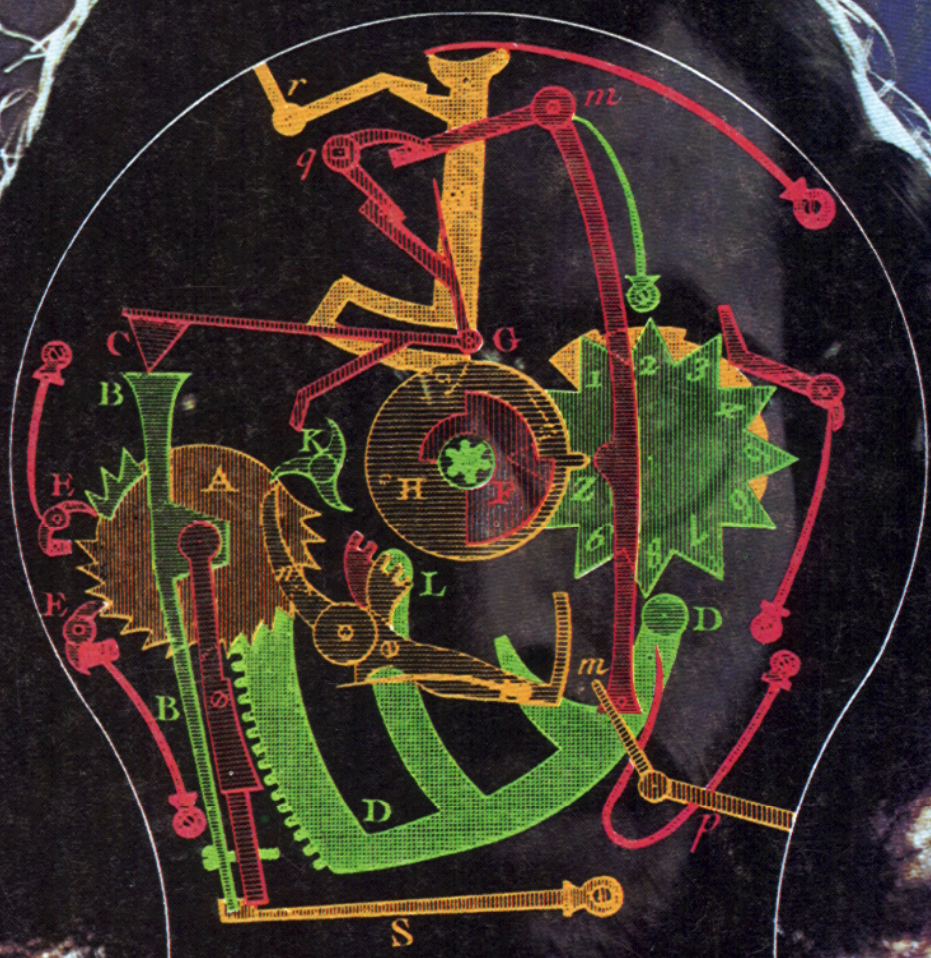
APRIL 1969 ONE DOLLAR

ICD

psychology today



MAN AND MACHINE

A BELT FROM BIG BROTHER

by Robert L. Schwitzgebel

THE 21ST CENTURY CHILD may well spend part of his school day in a nine-foot opaque spheroid "learning center"at home. Inside the spheroid will be a two-way T.V. set, a teaching machine with a typewriter connecting the student to the school's computer center, food and token dispenser, 360° color-variable lighting, temperature regulator, microfiche encyclopedia and reference library, tactile communication pad, and stereophonic speakers. After his music-appreciation class, the child might work through a program of elementary biology, and–having demonstrated a certain level of competence–be eligible to go on an afternoon field trip to the zoo.

Other new educational structures are likely to take the form of life-size mazes. A giant model of the human body might be used to teach anatomy à la *Fantastic Voyage*. Such giant models are not entirely a matter of speculation–an educational mazelike apparatus has already been built by the Monsanto Chemical Company at Disneyland. Seated in a capsule-shaped chair, listening to stereo speakers, one proceeds through an array of lights and sounds that represents a journey through the inner space of a snowflake. The Monsanto ride is an enjoyable and almost awesome experience, and occasionally a small child or a stoned hippie becomes frightened, believing he has shrunk.

