Where Your Computers Really Came From

by Peter Martinson

Any operation that can be performed by a machine, cannot be attributed to a human trait.

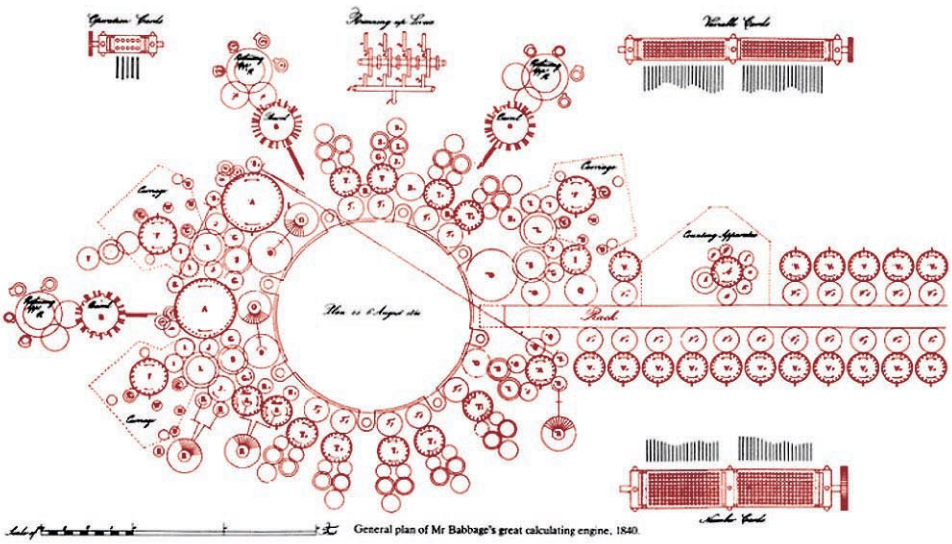
Prelude: LaRouche's Machine Tool Principle

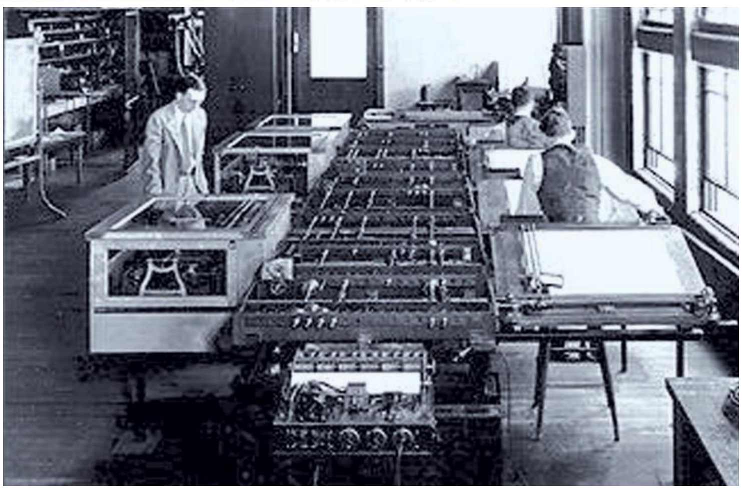
Lyndon LaRouche is the leading economic forecaster in the world. He is aided, of course, in this distinction by the world's other economists, who help him by being so incompetent. The truth, though, is that LaRouche is a typical American scientist:

> The increase of populations (for example, the potential relative population-density) of human societies, presents us with a phenomenon which is not met within the animal kingdom. Man is not an animal; the distinction of human ecology from all animal ecology, is comparable to the distinction between the chemistries of non-living versus both the living processes and the by-products specific to living processes.
>
> These distinguishing biochemical changes in the ecology of the human species, have been the special province of Russia's V.I. Vernadsky and his associates. The concept of the Noösphere is a result.
>
> As far as I know to date, the effective treatment of this distinction of human potential relative population-densities from animal varieties, has been among my unique contributions to the science of physical economy and of successful long-range economic forecasting generally.[1]

LaRouche has not only identified the present period, as being in a condition of final breakdown of the world's economic system, but has also proposed the

Babbage's 1840 schematic for his Analytical Engine. There have been no advances in the principles involved in digital computing since Babbage.





