

# Behavior modification:

## Here, there and everywhere

by Robert J. Trotter

*When B. F. Skinner published his bible on behavior analysis, outcries reverberated through all segments of society (SN: 8/7/71, p. 96). Psychologists, psychoanalysts, poets, preachers and politicians charged that in Beyond Freedom and Dignity Skinner had equated people with pigeons and rejected those qualities that set humans apart from animals. But the humanists weren't the only ones out to crucify Skinner. Some doubting Thomases among the behaviorists denied their master's philosophy while continuing to practice his techniques. One reason they and a host of pragmatic practitioners continue to operate in the Skinnerian mold is the immediate positive reinforcement it provides. In other words, the scientific model of behavior modification works. It produces the desired effects rapidly and efficiently. So, regardless of philosophical implications, behavior technology is being used increasingly on a variety of levels in a variety of areas.*

*In a three-part article SCIENCE NEWS looks at the widespread applicability of behavior technology and at some of the many ongoing examples of behavior modification at work.*

### Achievement Place: A behaviorally oriented treatment program for juvenile delinquents

In the 1950's juvenile delinquents had greasy ducktails, black leather jackets, bicycle chains and zip guns. In the 1970's this particular stereotype is seen more often on the stage than on the street, but juvenile delinquency still exists and is a problem. It is a status characterized by antisocial behavior (truancy, waywardness or incorrigibility) that is considered to be beyond parental control and therefore subject to legal action. For many such youthful offenders (usually between the ages of 11 and 18) legal action means confinement in a state institution. This keeps them off the streets but does little to correct delinquent behavior or teach socially acceptable behavior. Researchers in Lawrence, Kan., are attempting to change this situation by reeducating delinquents in a controlled environment designed specifically to overcome behavioral difficulties.

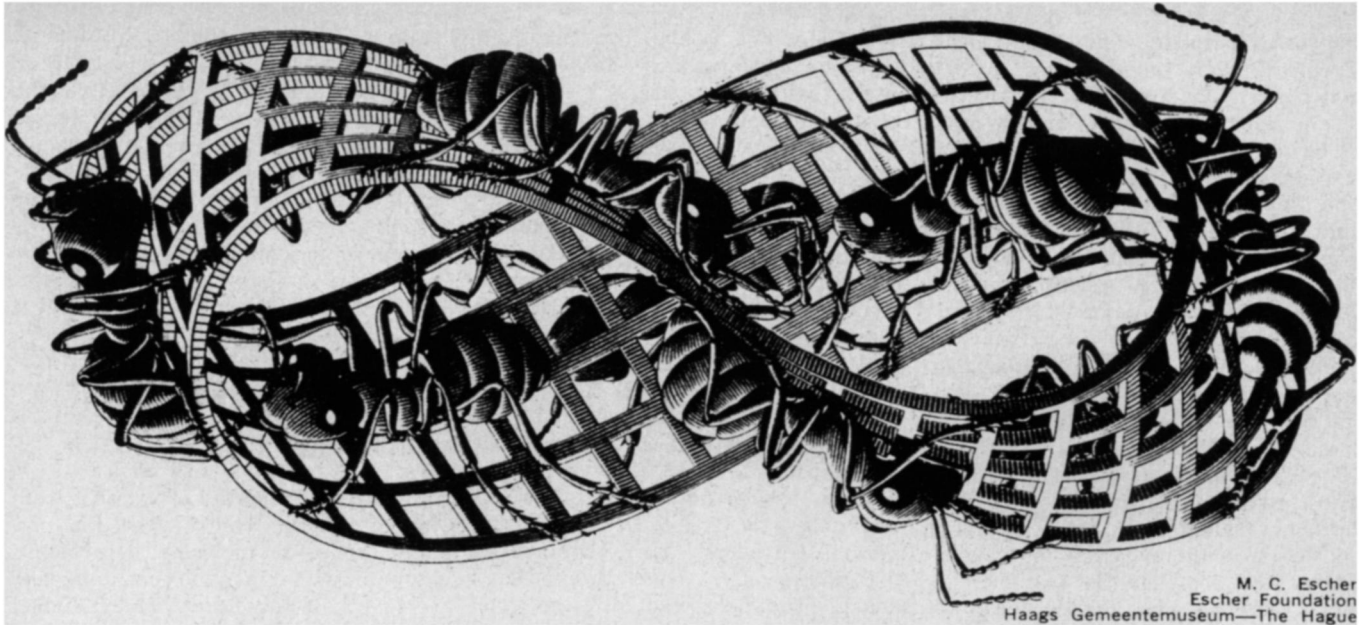
The model environment they are using is called Achievement Place. It consists of a residential home, two teaching-parents and seven or eight boys or girls (11 to 16 years of age) who have been sent there by the Juvenile Court or the Department of Social Welfare in the community. The home is run according to the principles of behavior modification and its goals are to educate youths in academic, social and self-care or vocational skills.