Machines

Single technical innovations often affect our lives to a degree unforeseen by the originator. As a young speech therapist, Alexander Graham Bell was originally interested in creating a therapeutic device for people socially isolated by deafness and mutism. His funds for the early demonstration of the telephone came from stockbrokers, and although it is still used today primarily for business purposes, the telephone shows how technology can alter the means and form of our social contacts. Because of the phone we interact with larger numbers

"... We are now using a miniature two-way radio unit, housed in a wide leather belt.... The sender activates a ... tap in the abdominal region.... The devices seem to be quite acceptable to adolescent delinquent males...."

"... We are now planning to increase the belt's circuitry to monitor physiological responses and to alert the therapist whenever the wearer moves outside a limited area...."

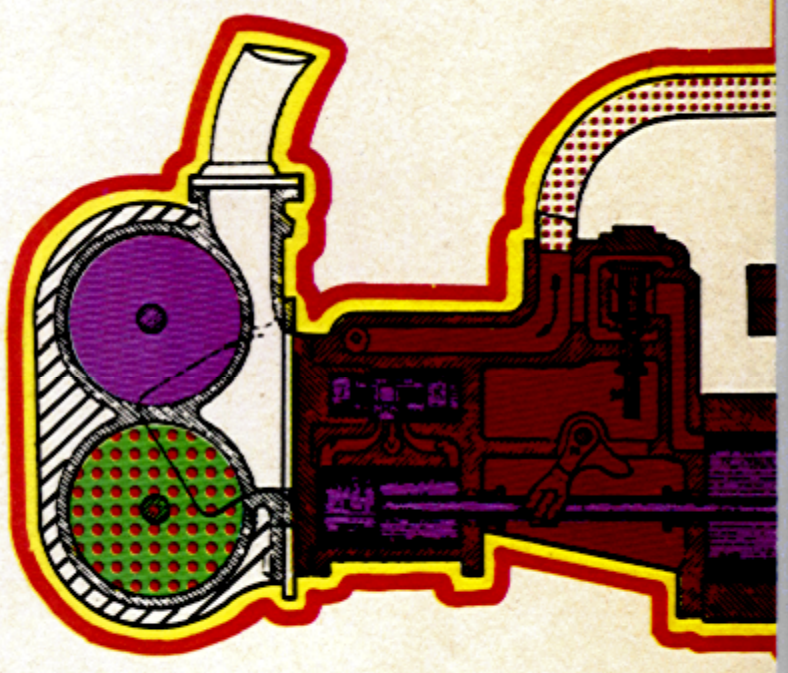
of people for shorter periods of time. And some people, like teenagers and call girls, could actually be considered creatures of the phone.

Psychologists have now begun to design electromechanical devices that one hopes will produce more predictable changes in human behavior. Although the efforts of these psychologists are not organized, there is little doubt that "behavioral electronics," "behavioral engineering," or "social instrumentation" will increasingly dominate the fields of psychotherapy, education and social administration. We can define "behavioral engineering" as the application of electromechanical technology to the understanding, maintenance and modification of human behavior. Such engineering will be, almost by definition, *interdisciplinary* and utilize specialties as diverse as politics and biochemistry. And the social effects of man–machine systems will likely become a distinct area of academic and technical concern—a discipline in itself. Before I speculate further, however, it may be useful to mention a few of our present behavior-modification machines.

Today at least 50 different devices are being used experimentally for psychotherapy. As early as 1904, a device consisting of a quilted pad and an electric buzzer was suggested for the treatment of bed-wetting. A modified version of this apparatus was reported by O. H. and W. M. Mowrer in 1938, and subsequently the "Mowrer sheet" has become the most common and widely used apparatus specifically designed to modify behavior disturbances. Two models are available through the Sears, Roebuck catalog. The most sophisticated versions of this device use a pad electrode that, when activated by a small amount of urine, triggers tape-recorded instructions telling the child to get up. After approximately one minute of silence, a buzzer or mild electric shock operates until it is switched off.

