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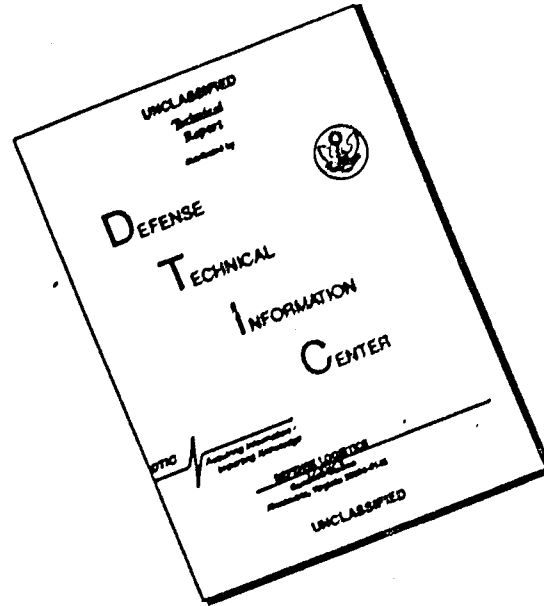
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HARVARD MEDICAL SCHOOL  
Department of Psychiatry  
BEHAVIOR RESEARCH LABORATORY  
Metropolitan State Hospital, Waltham, Massachusetts

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FINAL REPORT

Period Covered: 1 June 1953 - 31 May 1958

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Research under Contract  
with the  
OFFICE OF NAVAL RESEARCH, U.S. NAVY  
Contract Nonr-1866(18)  
NR - 174-220

Project Number: Contract Nonr-1866(18) sponsored by the  
Group Psychology Branch, Office of Naval  
Research, Authority NR 174-220.

Project Title: New Techniques of Analysis of Psychotic  
Behavior.

Project Directors: B. F. Skinner, Ph.D Professor of Psychology,  
Harvard University.

Harry C. Solomon, M.D. Professor of Psychiatry,  
Harvard Medical School.

Report Prepared by: Ogden R. Lindsley, Ph.D Research Associate,  
Harvard Medical School.

Period Covered: 1 June 1953 to 31 May 1958.

Additional Support:

In addition to the contract with the Office of Naval Research,  
the laboratory was supported by research grant MH-977 from the  
National Institute of Mental Health, of the National Institutes of  
Health, Public Health Service, since 1 December 1954. Work done  
under the Public Health Grant is not included in this report, but  
is described in Progress Reports of PHS Grant MH-977.

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## 1. GOAL OF CONTRACT

The goal of this contract, which ran a total of five years, was to determine the applicability of free-operant conditioning techniques to the experimental analysis and measurement of psychotic behavior. It was felt that this method of behavioral investigation which had proven so fruitful in the study of the behavior of small laboratory animals was ideally suited for the laboratory investigation of the behavior of chronic psychotics. It was clear that, if the method proved suitable for the investigation of the behavior of psychotic patients, automatic and objective laboratory measures of the kinds and degrees of psychosis would soon be forthcoming. Objective laboratory measures of the behavioral deficiencies and excesses produced by psychosis in individual patients are among the greatest needs of experimental and therapeutic psychiatry today. Significant steps forward in the development of objective laboratory measures of psychotic behavior would open the field of psychiatry to the powerful methods of fully controlled laboratory experimentation which characterize the natural sciences.

## 2. SUMMARY OF WORK ACCOMPLISHED DURING CONTRACT

Because of the exploratory nature of the research which demanded novel scientific procedures and unique apparatuses, the research has progressed slowly, but in an integrated fashion. The research is planned to cover a period of about twenty-five years, and this contract covers the developmental and methodological phase of the research.

The nature of chronic psychosis has also forced the research into a pattern that is unusual for current psychological investigations. Longitudinal and intensive daily investigation of single individuals over a period of many years is not familiar to twentieth century psychological science, and facilities for the publication of such results are not readily available. Also, the regular publication of the results of such experiments at six-month intervals is not efficient and would waste the time of the writer and reader as much as such frequent reports of elephant genetics would.