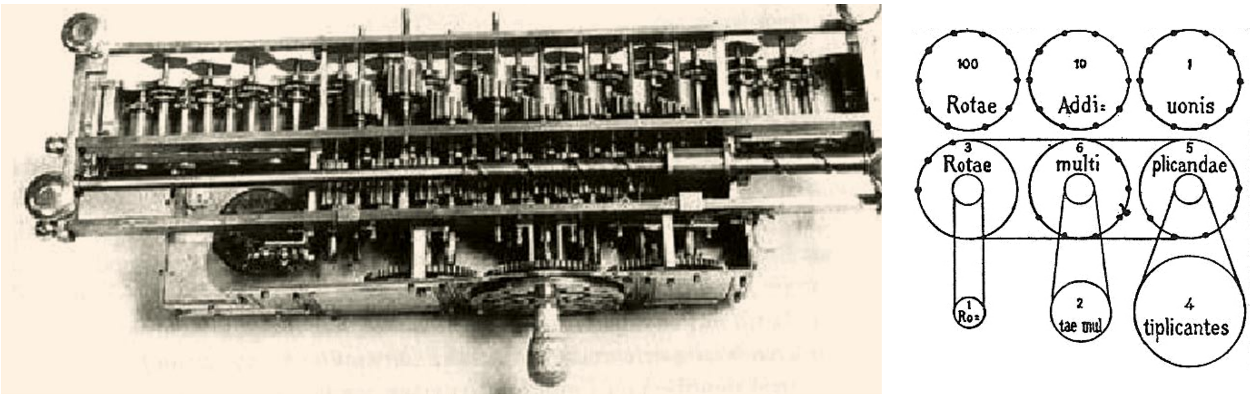
Vannevar Bush's Differential Analyzer, an analog computer which he designed in the 1930s, performed calculations by physically acting out the principles involved.

1. Lyndon H. LaRouche, Jr., "Nobel Economics Prize: The Price Is Usually Wrong!," *Executive Intelligence Review*, Oct. 26, 2007.

solution to the problem. Instead of trying to save the system, and thereby collapsing society into a horrible dark age that would literally be marked by roving bands of starving, video-shooter-game trained, adult child cannibals, LaRouche proposes to *scrap the system*, and is now demanding the passage of the Homeowner and Bank Protection Act of 2007 by the U.S. Congress, as an initial firewall to protect the people and banking institutions from the crash.

Immediately after that protective firewall is erected, the United States must enter into cooperation with Russia, China, and India, to replace the current sick monetary system with a New Bretton Woods fixed-exchange rate credit system. This new, stable system of national currency generation, organized through new national banks run by the governments, will be used to finance mega-projects, such as the Eurasian Land-Bridge and its associated crucial link, the Bering Strait Tunnel.

This would mean the mobilization, initially, of the destroyed manufacturing capability of Europe and, especially, the United States. The associated, *most crucially important*, aspect of this, would be the drive for new scientific discoveries and their implementation as new technologies. As LaRouche has described this process in many papers and public speeches, the application of new discoveries of universal physical principle to the production of, especially, basic economic infrastructure, is what increases Man's powers over the universe. The true source of economic growth, is that point of change at which a mind has



Leibniz's computer, which could add, subtract, multiply, and divide. The schematic shows the multiplication example discussed here.

Leibniz's Calculating Machine

Gottfried Leibniz, the man who discovered the Calculus and launched the science of physical economy, designed a device for performing the four basic arithmetic operations, without errors, even with huge numbers. Here is how Leibniz's calculating machine works:

The first row of wheels displays the digits of the resulting product—the ones, the tens, the hundreds, etc.—and each wheel has 10 gear-pins.

The second row is organized like the first, but the wheels have only as many pins as that wheel represents. For example, if this number is 365, then the first wheel has 5 pins, the second has 6 pins, and the third has 3 pins.

These wheels also have a smaller wheel superimposed upon them, for the multiplication.

The third row represents the number being multiplied by the second row, but the wheels are of various sizes, with diameters making a proportion with the smaller wheels of the second row that is equal to the multiplication factor. For example, if we are multiplying 124 by 365, the second row is organized as stated above, but the smaller wheels are connected by either belts or chains to the wheels in the third row.