Most youths sent to Achievement Place are having trouble in school. Truancy, tardiness and disruptive behavior have usually led to suspension or dropping out. A great many factors are involved in producing such behavior but lack of motivation is often the major problem. These students don't care about getting an education and see no

connection between doing well in school and success in later life. One way to change the situation is to make the rewards of doing well in school more immediate and more tangible. Students at Achievement Place go back to or remain in their community school, but immediate feedback and positive reinforcement are provided by a token or point system. Each student has a daily report card. Teachers in each class sign the card and note whether or not the student has behaved in class, completed homework or other assignments and performed adequately on tests or exams. Back at Achievement Place the student is given points for all desired behaviors. Points, in turn, can be used to purchase a variety of privileges (free time, trips, spending money).

Elery L. Phillips, Dean L. Fixsen and Montrose M. Wolf of the University of Kansas in Lawrence helped design and put Achievement Place into operation. They report that before using the daily report card, students spent about 25 percent of their time in appropriate study behavior. Using the card and token system increased the figure to almost 90 percent. An average of one letter grade increase was common for most students after a nine-week period. Gradually, as appropriate behavior is learned, the supportive system is removed and students are returned to the normal feedback system.

School, however, is only part of the problem for many delinquents. In the Achievement Place home, teaching-parents (trained in human development at the University of Kansas) instruct their wards in such things as proper social interaction, personal cleanliness and community involvement. Specific behav-



M. C. Escher  
Escher Foundation  
Haags Gemeentemuseum—The Hague

ior goals for each youth are based on behavior that members of the family, school, community and teaching-parents believe should be changed. Desired behavior earns points while speaking aggressively, arguing, disobeying, being late, stealing, lying and cheating lose points.

The immediate feedback provided by the point system helps the youths learn to respond to more natural rewards. When self-control, responsibility and the ability to work productively at home and school are demonstrated, the individual is ready to return to the community. Youths spend up to one year at Achievement Place.

Follow-up data indicate that the effects are long-lasting. The results can be seen in comparisons between Achievement Place delinquents, similar youths sent to a state institution and youths put on probation by the Juvenile Courts:

	AP	Inst.	Prob.
<b>Offenses per year</b>			
prior	3.8	3.6	2.6
during	0.4	0.5	1.3
1 year	0.7	2.4	2.5
2 year	0.0	1.4	0.8
<b>Recidivism (%)</b>			
1 year	6	13	31
2 year	19	53	54
<b>School attendance (%)</b>			
prior	75	75	77
during	100	100	84
1 semester after	84	58	69
2 semester after	90	9	37

In addition to being effective, Achievement Place is relatively inexpensive to operate. The average cost per bed to open such a home is \$5,800. A state school or institution costs

about \$22,000 per bed. The yearly operating cost of Achievement Place is about \$4,100 per youth; that of an institution is \$9,800 per youth.

Because Achievement Place has had

such good results, it has become a model for at least 15 similar homes in Kansas, Maryland, Arizona and California. North Carolina has made funds available to develop 11 such homes.

### The Keller method: A personalized system of instruction

The token system used at Achievement Place is nothing new to educators. For years teachers have been giving gold stars for good grades or good behavior. But Skinner and behavior technology have taught more than positive reinforcement to teachers. Programmed instruction and teaching machines are the result of more sophisticated uses of behavior modification. One system in particular—based on Skinnerian conditioning and learning theory—is gaining increasing acceptance in universities and colleges. It is known as the personalized system of instruction (PSI), and was designed by Fred S. Keller (now at Western Michigan University in Kalamazoo).

In the early 1960's Keller was asked by the government of Brazil to set up a department within a university and study their system of education. The European lecture model was in use there. Keller saw major drawbacks in the system and proposed methods to overcome them.