For these and other reasons, the detailed scientific results are being written in an integrated form, and will appear as a book entitled "The Behavior of Chronic Psychotics - An Experimental Analysis", which will be completed in 1960. This report only summarizes the work which was accomplished. The scientific public, which at this time is relatively technical and restricted, has been regularly informed of the progress of this research through lectures, talks, laboratory visits and personal communications.

During the five year life of this contract the major portion of the modification of the method of free-operant conditioning to the measurement of the behavior of psychotic patients has been accomplished. Unusual conditions had to be met in this modification, because if the apparatus and methods could not withstand the onslaughts of psychotic patients during their psychotic episodes and incidents (what such patients are hospitalized for doing) then psychotic behavior could not

be studied at the time it was occurring. The investigations of the behavior of psychotics when they are not behaving psychotically could at best be expected to reveal tendencies to be psychotic. Such investigation would be limited in the way that an investigator in physiological medicine would be limited if he could only examine patients who had frequent respiratory infections at the time they were not infected.

Indestructible experimental equipment was designed, constructed and made commercially available for the use of other laboratories.

### 3. SUMMARY OF THEORETICAL FORMULATIONS PRODUCED

Five years is really too brief a period for the investigation of a subject matter as complex as psychosis, to come up with any relatively secure theoretical formulations. However, some things can be tentatively said about psychosis which follow from our results. The first of these is that psychosis is not a single behavioral disease. It includes what appear to be at least thirty discrete and different forms of behavioral deficiency, and should more properly be called "the psychoses." These different types of behavioral anomalies are relatively stable and easily measured by objective techniques. Also, they may be intermittent in their effects, and any given psychotic may have one or more of these behavioral deficiencies. Our attempt to discover syndromes of deficiencies which may indicate a sub-type of psychosis has met with little success to date.

Another general statement which has surprised us is that the majority of chronic psychotics are so severely deficient in terms of current behavioral ability. They may have a large repertoire of behavior that they had acquired before they became ill, but their current behavioral acquisition ability is extremely low. The majority of chronic psychotics have a current learning ability below that of the common earth worm. Some of our psychotic idiots who have never learned anything have a current discrimination ability in an asocial situation that is higher than that of many of our acute schizophrenics who had learned a great deal before they became ill, and consequently have a relatively large behavioral repertoire with no current discriminative ability.

This observation, allied with our repeated failures at conditioned response therapy, has led us to discard our initial faith in the value of differential positive reinforcements as a therapy unaided by other procedures. We have a patient whose rate of symptom display is increased five times when his rate of non-symptomatic responding is increased only three times by differential positive reinforcement. No wonder that this patient is difficult to handle! The more he is rewarded for doing constructive things, the more (and even more) he does non-constructive, symptomatic things.

Our best current hypothesis is that the rate of symptom display can be reduced by differential positive reinforcement only by rewarding non-symptomatic responses that mechanically compete with the symptoms of that particular patient. Such an hypothesis would predict our results to date from a number of different experiments.

We are beginning to formulate a hypothesis of the nature of a common form of psychosis. The psychosis is not indicated by the presence of a symptom, nor by an absence of normal behavior. The psychosis is indicated by the abnormally long after-discharge of a response, lasting long after it would have subsided in a non-psychotic individual, and a simultaneous non-mechanical competition with other behavior which is appropriate and is being reinforced at the time. This combination of long after-discharge and high non-mechanical response competition severely debilitates an individual. For example, normal individuals can be made to hallucinate for brief periods of time when their name is called over a hidden microphone while they are alone in a room and at work on a standard lever-pulling task. (They might briefly answer, before they stop talking to no one and reject the hidden voice.) If they are given an hallucinogenic drug (e.g. Benactyzine) they might in this situation continue to talk for several minutes after their name was called. But they do not stop their lever-pulling while carrying on this one-sided hallucinatory conversation. But chronic psychotics can be made to hallucinate or talk to no one for long periods of time without hallucinogenic drugs. Simply calling their name over a hidden microphone is enough. The important point is that the experimentally induced hallucinatory vocalization of the chronic psychotic severely competes with his lever-pulling ability. He stops pulling the lever when he talks to no one. In other words, his talking to no one severely competes with all other behavior demanded of him at that time, and this competition is not mechanical, and not found in normal individuals.