Behavior therapists believe that unwanted behavior is often the result of a failure to deliver appropriate consequences, either punishments or rewards, at the proper time—that is, immediately after a particular behavior occurs. In order to provide such immediate (contingent) consequences, portable electric shock devices have been invented and used to suppress smoking, nail-biting, homosexuality, drug addiction and obsessional thoughts. A patient using one device receives a shock each time he opens his cigarette case; in another instance, writer's cramp is treated by a shock from a pressure-sensitive pen.

A so-called "tic-chair"—a swivel-tilt armchair with a large U-shaped magnet attached to the back—can measure the frequency and intensity of neuromuscular tics and deliver appropriate consequences. When the patient sits still, he



receives a positive stimulus (music) through his earphones; if he moves suddenly or "tics," the music is replaced by an aversive or negative consequence (loud noise).

A number of other devices have been used to facilitate deficient but acceptable behavior between people. Miniaturized battery-operated speaker packages have been prescribed for persons with insufficient voice volume. Stuttering has been inhibited by sending metronome rhythms through small earphones.

Bleeps

A common problem in the treatment of psychological disorders is the failure of clinically produced behavior to occur routinely in the patient's normal surroundings. One obvious approach to this problem is to design portable apparatus that will either allow the therapist to

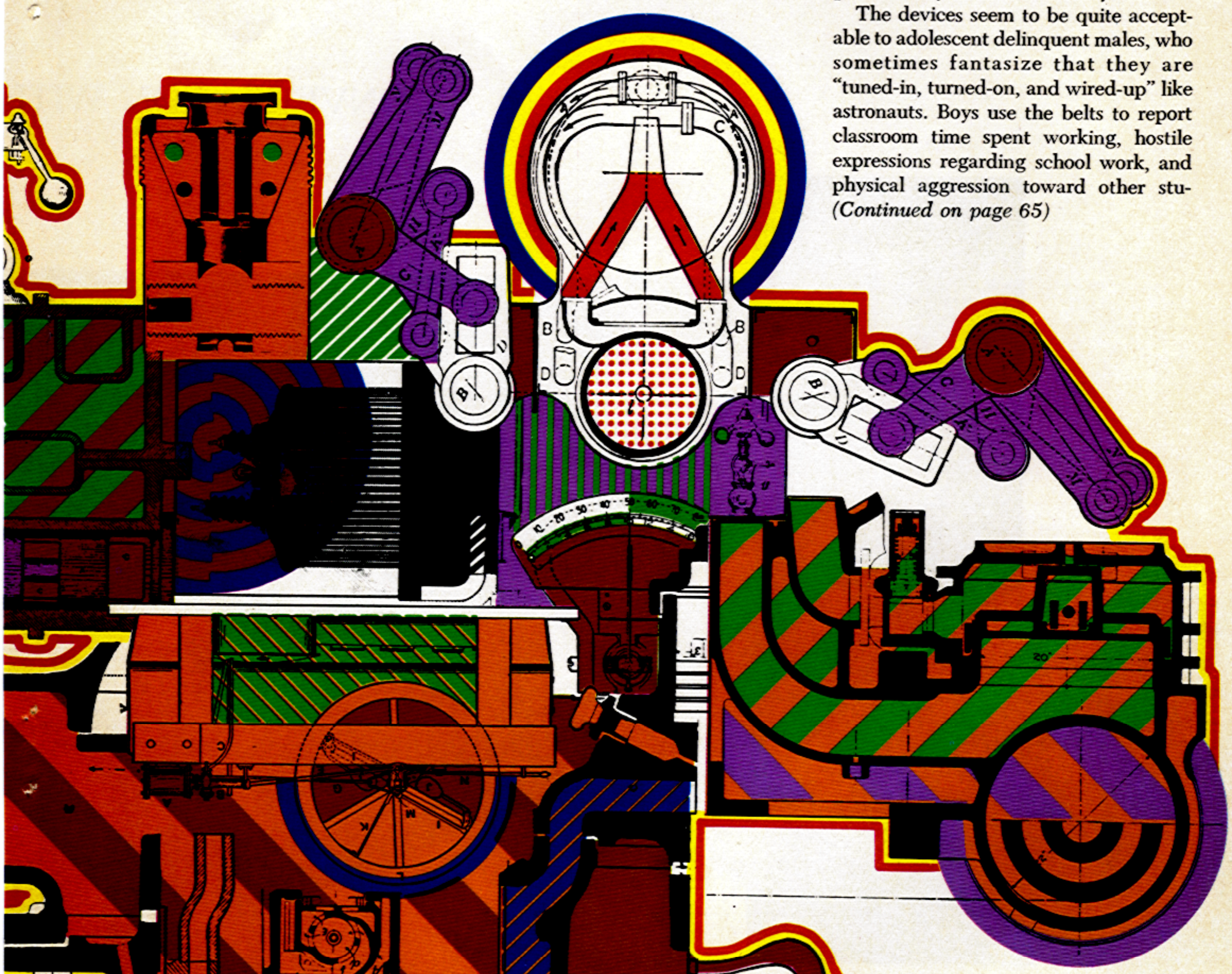
communicate with the patient after he leaves the clinic or provide stimuli necessary for change when needed. Such apparatus can neither be grossly uncomfortable nor restrict normal activities; it must be able to detect wanted or unwanted behavior, operate precisely and reliably, and deliver consequences effective for the particular patient. A sophisticated and successful portable instrument of this type has been used by Nathan Azrin and his colleagues at the Anna State Hospital (Illinois) to prevent poor posture or slouching. A shoulder switch controls a small speaker that clicks once, then three seconds later, bleeps an embarrassing sound at the sloucher if he has failed to straighten.