The lecture system, for instance, assumes that all students have the same capability and can learn at the same rate of speed. Grading often depends on whether the student understood the material at the rate it was given. The lecture system has other drawbacks. In some ways it is too unstructured. Some lecturers follow a text or outline, but many discuss whatever comes to mind at a particular time of day. In other ways the lecture system is too struc-

ured. Students are required to be in a certain place at a specific time to hear the lecture. Final exams for all courses are usually scheduled within a short period of time and few exceptions are made for any outside problems or commitments (financial, social, personal) a student may have.

The lecture system can be trying in other ways. Some lecturers are admittedly brilliant entertainers and catalyzers of students' thoughts. Most, however, just don't have the ability to hold the attention of a class for an hour, much less three hours, a week. Even if students are interested, note taking detracts from concentration and concentration detracts from note taking. And finally, almost anything a lecturer can say is already written down someplace.

With these problems in mind, Keller devised a system of teaching that allows students to proceed at their own rate of speed. He decided that information should be presented in small sequential steps. Objectives should be clearly defined and behaviorally stated prior to each step and students should demonstrate complete mastery of material before moving on to the next step.

Following the Keller method, an instructor selects course material (from a textbook, variety of texts or any other appropriate source). On the semester system, the material is divided into 20 subunits—each a little less than one week's work. The instructor tells the

student to learn the material and gives objectives, study questions and important points to be aware of. Upon completing each section, the student asks to be tested. If the material has been learned, he goes on to the next section. If not, more study is indicated and an alternate form of the test is given when the student again requests it. In this manner a student takes the course in whatever amount of time is required.

Test questions in this type of course are usually the short essay type, and students are allowed to defend any errors or mistakes. One year is often allowed to complete a semester's work. Those who do not complete it are not further penalized with an F, but are allowed to withdraw from the course. Those who complete the material get an A. Anyone who finishes ahead of time can devote more time to other courses or can move on to the next course.

In this system no lectures are given. The instructor merely designs the course (and continually redesigns it as necessary) and is available to answer questions. Graduate students or advanced students act as proctors and are available at all times to give and grade the tests and act as tutors. The first sections of the course are highly structured in order to shape student behavior. As the student learns how to study, extract information and answer pertinent questions, the crutches are removed. PSI provides immediate feedback (tests are graded on the spot) and positive reinforcement (complete mastery always earns an A). Progress

is charted in a public place and students are encouraged to complete and interact with each other as they would in a traditional course.

Upon his return from Brazil, Keller and J. G. Sherman of Georgetown University put PSI to use at universities in the United States. James R. Nazzaro of the American Psychological Association used the method for seven years at the University of Virginia. He sees it as a powerful teaching tool and says students learn more and enjoy courses more when taken under the Keller method. He, João Todorov and Jean N. Nazzaro reported in the December *JOURNAL OF COLLEGE SCIENCE TEACHING* that PSI not only works but works impartially for all students. They report that students have better recall five weeks after a PSI administered course than those who took the same course in the traditional method. They further report that the individualized approach gives the weaker student the necessary structure to improve study skills and continual success serves as a motivator.

Nazzaro admits that the Keller method may not be the best way to teach someone to interpret a poem of Shelley, but he says it is extremely promising in courses where a large body of information is to be conveyed. It is especially useful in the hard sciences but is also used in sociology, economics, psychology and introductory courses in all fields. At present more than 1,000 courses are being taught in the United States by the Keller method. Colorado Woman's College in Denver, for instance, uses PSI in 50 percent of its

courses. The Massachusetts Institute of Technology uses it in 9 courses. Rice University, Denison University, the University of Texas, Michigan State and Lafayette are only a few of the schools using PSI. But Nazzaro says the whole field of behavior modification is burgeoning and the Keller method is sweeping the country.

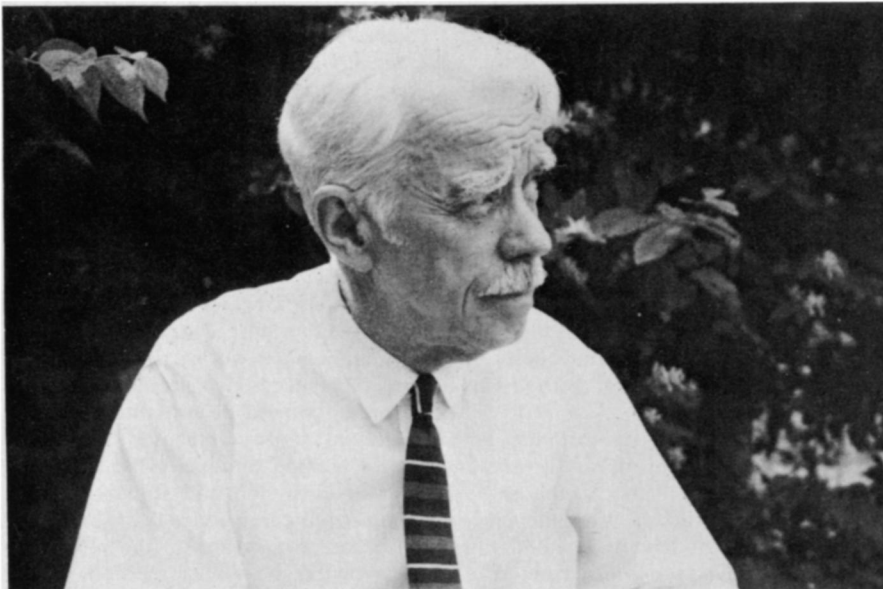
## Behavior modification in community mental health

In the mid-1960's the National Institute of Mental Health started a program aimed at replacing state mental hospitals with community mental health centers. Last year Ralph Nader's Center for the Study of Responsive Law charged that the 300 community centers in operation offered little more than a collection of traditional clinical services instead of the bold new approach originally intended (SN: 7/29/72, p. 70). The Nader group said there was too little accountability: Federal money is being funneled into a system that cannot prove it is doing its job.

William H. Goodson Jr. and A. Jack Turner of the Huntsville-Madison County Mental Health Center in Huntsville, Ala., disagree. They have an extensive system of accountability, and they say they can prove that they have an efficient, effective community mental health center. Their center operates almost entirely on the principles of behavior modification.

Since the advent of community mental health centers, the most popular therapeutic philosophies have been based on the psychoanalytical model. Goodson and Turner feel the psychoanalytical model has failed to generate data supporting its efficacy. In contrast, they say the behavioral model has mounds of data (behaviorists tend to count everything) showing how well it works in treating and preventing mental illness. "At the present state of mental health technology," says Goodson, "behavioral/learning methods offer the most accountable, empirical and practical approach to human problems."

In 1971 the Huntsville center received NIMH funding for a research project entitled "Behavior Modification as Applied to a Mental Health Center." Since then everything at the center has been done in accordance with the principles of operant conditioning. Inpatients, outpatients and even staff members are conditioned, rewarded, counted and evaluated. Goal setting, intervention (changing behavior), data collection and evaluation are the major components of the system.



F. S. Keller

*Keller: "I can see the day when the length of a course depends on its natural content, when letter grades are gone, when everybody is a dropout at one time or another, when no one is moved up unless he deserves it and when teacher pay and tenure is dependent on teaching and not on scheduled presence in the classroom."*

In the inpatient service, for instance, goals are set for each year: return of patient's behavior quickly to acceptable discharge state, reduction of admissions to jail on insanity warrants and reduction of admissions to state mental hospitals. These goals are reached by setting individual goals for patients. A major goal might be the return of a patient to work. Sub-goals could be an increase in conversation, increase in job skills and increase in out-of-bed time. Base-rate data are collected on these activities, and contingencies and reinforcements (such as tokens, social praise and passes to leave the grounds) are devised to increase them. As desired behavior is learned and established, patients are transferred to the outpatient service.

Two years of operation show that the system is working. The number of residents from Madison County in the state hospital has decreased from 153

in 1970 to 93 at the end of 1972. The number of admissions has decreased from 112 to 28. The frequency of jailings on insanity warrants has decreased from 74 to 13, and the number of days in jail has been reduced from 514 to 67. The number of patients admitted to the inpatient unit has remained almost the same, but the average stay has decreased from 18.4 to 12.5 days. This reduction alone has meant a savings of \$40,219.

Similar achievements have been made in the outpatient service with clients whose behavioral problems are not severe enough to warrant intensive care. Behavioral therapies are successfully used with outpatients in the modification of such behaviors as phobias, marital problems, family conflicts, sexual anomalies, drug use, psychosomatic complaints and depression. Members of the patients' families are encouraged to learn behavior therapies and use

them to maintain adaptive behaviors in the home. Using these and other behaviorally oriented therapies the Huntsville center is able, with a staff of 35, to effectively provide a variety of comprehensive mental health services to a population of 186,000 residents.

At a time when the Federal Government is cutting back on social programs and consumer protection agencies are calling for accountability, mental health centers will be fully funded and supported only if they are shown to be effective. Goodson and Turner feel they have met these qualifications and have taken the concepts of mental health out of the ephemeral realms and given them concrete meaning.

So, while behavior manipulation may have its drawbacks and detractors, the fact remains that the Huntsville center (like Achievement Place and the Keller method) has shown itself to be a workable and efficient operation. □

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## aerospace

### Outmaneuvering the Great Lakes ice

A major problem with shipping in the Midwest is ice on the Great Lakes, which limits the shipping season to eight months a year. Commerce worth millions of dollars is blocked. In a joint effort, NASA and the U.S. Coast Guard are now working on a method to maneuver around the ice.

The ice information system would use aircraft and, some day, satellites equipped with special sensors that detect the ice thickness, the type and its distribution. Maps would then be made of the ice and given to icebreakers and cargo vessels on a regular basis. Scientists and engineers at NASA's Lewis Research Center in Cleveland tested the instruments this winter. They used side-looking radar aboard an OV-1B aircraft on loan from the Army. The result was detailed images of the ice distribution.

### Ballima's link to probes in deep space

Tracking and communicating with spacecraft to the far corners of the solar system require a network of large space antennas—the 210-foot versions. The first one, at Goldstone, Calif., has been operational for seven years.

Last week the second such 210-foot antenna was dedicated at the Tidbinbilla Deep Space Communication Complex near Canberra, Australia. Prime Minister E. G. Whitlam and NASA Administrator James C. Fletcher officiated. The new antenna is called Ballima, the aboriginal term for "very far away." The antennas communicate with Pioneers 10 and 11 on their way to Jupiter. Tidbinbilla was first opened in 1965 with an 85-foot antenna called Weemala, meaning a distant view.

A third 210-foot antenna is nearing completion at Madrid, Spain.

### Soyuz and Apollo in Paris

The Paris Air Show in May will feature actual-size models of the Apollo and Soyuz spacecraft docked together. The two spacecraft will link up in orbit in 1975 in the first international cooperative manned mission. Teams are at work to develop compatible systems for the mission.

## astronomy

### Binary X-ray sources and W-R stars

So far four X-ray sources have been identified with binary systems containing a star that appears very young and a dark companion. The X-rays are believed to be generated by matter falling onto the dark companion, which could be either a neutron star or a black hole.

In the April 2 NATURE PHYSICAL SCIENCES E. P. J. van den Heuvel of the Free University of Brussels and the State University of Utrecht links these X-ray binaries evolutionarily with another astronomical curiosity, binaries containing Wolf-Rayet stars. [Wolf-Rayet stars are extremely hot (about 50,000 degrees K.) and surrounded by an expanding envelope of gas.]

The hypothetical history of the X-ray binaries is that they start out as binaries with very massive stars. The primary transfers its outer layers (about 70 percent of its mass) to the secondary. The transfer rejuvenates the secondary, taking it back to the early stages of stellar evolution. Meanwhile the primary, now become the secondary, evolves rapidly to a supernova explosion that produces the collapsed object. In a few million years the rejuvenated star begins to send matter to the collapsed object, and X-ray emission begins.

Van den Heuvel suggests that during some of this period of evolution the system is a Wolf-Rayet binary. He shows that if the W-R star in known W-R binaries exploded in such a way that it left behind a collapsed object with a mass similar to those in the X-ray binaries, the remaining binary system would have orbital periods and other parameters like those of the X-ray binaries. From this he predicts that certain W-R systems should evolve into X-ray binaries and that X-ray binaries with periods between 10 and 150 days should exist.

### A star for Centaurus X-3

A variable star has been proposed as the optical identification of the fifth known X-ray binary, Centaurus X-3. In International Astronomical Union Circular 2518 William Liller of the Harvard College Observatory suggests a star with a variation period near that of the X-ray source.