The wheel representing the 4 is 4 times the diameter of the small circle on the 5-wheel; that of the 2-wheel is twice the diameter of the small circle on the 6-wheel; and the 1-wheel is the same diameter of the small circle on the 3-wheel. All the wheels of the second row are connected, so that they rotate at the same speed together.

Finally, the wheels in the first row are set at right angles to the wheels in the second row, so that the pins catch on each other, like gears.

Multiplication

To perform the multiplication, first rotate the 4-wheel once, which rotates all wheels of 365 four times. This rotation advances the first row to represent 365 times 4, or 1,460. Now, the first row is slid to the right, so that the 5 in the second row is above the 10s digit in the first row. Now, the 2-wheel is rotated, rotating the 365 wheels twice, which rotate the first set of wheels (not including the 1's wheel), effectively adding 7,300 to 1,460; the first row then displays 8,760.

Lastly, the two rows are slid over again, and the 1-wheel is rotated. This adds 36,500 to 8,760, resulting in 45,260. All of the motions, after the initial set up, can then be automated by a simple hand crank, or a steam-powered engine.

generated a crucial insight into a principle of the universe, and has then tested that insight against a crucial experiment.

The human mind is emphatically not a digital system. A digital system performs long chains of logical operations on integers. The real universe, on the other hand, violates simple logical systems, and always presents us with these violations as paradoxes. The human mind is unique in its ability to observe the various sense perceptions, but to see the paradoxes among them. No digital system can approximate this uniquely human sense. Computers were designed by scientists, but a mysticism has been developed around computers by crazy science fiction writers, such as Alan Turing or John von Neumann. In fact, the true history of the development of computers was never intended to design an artificial intelligence machine, but to aid the scientist in using his or her creativity. We present here a short vignette of that history, which is now placed into the proper context.

Kepler and Leibniz: Giving the Astronomer a Hand

It is said, that when Johannes Kepler first saw John Napier's table of logarithms, he wept tears of joy. Kepler spent, literally, years on simple, repetitive calculations, and even hired a young man for the sole purpose of aiding him in calculations. Despite this enormous burden of logistics, Kepler made those crucial breakthroughs upon which all of modern science is based. Those are the discoveries of, first, universal gravitation, and second, the harmonic ordering of universal gravitation throughout the Solar System.

Among his unpublished works, two letters were found between Kepler and Wilhelm Schickard. Schickard was a close friend of Kepler at Tübingen University, and both were students of Michael Maestlin. The letters represent a discussion the two had on the construction of a machine that could perform the four routine operations of arithmetic, even with very large numbers. It used a series of sliding windows, buttons, and geared vertical cylinders. It can be surmised that, given Kepler's very clear insight into the importance of scientific discovery, and the enormous impediment created by long series of routine calculations, he must have been very interested in constructing such a machine. A working version was never located.

Blaise Pascal devised a calculating machine some time later. Pascal's *Pascaline* was built on similar principles to those of Kepler's machine, but was not as advanced, as it was designed only to add and subtract, and could multiply only by means of repeated additions. He built the machine when he was 18, with the immediate intent of aiding his father in financial arithmetic. It apparently cost more effort to construct than the labor-saving involved in its use, but all future calculating machines used its core principles.

Gottfried Leibniz, the man who discovered the calculus and launched the science of physical economy, designed his own calculating device, which incorporated Pascal's addition wheels, but added a crucial third row, in order to perform multiplication and division. In Leibniz's machine, two sets of wheels performed the additions and multiplications. These wheels were placed at right angles to the set of wheels that displayed the numbers.

