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Review Article

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Cybernetics: The Forgotten Language of the Age

Hazar Shtat*

Visiting Professor at Several State Universities, Jordan

***Corresponding Author**
Hazar Shtat, Visiting Professor at Several State Universities, Jordan.

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1. Introduction

In a side office attached to one of the world's research centers, an unusual commotion is being stirred up by highly qualified professors and electrical and electronic engineers with their counterparts from the departments of theoretical and applied physics.

On the other side, a group of veteran medical professors sit recording their notes, then one of them goes to a slide display board and begins a detailed explanation of the structure of the eye… a surreal scene that may not seem coherent at first glance.

In another office attached to the same center, and perhaps to another center, a group of professors specializing in pure mathematics and others from the Department of Physical Mathematics sit with professional programmers to discuss a purely mathematical topic related to Fourier series in particular, and approximate solutions to differential equations in general.

The discussion is limited to the most precise coefficients and partial variables that when taken into consideration, contribute to achieving the highest possible practical accuracy when performing this type of calculation.

In a third, perhaps a fourth, fifth, and tenth side office, these scenes are repeated dozens of times.

2. Design Problems

2.1 Collective Effort in Modern Innovations

Contemporary designers generally suffer from many problems while converting a physical concept into an electronic circuit whose output achieves this concept, especially if these circuits require the interaction of many physical and electrical concepts.

The problem becomes more difficult if the output is linked to a linear or differential mechanical movement of high precision and designed primarily for another branch of science such as medicine or applied chemistry (magnetic resonance imaging devices, for example, or super-rotation centrifugation devices used extensively in biochemistry and applied chemistry), which requires a double joint effort between all branches of science to meet the requirements needed of civilization.

• Now Let Me Try To Explain the Concept in a Less Complicated Way

Let us imagine that one of blood analysis center needs a centrifugation device with a certain capacity and a certain rotational speed, according to certain specifications set by doctors and chemists who are experts in blood, serum, sedimentation speed, etc.

Of course, electrical and mechanical engineers are theoretically able to manufacture an electric motor whose axis rotates at the maximum physical speed allowed by the laws of mechanics, regardless of Carnot's principles and concepts of friction.

However, with the help of mechanical consultants and designers, the practical speed that can be reached in light of contemporary mechanics and motion science can be determined, especially when installing volumetric applications on the axis, "which will lead to a slowdown in the speed on the circumference, and the slowdown increases the larger the circumference, as you know."

That is, the required axial speed is originally linked to the volumetric application that will be installed on the axis, and this cannot be calculated in ultra-precision devices except with the help of mechanical engineers first and last. Also, no electrical or mechanical engineer can know the required sedimentation speed, and if they knew it, they would not design such devices on their own responsibility based on that knowledge. It is outside their scope of expertise originally, and therefore determining the sedimentation rate required to test for hemophilia, for example, is subject to the advice and guidance of doctors and biochemists specializing in blood.

Thus, we see that our new device that I intend to design with you, and which we started with a little while ago, simply needs, in addition to us, doctors, chemists, mechanics, and perhaps industrial engineers as well, to reach the optimal form when we intend to market it commercially in large quantities.

What do you think of this profitable idea?!

These were some of the problems that modern engineers and designers suffer from, problems that did not seem to constitute an obstacle to the early pioneers of innovation and creativity,

when the era of individual innovations and creativity was prevalent, ….

That era that seems to have unfortunately passed, except for rare individual cases here or there.

We are not here to mourn Edison, Michael Faraday and other inventors or genius scientists, but we are only trying to explain what is going on in the world around us now while we are sleeping in honey, content with talking about geniuses and rare talents among our neighbors and colleagues who did not have the opportunity to show that genius as a result of the lack of care, funding and attention … This may be true, but what is more true and certain is that all modern inventions are collective creativity and not individual, as is development, starting with the first uranium enrichment reactor and passing through jet aircraft and computers, and ending with the latest logic circuit whose designers have finished putting the finishing touches on it today.

• So We Can Say With Ease: The Current Inventions and Innovations Are the Result of a Collective Effort by a Group of Professional Work Teams and Not an Individual Effort

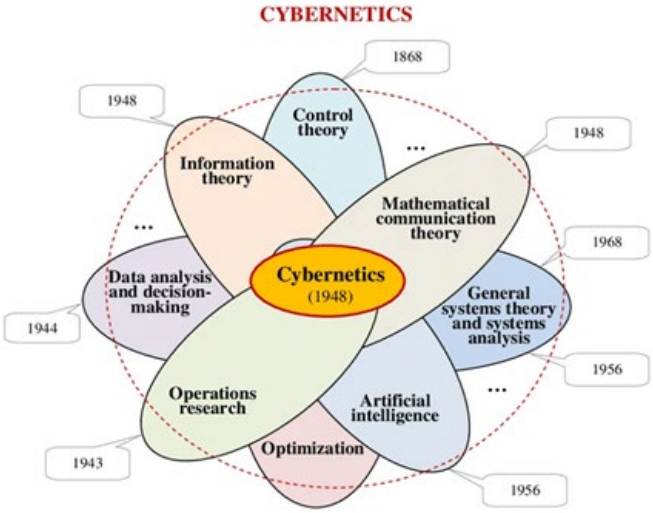

Figure 1: The Evolution of Cybernetics through out Its History

2.2 The Black Box Concept: [1]

• John Wallace, Makes and Sells Hats

The design of modern circuits, especially those with multiple layers, is based primarily on a concept called the black box, which is a fundamental concept not only in design, but in radio astronomy, spectroscopy, quantum mechanics in its classical and relativistic aspects, and other branches of science that I don't have in mind now.