Said in another way, the psychotic characteristic of symptoms appears to be not only that they last far longer than they should, but that they dominate the individual and severely compete with all other behavior demanded of him at the time, even though a non-psychotic could engage in both behaviors simultaneously.

This information taken together with our observations of the frequent pauses in responding exhibited by a large number of psychotics, leads us to hypothesize that a very common form of psychosis appears to be due to abnormally high response competition, or, said in an older and less exact terminology, a disorder of attention.

#### 4. SUMMARY OF METHODS PRODUCED

A great deal of our time has been spent in developing and in attempting to perfect methods for the experimental analysis of chronic psychosis. The major scientific procedures in current use by psychologists are not appropriate to the experimental analysis of chronic psychosis. This does not mean that they are sterile when used elsewhere. Neither does it mean that they do not produce information concerning psychotics and their behavior. However, it does mean that the commonly used procedures are severely limited in their application to the analysis of psychosis. Most of the commonly used procedures produce information of public health or hospital administration value concerning what psychotics in general can do. It is significant in this connection to note that many psychiatrists and clinical psychologists are basically schizo-scientific. In their research they study groups of psychotics, but in their practice they therapeutize and observe psychotic individuals. No psychotherapist ever

psycho-therapeutized a group, saying after three hours of talk, "I will bring up Mother", After two hours of this, "I will bring up the oedipus complex", etc. No physician ever asked his nurse, "what was the average oral temperature of the patients on ward 3 last night?" And after her reply, "100.2, sir", said, "Then give them all 2 grs of seconal and 15 mg of Amphetamine tonight." In the morning the nurse may report, "Sir, last night 10% of the patients on ward 3 died."

Medical practice, because of its basic goal of trouble-shooting, diagnosis, and repair of the individual, and because of multiple causation of disease, must always be concerned with the individual. The major portion of exploratory medical science must always be geared to the study of the basic medical unit, the individual. Public health science can give many leads to medical science, and is useful in the control of societies, but it can never supplant and must always be finally tested in a medical science of the individual. The science of behavioral medicine can be no different in this respect than is the science of physiological medicine.

Then, in brief our methods were developed to be sensitive to, and to accurately and continuously monitor, the behavior of individual psychotics. The methods were designed so that a chronic psychotic, in his natural habitat (the back wards of a state mental hospital) could be observed while he was behaving psychotically. To us, behaving psychotically meant while he was doing what he is currently hospitalized for doing.

Also, the methods had to be designed so that the results could be analyzed in terms of the behavioral deficiencies or excesses displayed by the patients. Many devices are inappropriate for analyzing psychotic behavior because if a patient performs sub-normally on the device, one cannot tell which supporting behavior demanded for the successful operation of the device the patient lacks. In this sense, the device must be looked at from the patient's point of view. Two levers, to a patient who cannot differentiate two levers - or cannot tell them apart behaviorally, are not two levers to the patient, and cannot be considered to be two levers in terms of the experimental analysis. If we place a patient in a two-lever experiment, we must have previously shown that he can respond differentially on one of two levers before we can interpret the experiment as a two-lever experiment. Such problems severely limit experimental design, but to ignore them is to invite interpretive chaos and error.

Also, the experiments must be individually geared to the abilities and time dimensions of the patient under study. It makes no sense to reinforce a patient for 10 hours, and then withdraw the reinforcement to study extinction of the reinforced response, if the patient had not acquired a useful rate of response during the 10 hours of reinforcement. Sensible scientists do not spend valuable experimental time watching nothing go away. For reasons such as this each patient must be treated as a separate individual experiment, and the experimental design must be daily monitored and subject to revision if changes in the patient's behavior demand such revision.

Since the patient's natural habitat cannot be completely controlled, there is a high percentage of experimental loss with chronic psychotics.