In his description of this procedure, Leibniz points out that, by using his machine, scientists will never incur an error in calculation, and huge numbers are just as easy to use as small numbers. As for the uses of this machine, Leibniz says, in conclusion:

> [T]he astronomers surely will not have to continue to exercise the patience which is required for computation. It is this that deters them from computing or correcting tables, from the construction of Ephemerides, from working on hypotheses, and from discussions of observations with each other. For it is unworthy of excellent men to lose hours like slaves in the labor of calculation, which could be safely relegated to anyone else if the machine were used.[2]

Leibniz clearly wanted everybody to know how his machine worked, so that knowledge could be spread as far as possible. He even tried to convince the Russian Czar, Peter the Great, to give one of his calculators to the Emperor of China. Unlike the 16th Century Paolo Sarpi and today's Bill Gates, Leibniz did not want the mechanical calculating machine to be a hidden black box, that kept the knowledge of the operations from the operator. He intended to create a society where everybody was highly educated, and scientific discoveries were the commonly discussed events. This ideal of Leibniz made him hated by the agents of the newly British-bedecked Venetian party seated in London, which deployed the "Wicked Witch of the West" Isaac Newton hoax against the great German scientist.

Charles Babbage: Saving English Science from the British

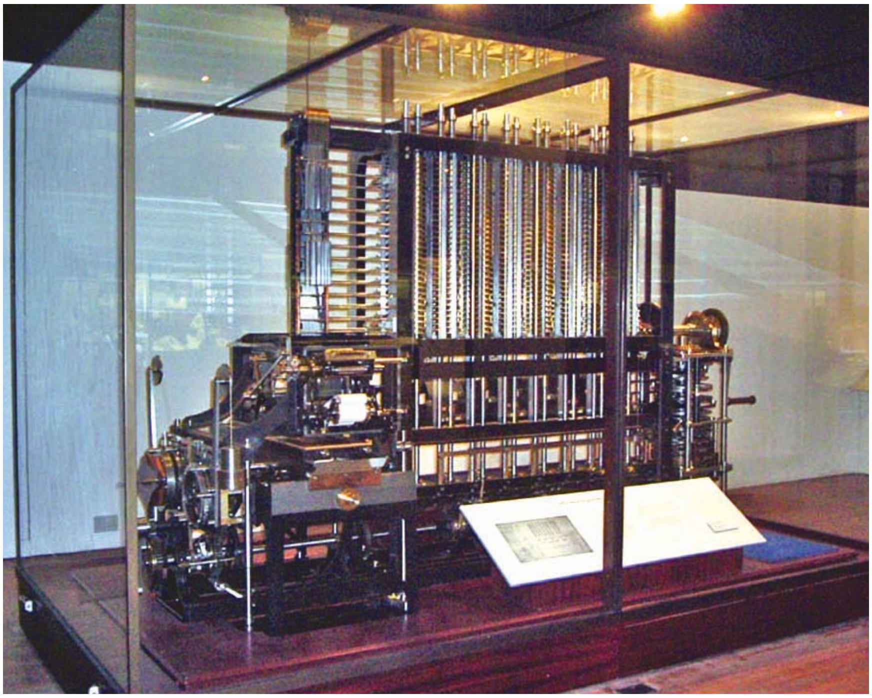
There was virtually no advance in mechanical computing technology between the death of Leibniz in 1716, and the work of Charles Babbage (1791-1871) in the early 19th Century. Babbage, and with his collaborator, England's leading astronomer John Herschel, working at Cambridge, realized that their country had become the stagnant intellectual backwater of Europe, and was lagging disastrously behind the growing economic and industrial power of the new U.S.A. In 1812 they attacked this problem, by adopting Gottfried Leibniz as their champion, and they published an attack called *The Principles of Pure Deism in Opposition to the Dotage of the University,* referring to the political decision of the Royal Society to push Newton's not-Calculus over Leibniz's Calculus. This attack prompted the creation of the Cambridge Analytical Society.[3]

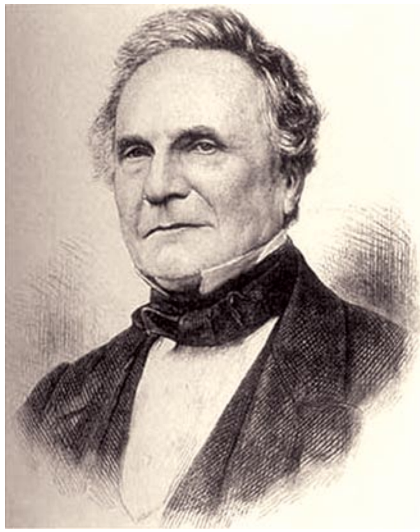
In the aftermath of Gauss's discovery of the orbit of Ceres,

---

2. From Leibniz's 1685 description of his machine, as quoted in David Eugene Smith, *A Sourcebook in Mathematics* (Dover Publications, Inc.: New York, 1959).

3. Lyndon H. LaRouche, Jr., "I Don't Believe in Signs," *Executive Intelligence Review*, July 21, 2006.





Charles Babbage (1791-1871) with a model of his last computer, the Analytical Engine, which was inspired by the use of punch card programming of mechanical looms in France.

Babbage saw the immediate need to rapidly improve the accuracy and error reduction in astronomical observational data, which had become a limiting factor in further breakthroughs. In 1823, he convinced the British government to grant him the money to build a machine capable of improving the astronomical tables used by maritime navigators for determining longitude. His *Difference Engine* was able to take a small number of manually performed calculations, and then mechanically generate a fully completed nautical almanac, all based on the initial principles of Leibniz's original calculating engine. The construction of the machine was slow, and ran into many problems, which Babbage blamed, in part, on the lack of precision in machine-tool design in England.

Before completing his Difference Engine, Babbage moved on to his more advanced *Analytical Engine,* which would be able to solve virtually any set of algebraic relationships. He was inspired by the use of punch-card programming of mechanical looms in France, designed by Joseph Marie Jacquard, and he decided to also use punch cards for his engine. He used two sets of cards:

> [T]he first to direct the nature of the operations to be performed—these are called operation cards; the other to direct the particular variables on which those cards are required to operate—these latter are called variable cards.
>
> Every set of cards made for any formula will at any future time, recalculate that formula with whatever constants may be required.
>
> Thus the Analytical Engine will possess a library of its own. Every set of cards once made will at any future time reproduce the calculations for which it was first arranged.[4]

This machine was also never completed. Babbage had designed a yet more efficient machine, for which he believed "... it will take less time to construct it altogether than it would have taken to complete the Analytical Machine from the stage in which I left it."[5]

Lyndon LaRouche has noted that the principles established first by Leibniz, and then furthered by Babbage, are the core of all modern digital computers. The only advances made in this domain were in the types of materials used, and the technology used in manufacturing. The inverse of this is, that no advances in the principles involved in digital computing have been made since Babbage. Faster calculation is not, in itself, a technological advance. Of course, this statement disregards the development of Analog Computers, which are more analogous to the designs of machine tools than are digital systems.

Vannevar Bush: A Typical American Scientist

Vannevar Bush (1890-1974) wrote in 1945:

> Two centuries ago Leibnitz [sic] invented a calculating machine which embodied most of the essential features of recent keyboard devices, but it could not then come

4. Charles Babbage, *Passages from the Life of a Philosopher,* cited in Herman A. Goldstine, "A Brief History of the Computer," *Proc. of the Am. Philosophical Society,* Vol. 121, No. 5, October 1977.

5. Lord Moulton, "The Invention of Logarithms, Its Genesis and Growth," *Napier Tercentenary Memorial Volume,* ed. C.G. Knott (London, 1915).

into use. The economics of the situation were against it: the labor involved in constructing it, before the days of mass production, exceeded the labor to be saved by its use, since all it could accomplish could be duplicated by sufficient use of pencil and paper. Moreover, it would have been subject to frequent breakdown, so that it could not have been depended upon; for at that time and long after, complexity and unreliability were synonymous.

Babbage, even with remarkably generous support for his time, could not produce his great arithmetical machine. His idea was sound enough, but construction and maintenance costs were then too heavy. Had a Pharaoh been given detailed and explicit designs of an automobile, and had he understood them completely, it would have taxed the resources of his kingdom to have fashioned the thousands of parts for a single car, and that car would have broken down on the first trip to Giza.

Machines with interchangeable parts can now be constructed with great economy of effort. In spite of much complexity, they perform reliably. Witness the humble typewriter, or the movie camera, or the automobile. Electrical contacts have ceased to stick when thoroughly understood. Note the automatic telephone exchange, which has hundreds of thousands of such contacts, and yet is reliable. A spider web of metal, sealed in a thin glass container, a wire heated to brilliant glow, in short, the thermionic tube of radio sets, is made by the hundred million, tossed about in packages, plugged into sockets—and it works! Its gossamer parts, the precise location and alignment involved in its construction, would have occupied a master craftsman of the guild for months; now it is built for thirty cents. The world has arrived at an age of cheap complex devices of great reliability; and something is bound to come of it.[6]

Bush testing out the Profile Tracer, his first machine, built in his engineering doctorate program. It formed the basis for his next invention.

Franklin Delano Roosevelt understood the necessity of scientific advancement for national security. During World War II, the involvement of science in the war effort was not only required in the development of new, more powerful, and longer-range weaponry, but also in aiming the new ordnance. Accurate trajectory charts for the various ballistic weapons, including underwater weaponry, were in high demand, but they required astronomical amounts of calculation to produce.

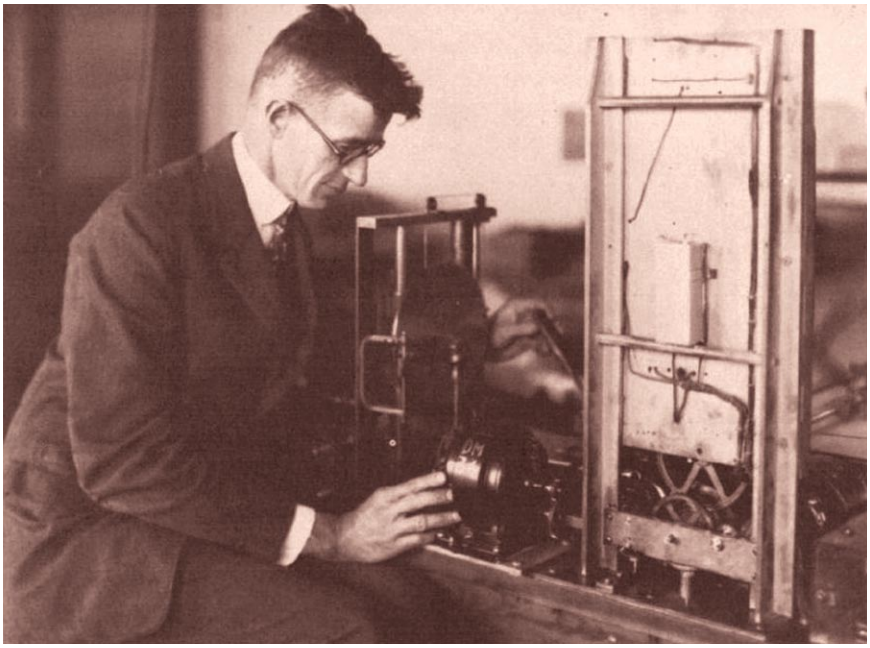
Vannevar (pronounced like "achiever") Bush had already been concerned about producing number crunchers, in the tradition of Leibniz and Babbage. Just before the war broke out, the Army Ordnance Department had commissioned Bush to apply his machine shop at MIT to the calculations of ballistics trajectories. He had been working on improving his *Differential Analyzer* since 1931, and was assembling a new, more powerful version. This machine was an advance on both Leibniz's and Babbage's devices, in that, instead of calculating using only discrete steps of integers, it could perform *continuous* calculations. This *analog computer*, which performed calculations by physically *acting out* the principles, opened up the prospect of applying mechanical calculation to problems involving the integral calculus.

The Differential Analyzer used principles similar to Leibniz's engine, but, instead of displaying a set of digits representing the solution to the problem, it could be set up to draw a smooth curve on a drawing board, and it could even take as input a curve that a person traced on a piece of paper. To accomplish this, Bush replaced the orthogonal gears of Leibniz with smooth disks, one rotating to turn the other. The greatest source of error, initially, was transmitting the small, precise rotations through yards of machinery to the output table.[7] This technical problem was solved by the machine-tool designers at Baltimore's Bethlehem Steel, who designed the *torque amplifier,* which amplified the smallest, weakest rotations into powerful cranks.