It simply depends on the lowest forms of knowledge, then gradually increasing this knowledge by canceling or confirming the possibility.

let's suppose that I am ignorant of everything about the distance between the Earth and the Moon, then I somehow learned that the distance between the Earth and the Moon is farther than the distance between London and Paris, and I know in advance that the distance between London and Paris is approximately 500 km.

Here I know for certain that the distance between the Earth and the Moon is more than 500 km, it may be 600 km, I don't know, but it is definitely not 500 km, … and I may later be able to know that the distance is greater than the distance between Beirut and Paris, and I know in advance that the distance between Beirut and Paris is 4000 km, and thus I can automatically From being certain that the moon is more than 4000 km away from us, and at the same time, somehow I am able to know that the moon is closer to us than the sun, and thus I know that the moon is located at a distance between 4000 km and the sun, and the distance of assumption narrows as I learn new information, until I reach the true value or a value very close to it in the end, this may be the most scarce form of knowledge, but in nuclear engineering and astrophysics it is a basic concept until the date of writing these lines, as well as in many other branches of science [1].

Now let's leave this digression, and return to our lunar example, the distance from the moon here is a black box that needs to be known.

The same thing happens when designing an electronic circuit for a purpose, the only difference here between the moon as a black box and the electronic circuit, is that the electronic circuit is viewed as a black box through what is called virtual reality, as long as the esteemed circuit has not been designed yet…

What happens here is that I assume that I have designed it, and then I start studying it as a black box, depending on the output that it is supposed to produce, and assuming that the required circuit is a normal transistor radio circuit on the FM wave.

The Subject is Simply Viewed in Three Stages, which are:
• AC or DC input regardless of voltage.
• The Black box here is the transistor radio that I intend to design, and I will not share its profits with you when I start mass commercial production of it, and note here that I assumed that it already exists
• Audio output that makes me listen to the gibberish and noise of hard rock music against my will.

• The Subject Simply Lies in the Following Question

What is the thing that this black box is supposed to contain, which can be viewed initially as a converter of the power current from electricity to a sound wave.

The answer may be simple for you due to the simplicity of the example, but when designing more complex devices, the answer becomes more complex of course, and the answer to such questions and examples that we have presented in this haste, including our last lyrical example, falls under the name of cybernetics.. this science that has allowed us to invent many of the inventions and innovations that we see today, the most important of which are the computers that are widely spread these days, and programming languages, which are the main means of interaction of these computers with the surrounding outside world, and jet aircraft and satellites, and automation and automated mechanization in large factories, and medical and

industrial laser devices and modern medical sound and wave imaging devices, and everything we see in our lives of inventions is due to groups or work teams and not to the creativity of one person [2].

This leads us to simplify the definition of cybernetics and say that it is the scientific innovation resulting from the union of different types of science and not one science in itself. It is closer to the concept of a United Nations for sciences "without a Security Council, of course." It is also based on simplification and abbreviation whenever possible. This appears clearly in the following example, which is provided by all references and encyclopedias of cybernetics in all languages, without exception, to clarify the concept of cybernetics and its tendency to abbreviate by neglecting what is believed to be unnecessary and keeping only the necessary minimum.

The important thing is that the example tells a funny story about Mr. John Wallace, one of the owners of a tailoring workshop specializing in hat making in the suburbs of London, who wanted to advertise his workshop in an innovative way, so he brought four cybernetic scientists, asking for their advice on creating a model advertisement for his workshop, suggesting that the advertisement be in the shape of a hat on which would be written:

John Wallace: Makes and Sells Hats

• The first Cybernetician said: It is known that a hatter makes hats, and therefore this phrase is redundant and meaningless.
• The second said: A hatter is also a word that includes someone who sells hats, and therefore this phrase is also redundant.
• The third said: John Wallace?? .. The customer does not care whether you are John Wallace or James Dion or any third name, the important thing is that your hats are good.
• As for the fourth, he said: The phrase My hats written on a sign in the shape of a hat is a provocation to the customer, and an explicit accusation of stupidity, which may have a negative impact on sales, as it is clear that the shape of the hat clearly suggests to the customer that this is a hat shop and not a grocery store.

Regardless of whether the story actually happened or not, it clearly illustrates the basic principles of cybernetics, and I think you now understand the surreal images I mentioned at the beginning of the topic.

The first example talks about designing an argon laser to treat the cornea of the eye, while the second example revolves around designing an application program to deal with Fourier series with the power of the famous Mat-lab software program, and with the ease and smoothness of Mathcad.

You may be surprised if you know that there are civil and architectural engineers in addition to industrial engineers in the computer motherboard design centers in all global companies to assist researchers and engineers who develop and innovate new boards, in order to overcome some of the some stupid solutions provided by the computer for multi-layer printed boards during the occurrence of unwanted intersections, or to reduce the connection bridges, which increase energy waste, back currents and noise, which negatively affects the performance of the board in general.

So: Cybernetics is the scientific innovation resulting from the union of different types of science and not a science in itself [3].

In the future, I may try to include an electronic protection circuit 195 - 240 volts / ~, with a maximum load of 80 amperes of my own design as an individual effort, and to provide another protection circuit with the same capacity and designed by Siemens according to the finest details of Cybernetics, to compare between them, and you will find in my circuit that has been working in my home for more than five years, dozens of parts that can be overcome physically or engineeringly, once you look at the diagram of the wonderfully studied German circuit, but I hope with all my heart that you will vote for my circuit.

One Final Point worth Mentioning: in the mid-1960s, the term electromechanical cybernetics, which referred exclusively to the combination of mechanical and electrical engineering, was neutralized by the invention of a new term related to both, called mechatronics [4].

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