Some are discharged, some die, some must be placed upon certain medications for severe problems of care. Such changes often destroy or terminate an experimental design, and they must be expected and accepted as a necessary property of the investigation of chronic psychotics. One simply gets used to a 20 to 30% experimental loss and plans for it in his experimental design.

Since extremely long (5 to 6 years) experiments often must be undertaken in order to monitor lawful changes in the behavior of chronic psychotics, it becomes doubly important to insure careful control of recording and controlling equipment. An apparatus breakdown which destroys an experimental design that has continued for six years of daily observation can be extremely costly and heart-breaking. For this reason, we have perfected a very reliable method of apparatus and data control which is described in detail in the forthcoming book, and briefly in Annual Technical Report 3.

New devices for measuring the behavioral deficiencies characteristic of the psychoses must be carefully designed so that chronic psychotics are spread out along the measurement scale. Usually this means that the normal individuals are piled up at one end of the scale. But this is alright because we are studying psychotics and our measurement device must accurately differentiate between different degrees and types of psychosis. Most devices that have been previously used were adjusted in sensitivity for differentiating between normal individuals. On such scales the normals are spread out along the scale with the psychotics piled up at one end. Such a scale is no more useful in analyzing psychosis than knowing that the patient is hospitalized, or has no keys or no necktie. We start with that information that he is psychotic. What we need to know is how he differs from other psychotics, and from himself from time to time under different forms of treatment.

This brings up the difficult problem of demonstrating the validity of the new measurement device. If it correlates perfectly with previous measures of psychosis it is no more accurate than they and is merely an analog or a translation device. On the other hand, if it does not correlate at all with any previously accepted and known indices of psychosis, it is not measuring what people mean by psychosis. What is needed is a new device that correlates lowly with a large number of previously used devices. The final proof of the new device is whether it shows the effects of therapies and other variables suspected of effecting psychosis, and whether it proves to be useful in the diagnosis of psychosis and evaluation of the effects of therapies upon it.

##### 5. SUMMARY OF INSTRUMENTS PRODUCED

A complete set of instruments for modifying basic operant conditioning equipment for use with chronic psychotic patients has been designed, constructed, tested in operation over a period of 5 years, and made commercially available. The final step of placing equipment in the hands of commercial manufactures was important, because the majority of people interested in the measurement and analysis of psychosis do not have the time nor, in most cases, the skill necessary to design and construct apparatus. However, if appropriate apparatus is commercially available, they can readily equip laboratories in which to undertake their own research. Appendix 1 of this report contains a few leaves from the catalog of a supplier who constructs human operant conditioning equipment of our design. Appendix 2 of this report is a list of other investigators who are now conducting or soon plan to conduct human operant conditioning research. Many of these

investigators are using equipment that we designed.

More important than this facilitation of research by others is the advantage that similar apparatus provides in the interpretation of the results of research produced by different investigators. If other investigators, studying different kinds of subjects, obtain slightly different results but have used identical equipment, it is possible to rule the equipment out as a confounded variable. This attempt to insure the use of standard, high quality equipment by the earliest investigators in human operant conditioning prompted us to turn our designs over to commercial manufacturers who could meet the demands of other investigators.

In brief, the following instruments were produced under this contract:

- 1) Standard size and design of experimental enclosures, described in Status Reports I, II, and III, and publication 5.
- 2) Standard Manipulandum, Manufactured by Ralph Gerbrands, Arlington, Mass., and described in Annual Toch. Rept. 3.
- 3) Conditioning Panels for Human Operant Conditioning. Manufactured by Robert C. Dalrymple, Lexington, Mass., and described in Appendix 1.

#### 6. SUGGESTIONS FOR FURTHER EXPERIMENTATION

Applications of the methods that we have developed should be made in the experimental analysis of the different major types of behavioral deviation, i.e. Mental retardation, Sexual deviants, Acute psychosis, Senile psychosis, Senility, and Child psychosis. Several investigators have already begun such applications in independent laboratories (see appendix 2).

