics is demonstrated in Fig. (2) by the symbol of infinity painted by Todd Davidson. Here a man is mowing his backyard in the shape of infinity.

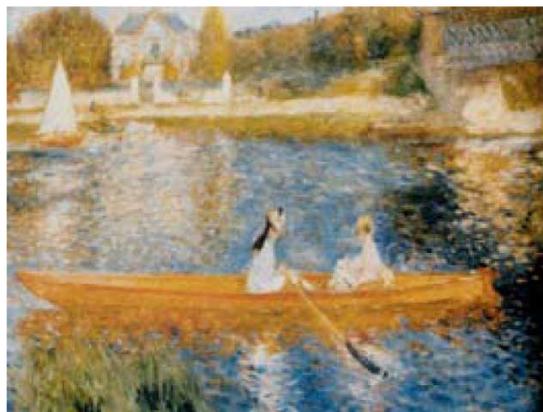


Fig. (1).

Chemistry is demonstrated by reaction $2AB \rightarrow A + B + A$ in Fig. (3). The reaction is based on an element on the left of Fig. (3) of the artwork entitled "2 -motifs, transi

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Fig. (2).

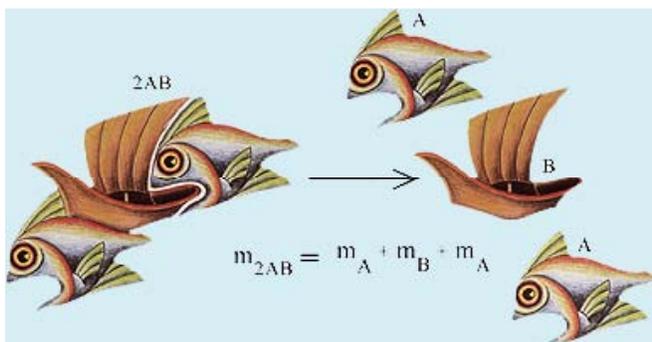


Fig. (3).

tional system I^A-I^A painted by Maurits Cornelis Escher (1898–1972), a Dutch graphic artist [2]. To conclude part of the subjects related to science, “reflexology” related to alternative medicine that belongs to life sciences is presented Fig. (4) of an unknown artist. An ancient Chinese technique uses pressure-point massage (usually on the feet, and also on the hands and ears) to restore the flow of energy throughout the entire body. While the art of reflexology dates back to Ancient Egypt, India and China, it wasn’t until Dr William Fitzgerald introduced this therapy to the West as ‘zone therapy’. He noted that reflex areas on the feet and hands were linked to other areas and organs of the body within the same zone. It has been observed that a tension in any part of the feet is mirrored in the corresponding part of the body. It is a complementary therapy, which works on the feet to help heal the whole person and not just the prevailing symptoms. It is interested to note that Fig. (4) reminds the famous artwork “The creation of Adam”[3] painted by Michelangelo (1475–1564) Italian Renaissance.



Fig. (4).

WHAT IS ENGINEERING?

According to Wikipedia, the free encyclopedia, Engineering is the discipline and profession of applying scientific knowledge and utilizing natural laws and physical resources in order to design and implement materials, structures, machines, devices, systems, and processes that realize a desired objective and meet specified criteria. More precisely, engineering can be defined as “the creative application of scientific principles to design or develop structures, machines, apparatus, or manufacturing processes, or works utilizing them singly or in combination; or to construct or operate the same with full cognizance of their design; or to forecast their behavior under specific operating conditions”. An important step in developing a process is testing in the lab the optimal conditions of the chemical reaction that will take place in the plant for producing on a large scale the required product. The lab is demonstrated in Fig. (5) [4] by an image of Louis Pasteur, a French chemist and biologist, in his laboratory painted in 1885 by A. Edelfeld. Following the lab stage, the plant is constructed, an example of which is demonstrated in Fig. (6) [5]. It is an artwork of the Publicker Industrial Chemicals plant with the world’s largest capacity for the production of ethyl alcohol. It is located on the Delaware River, near the southernmost tip of Philadelphia, where Fig. (7) demonstrates a photograph of a real steam plant which may be looked upon as a very nice artwork. And finally, Fig. (8) [6] entitled “Man as industrial palace” is an interesting artwork painted by Fritz Kahn (1888–1968). One can clearly see the hierarchy of departments within the body factory, with the center of operation located at the top of the head, namely in the brain. By simulating the body as a factory, Kahn was able to relate the body’s complex organic interior to the industrialized space. Thus, Fig. (8) can simulate a controlled chemical plant that is composed of different elements that interact with each other, similar to man’s body.

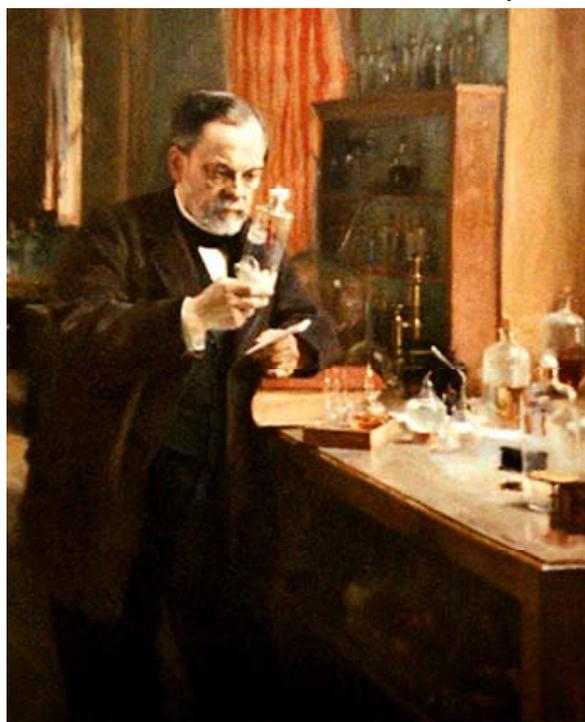


Fig. (5).



Fig. (6).



Fig. (7).



Fig. (8).

CONCLUSIONS

The author has recently established in this journal a new section entitled Engineering and Science by Arts. The present article demonstrates this approach by describing different elements of engineering by artworks. In future articles, subjects related also to Chemical Engineering and Science will be presented hoping that the readers will also apply this approach and write articles of this kind.

ACKNOWLEDGEMENT

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