A few years ago, my colleagues and I began exploring the possibility of providing therapist-controlled positive reinforcement for juvenile delinquents in natural settings. The model we are now using is a miniature two-way radio unit, housed in a wide leather belt that contains the antenna and rechargeable batteries [*see illustration, page 46*]. By pressing a button on the belt, the sender activates a small coil on the receiver's unit that makes itself felt as a tap in the abdominal region, accompanied by a barely audible tone and a small light.

Information is conveyed by a coded sequence of taps. We had originally planned to use verbal communication, but quickly discovered that this not only disrupts the activity of the person who receives a message, but also disturbs the FCC, which does not approve of the language delinquents tend to use. A simple arbitrary code works fairly well.

The devices seem to be quite acceptable to adolescent delinquent males, who sometimes fantasize that they are "tuned-in, turned-on, and wired-up" like astronauts. Boys use the belts to report classroom time spent working, hostile expressions regarding school work, and physical aggression toward other stu-

(Continued on page 65)



"... Portable electric shock devices have been ... used to suppress smoking, nail-biting, homosexuality, drug addiction and obsessional thoughts...."

A Belt from Big Brother

(Continued from page 47.)

dents. The reports are checked by classroom observers, and when the subject's behavior improves, the experimenter sends a signal indicating that the subject has earned some positive consequence—for example, bowling at the Student Union.

Limited field tests indicate that all reported behavior increases—whether or not it is rewarded. That "someone cares" is perhaps more important than *what* they care about. Furthermore, that this care is expressed by a vibra-tactile thunk is not crucially important. To the recipient, it easily becomes a pat on the back or symbolic praise. Someday we may store such expressions of concern electronically in machines, much as a lovely 17th Century sonnet (a verbal pattern) is now stored in a 50¢ paperback.

An "electronic parole system" using similar belts is being developed to monitor a subject's location and certain physiological responses. Conceivably a device could alert the wearer whenever his specific responses (nervous gestures, anxiety reactions, verbal or physical activity) exceed or fall below an optimal level. Eventually monitoring may include high blood-alcohol level or other likely precursors of illegal behavior. The parolee can then be warned or rescued before he commits another offense.

The deterrent function of an electronic parole system is based on the assumption that we can suppress unwanted behavior most effectively by applying mild punishment for every transgression rather than administering infrequent, strong punishment. To what extent we can define the precise psychological and social context of an illegal act, and in what ways we can prevent political abuse of such technological alternatives to imprisonment, are questions very much unanswered. But the answers should make possible a less expensive and much more humane means of both protecting the public and controlling illegal behavior.