Further, more systematic evaluation of the effects of the various therapies should be undertaken. We have shown in selected cases that the one-minute variable-interval response rate is a highly sensitive indicant of the severity of the psychoses in individual patients and between patients. This index is not specific to the different forms of psychosis, but has the advantage that the various forms are all measured in terms of their severity, or destructive power on normal behavior, on a single behavioral base-line. Therapies that we have evaluated and to which the index is sensitive are: Social environment changes, individual psychotherapy, insulin and electroshock coma, psycho-energizing and tranquilizing drugs, and biochemical agents.

Experimental analysis of the chronic psychoses should be undertaken by further refinement of our methods in attempts to make the measures more clinically relevant and to produce emergent properties of behavior which identify the various sub-forms of psychosis. Along these lines objective laboratory measures of criminal tendencies, impulse, lack of reality testing, deviation between verbal and non-verbal behavior, competition between symptoms and non-symptomatic behavior, control of primitive emotional behavior, analysis of deviations in social behavior, etc., should be developed. We are currently testing devices which measure lack of reality testing, competition between symptomatic and non-symptomatic behavior, and deviations in social behavior. Further research in the other dimensions mentioned should be undertaken.

## 7. POSSIBLE APPLICATIONS OF FINDINGS

Since very little is known concerning the basic nature of psychosis in the terms and framework of modern experimental psychology, our primitive, exploratory results concerning the nature of psychosis will find ready application in text-books and teaching. Our methodological and instrumental innovations are also beginning to be applied by other investigators into the basic nature of behavioral deviation and into the evaluation of therapies for behavioral deviation. These applications might be thought of as the basic scientific applications of our research. The list of individuals now conducting human operant conditioning research attests to this increased interest and application, since our laboratory was number one on this list.

The earliest applications of our findings and methods by other investigators appear to be in determining the behavioral deficits characteristic of the mentally retarded and various sub-types of the psychoses (i.e. "autistic children", "brain damaged", "acute psychotics", etc). Additional applications are recently being undertaken in evaluating the effects of psychotherapeutic drugs and in disclosing biochemical correlates of mental illness. (see appendix 1.)

Possible applications of the findings for therapeutic manipulation of psychotics through the use of positive reinforcement are rather bleak. However, we have shown that it is possible to maximize the behavioral ability of mentally retarded psychotics who were previously thought to be uneducable. For schizophrenic patients, who have been previously thought to be more educable, the situation is not so simple and appears rather bleak. About all we can say for the chronic schizophrenics is that they are extremely resistant to behavioral change through simple positive reinforcement, even though surprising effects can be recorded from the visits of a student nurse, ward changes etc. It appears that if one attempts reinforcement therapy with schizophrenics, non-symptomatic responses should be selected for reinforcement which mechanically compete with the patients' symptoms. If this is done for a period of years, the frequency of non-symptomatic behavior might be permanently increased, and the frequency of symptom display permanently decreased. To date no others have attempted an extensive application of these therapeutic findings.

## 8. SUMMARY OF WORK ACCOMPLISHED SINCE SUBMISSION OF LAST TECHNICAL REPORT

(15 February 1957 through 31 May 1958)

During this period of time the intensive analysis of individual patients with important "key" behavioral deficits continued. These long term analyses are described in detail in Annual Technical Report 3, beginning on P. 42.

With Patient #1 and #32 we were able to demonstrate two similar cases of extremely slow acquisition of a high, or normal response rate on a one-minute variable interval schedule of reinforcement. Their rates of lever-pulling increases from less than 10 responses per hour to over 8,000 responses per hour during 260 hours of conditioning over a period of 14 months. When they were no longer reinforced, the rates of responses fell to less than 100 responses per hour within 140 hours of extinction (a period of 7 months). During extinction P#1 was taken out of the experiment for 2-1/2 years, after which time he showed a spontaneous recovery

of 1000 responses per hour. When the responses were again reinforced, both patients showed an immediate re-acquisition of responding at rates above 5,000 responses per hour. This immediate re-acquisition showed that the change in the patient's behavior was permanent and was produced by the candy reinforcement.