Bush built his first machine, called the Profile Tracer, to obtain his doctorate degree in engineering. This machine was slung between two bicycle tires and pushed like a lawnmower. As it moved, a pen inside would continuously draw the changing elevation of the land onto a rotating drum of paper, producing a virtual photograph of the cross section of the land traversed. The mechanism inside the Profile Tracer formed the basis for his next machine, made purely for calculation—the Product Integraph. This device, built with his student Herbert Stewart, was the key

6. Vannevar Bush, "As We May Think," *Atlantic Monthly*, July 1945.

7. For a pedagogical example of this, please see Sky Shields's construction of the catenary curve in this issue.



Vannevar Bush with his Product Integraph on his Differential Analyzer, 1927. The Integraph performed integral calculus using an array of rotating wheels. The Differential Analyzer used several of these, and was the fastest, most accurate calculating machine during World War II.

to performing integral calculus using an array of rotating wheels.

Stewart's plan had been to observe the output at specific time intervals, but Bush recommended attaching a pen to it, to draw a smooth curve that represented the integral itself. The Differential Analyzer used more than a dozen of these Product Integraphs, in a structure half the size of Bush's laboratory. By the end of the war, it was the most important calculating machine in the United States, as it was the fastest and most accurate producer of trajectory tables.

The development of the principles governing the functioning of analog computers lost all funding after the death of Roosevelt. At that point, the new program of Cybernetics, driven by London through Columbia University, had virtually taken over. Norbert Wiener, Bush's former student, had been installed as the head of MIT's Research Laboratory for Electronics,[8] and all research was now directed towards development of the digital computer. In Wiener's new recommendations for development of the computer, he specified:

> That the central adding and multiplying apparatus of the computing machine should be numerical, as in an ordinary adding machine, rather than on a basis of measurement, as in the Bush differential analyzer.[9]

Today, Bush's Differential Analyzer sits in a museum case in the basement of MIT, while the digital computer, operating with no advance over Babbage's Difference Engine, has become the false symbol of "technological advance." Each somewhat faster component is advertised as a great breakthrough, although the principles remain the same.

To sharpen the point about computing machines, it should be sufficient here to state, once again, the difference between Man on the one side, and both animals and computers on the other. The great hoax, is the promotion of the idea that Man can be studied as either a social animal, or an advanced computer. As any of the scientists just described knew, because human beings are not computers, computers cannot perform science.

Inverting this, any operation that can be performed by a machine, cannot be attributed to a human trait. Mathematical calculations are purely logical deductive procedures, which humans can, of course, do. But, human scientific discovery is not an epiphenomenon of calculations. For example, Karl Gauss was known for his titanic calculating abilities, yet his work was not an outgrowth of his calculations. He knew that calculations were merely a necessary, albeit *mechanical*, tool for precisely locating those *paradoxes* which lay between measurements taken from various senses.

The human mind was not modelled on the design for the digital computer; therefore the mind cannot be assumed to follow the rules of those machines. But, Lyndon LaRouche has demonstrated that true economic growth must proceed from an increasing density of discoveries, per person. There are principles bounding the creative abilities of the human mind, and they are knowable principles. But, they are not found by looking at how computers or animals work.

So, get your sticky hands off that computer keyboard or joystick, and go use your creativity! For starters, begin with Kepler's discovery of universal gravitation, followed by his discovery of the harmonic ordering of the whole Solar System, at http://www.wlym.com/~animations. And get political—it's more fun being creative during a renaissance, than during a dark age.

Peter Martinson is a leader of the LaRouche Youth Movement in Seattle. His article previously appeared in the LYM-authored pamphlet "Is the Devil in Your Laptop?"

---

8. Wiener, who got his start when Bush appointed him to head up the anti-aircraft ordinance department, faced the problem of targetting a German Luftwaffe diver bomber, which moved just as fast as the bullets used to shoot it down. He made some unique innovations, including his concept of *feedback loops*, in modelling the targetting of a weapon after the mind's control over the human body. Wiener then went off the deep end, when he started modelling the mind after weaponry control systems.

9. Norbert Wiener, *Cybernetics* (New York: MIT Press, 1961).