A broader and more positive approach toward shaping behavior is also possible. Why not shift a small proportion of our $71-billion defense budget from the development of weapons to the development of devices for measuring and reinforcing behavior of large groups? An online computer at the United Nations, using sampling methods as we do in elections, might monitor the degree of cooperation and conflict between member nations. Cooperative nations or leaders could then receive frequent social or monetary recognition. Or in our traffic-congested cities, "bonus parking meters" (ones with green flags, in addition to the present red flags, indicating a small rebate on motor vehicle registration fees) might be placed in locations where parking causes minimal inconvenience.

Not too many years ago in England, a law required that every moving automobile be preceded by a man on foot, waving a red flag. I believe that creative behavioral engineers may be able to make our laws—measures that prompt acts of war, overpopulation, and environmental pollution—seem equally absurd.

Hook-ins

Many of the behavior-changing machines or machine systems I've mentioned are attached, in one way or another, to humans. These humans are thus attached to or wired into larger systems that represent electromechanical patterns of accumulated human wisdom and labor. Man–machine integration frightens or disgusts many people. Erich Fromm, for one, cries eloquently that man is being built into his machines and hence dehumanized and degraded. Historical analysis does not, however, sustain this complaint.

Man has traditionally thought in terms of systems or patterns, and has always thought of himself as *an element* in such systems. Whether pagan, theological, naturalistic or scientific, these have inevitably consisted of (1) objects or factors isolated for observation, and (2) imaginary or theoretical frameworks devised to connect or explain these observations. The result of this structuring is something we might call "a functional analogy" or "metaphor." When we speak of a "will of iron," or even a "train of thought," we are simply connecting, by way of perceived analogy, certain aspects of ourselves and certain aspects of the natural or man-made world.

It would seem thoroughly *natural* therefore to analyze the continuities and similarities of what we now think of as physical, biological and psychosocial systems. A "General Systems" approach suggests that we can describe all organized phenomena—including "us"—in terms of systemic structure and function.

A very simple model of human behavior might include the following elements: energy and information inputs, a decoder that interprets the input, a memory subsystem, a decision-making unit, internal monitoring and regulating circuits, and some form of output. One advantage of this type of model is its applicability to both living and nonliving systems.

Given such a model, we see that electronic computers have certain subsystems or functions similar to those of human beings, and to the extent that such subsystems are shared, substitutions presumably can be made. We should be able to substitute an electromechanical device at man's input or output boundaries or use it between subsystems. Our limited use of artificial limbs, hearing aids, lung machines, and cardiac "pacemakers" demonstrates a degree of functional analogy between living and nonliving systems.

Certain key human subsystems, for example, memory and decision-making (thought) already have been crudely mimicked or reproduced. The computer's ability to store and retrieve data, or to "decide" complexly (as when making orbital corrections) is even now formidable and worthy of respect. Possibly the most complex and unique "interfacing" apparatus, constructed in an Air Force laboratory, demonstrated that people—aided by a computer—could type out messages through voluntary control of an electroencephalograph or "brain wave recorder."

In time to come, when men transport themselves across the solar system by radio-telegraph (a prediction of Norbert Wiener's) and life spans are measured by radiation count rather than by the speed at which the Earth revolves around its sun, our descendants may experience pleasures and terrors we cannot imagine. Their machines may be as incomprehensible to us as our energy-transformation devices (the transistor, for example) would be to an 18th Century technician who thought only in terms of the mechanics of the steam engine.

I believe it is safe to say that man–machine relationships will take place on increasingly intense *esthetic* levels, too. Many people are, at present, ready to concede a certain "esthetic quality" to man–machine integration of the blacksmith-at-his-forge variety. But we can do better than that. Alexander Calder's massive arrangement of mobiles decorating the ceiling of an auditorium at the University of Caracas moves beautifully and at the same time cushions sound and distributes light throughout the hall.

Behavioral engineers are lucky, I think. They are preparing to invite men to a feast of new sounds and sights and feelings so powerful, wonderful and compassionate that the word "men" will not adequately describe them.