These two cases are presented here in finer detail to show that certain forms of psychotic behavior must be studied over extremely long periods of time, if the laws controlling that behavior are to be revealed. At the time of writing this report these long-term intensive analyses are continuing.

Patient # 23 did not pull the lever at a slower rate (extinguish) after 340 hours of extinction following 50 hours of one-minute variable-interval reinforcement. This unusual case of acquisition without extinction was important to investigate further because it is the only known case of such a deficit. Experimental proof of such a behavioral deficiency would clearly show that acquisition and extinction are separate processes, because a man exists who has one without the other. Such a proof would also demonstrate the advantages of studying unique pathological systems. For nature, in its pathology, can conduct experiments that man might not think of conducting, and even if he did think of conducting them, would not know how to instrument. By a series of carefully conducted experiments on this patient we have been able to show that his behavior is controlled by presenting reinforcement contingencies, but not by removing or terminating reinforcement contingencies. We have also shown that his problem is not so simple as "he can learn, but can't forget", because if we remove the lever (the opportunity to respond) for 75 hours, and then replace it, he will not pull it. In other words, he will continue responding without reinforcement if given an opportunity to respond. But, if given no opportunity to respond, he will "forget" if given a long enough period of time.

Thus we have shown that Patient # 23 has a very unique behavioral deficit, and we have also shown how to engineer the environment so that his deficit is not debilitating. Such behavioral engineering of the environment so that behavioral deficits are not debilitating is a possibility that could be used in reclaiming certain psychotic patients, even through their psychosis is found to be incurable. Such environmental engineering would be a true form of behavioral prosthetics, in which environments are created in which the behavioral skills that a psychotic lacks are not called for.

## 9. Summary of Teaching Functions Performed Under Contract

The training of new research personnel and the communication of these new methods to students are among the functions of government sponsored research. The following teaching functions have been performed by the laboratory during the period it was supported by this contract:

### a) Supervision of Individual Research:

1955 - Larry Fane, A.B. - Supervision and conduct of Honors Thesis, for Psychology Department, Harvard University.

1956-57 - Martha T. Mednick, Ph.D. - U.S. Public Health Service Post Doctoral Fellow.

1957-58 - Paul Blachly, M.D. - Supervision of research program for 3rd year resident in psychiatry.

1958-59 - Thomas F. Gilbert, Ph.D. - National Science Foundation Post-doctoral Fellow.

1955-58 - In addition to these formal training programs, 3 graduate and 4 undergraduate research assistants worked in the laboratory and received research training relevant to their future professional careers.

b) University Field Trips: Invitations to visit the laboratory and hospital were extended to the psychology departments of neighboring colleges and universities. During the period covered by this contract 26 field trips were made comprising a total of 923 students.

c) Professional Visitors: Three hundred and sixty-two interested scientific researchers have visited the laboratory during the period covered by this contract. They were conducted through the laboratory and hospital and shown the data in which they were most interested.

## 10. SUMMARY OF LECTURES AND ORAL PRESENTATIONS OF RESULTS:

During the period covered by this contract 49 lectures were given before various professional societies, and agencies. The method, the current results, and their implications were presented to over 2,500 psychiatrists, psychologists, and professional mental health workers in this fashion.

11. LIST OF PUBLICATIONS RESULTING FROM CONTRACT:

1. Lindsley, O. R. & Skinner, B. F. A method for the experimental analysis of the behavior of psychotic patients. Amer. Psychologist, 1954, 9, 419-420. (Abstract.)
2. Skinner, B. F., Solomon, H. C. & Lindsley, O. R. A new method for the experimental analysis of the behavior of psychotic patients. J. Nerv. Ment. Dis., 1954, 120, 403-406. (Interim Tech. Rept. 1.)
3. Skinner, B. F. Critique of Psychoanalytic Concepts and Theories. Scientific Monthly, 1954, 79, 300-305.
4. Azrin, N. H. & Lindsley, O. R. The reinforcement of cooperation between children. J. Abnorm. Soc. Psychol., 1956, 52, 100-102. (Interim Tech. Rept. 2.)
5. Lindsley, O. R. Operant conditioning methods applied to research in chronic schizophrenia. