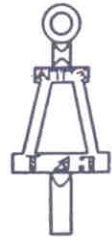


The Simulation of Human Activities by Machine



First Prize winning entry in the Fall Tau Beta Pi essay contest.

The growth of the electronic brains over the past two decades has stimulated much thought on the question of where does the machine stop and real creative thought begin.

By Kenneth Steiglitz

MAN has, in the few seconds of all eternity that he has been scuffling around on this earth, achieved a remarkable understanding of the universe around him. He has constructed complex machines, capable of a wide range of activities. What is more remarkable is that he has done most of this in the last two thousand years, and more in the last two hundred years than in the last two thousand before. Each new discovery has made possible even more discoveries, and this cumulative effect has brought us to the maddening, yet ever increasing pace of the Twentieth Century. One of the characteristics of the machines that man has constructed has been the ability to simulate human activities. In certain areas of activity, machines can outperform humans—the giant arm of a derrick replacing the feeble arm of a man, or the whirring desk calculator replacing the plodding brain. Surely, there are areas where humans have not yet met competition from machines; and certainly, without wonderful human minds to guide them, all present machines would quickly stop functioning. It is not that man has simulated himself to such a great degree; but rather that he has done so much in this direction in so short a time, with ever increasing promise for yet greater achievements. It will be our purpose here, then, to investigate those areas of activity where humans have been simulated, and to speculate as to the limits of this simulation of living organism by unliving organism.

René Descartes, in the Fifth Part of *A Discourse on Method* argues that if a machine simulating a human were to be built, it would be a mere collection of organs, and that

these organs . . . need a particular arrangement for each particular action; whence it must be morally impossible that there should exist in any machine a diversity of organs sufficient to enable it to act in all the occurrences of life in the way which our reason enables us to act.

Descartes has ignored the possibility of thinking machines, and understandably so. He has done so because his definition of thinking is intuitive and subjective, being intimately related to the notion of consciousness. Since we are concerned for the moment only with the simulation of human activity, we will consider as thinking *any process which produces the same outward effect as the conscious thinking of Descartes*. Then the question of whether there is an essential distinction between the two processes, one of which we would call thinking only under our definition, must now remain unanswered. The fact remains that the possibility of thinking machines is the key to our present discussion, for if we limit ourselves to non-thinking ma-



This apparatus is part of a larger system capable of simulating new devices used to test theories or design concepts in speech and video work. The men engaged in the design of many new devices have been replaced by those engaged in the design of this one simulation device.

chines, we can never hope to construct anything more than elegant and useful tools which must be guided in every action by human decision. Armed with our new and broader definition of thinking, we may freely talk of thinking machines, both actual and hypothetical; but let us not forget the Cartesian and humanistic conception of thinking, and let us not forget our unanswered question.

The fact that man has been successfully building thinking machines of a significant complexity only in the last two decades emphasizes the explosive nature of technological progress. Already, high speed digital computers have been programmed to play a fine game of checkers and a fairly respectable game of chess. The quality of game playing programs is limited only by the speed and size of the computer, since the level of analysis is determined only by the time-per-move or the space limitations of the computer's memory. Thus, we can confidently expect that our chess masters will eventually be outclassed by an IBM product; probably within ten or twenty years. Programs will be written which will translate languages, and there are formula translation programs which write programs from what is essentially an algebraic statement of a problem. The computer is becoming more and more independent of specific human direction.

Just how good a simulation do such programs provide? One may claim that such blinking lights and twirling of tape reels is devoid of creative activity. But just what is creative and what is not? Computers are capable of writing fugues. If one cannot distinguish between fugues written by a digital computer and fugues written by a human, are we to credit the human composer with creativity, but deny the electronic device our compliment?

Low temperature research gives promise of providing the computing field with a superior memory device. Solid state electronic devices will probably replace inefficient vacuum

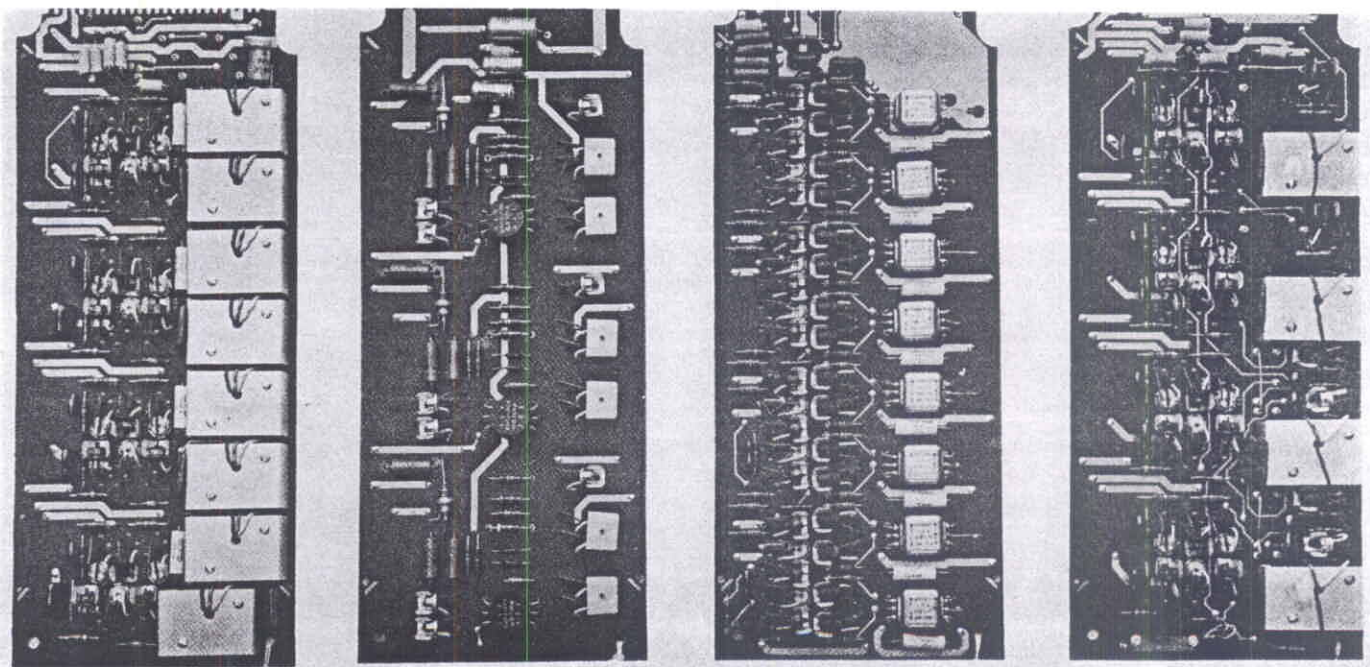


WHAT, ME WORRY?

Kenneth Steiglitz, E.E. '59

The Wunderkind of the E.E. department had his essay chosen over thirty others in the Tau Beta Pi essay contest. The other organizations boasting of his membership are Eta Kappa Nu and AIEE-IRE of which he is treasurer. He plans to continue his studies on a graduate level.

tubes in a few years. And each new thinking machine will make possible more research; so that better thinking machines will be possible. Will we always be able to draw the line between our minds and those of our machines? All our questions return ultimately to our original unanswered question: Is the activity of thinking tied ultimately to the humanistic and subjective concept of consciousness, or are two activities which produce the same outward effect completely equivalent? Clearly, whether the two activities are completely equivalent or not is immaterial as regards ends, since the fact that they produce the same outward effect assures us that the consequences will be identical. Thus, we may envision an ever increasingly complex society of machines independent of human direction. Whether these machines will be conscious or unconscious remains unanswerable. And will not these machines be subject to the same pitfall that humans were subject to—the pitfall of being replaced by one's own creations? We may therefore add to our envisioned society an ever changing stream of artificial organisms, each the product of its predecessor and the creator of its successor. We may at first revolt at such an idea, but why cannot such a thing be in the order of things?



This magnetic memory device stores information concerning a multitude of aspects of an industrial mechanical process. When certain circumstances in the functioning of the mechanical plant arise, this device transmits instructions to the machines needed to meet the demands of the circumstance. The device replaces a great deal of manpower requiring only a few men to supervise its operations.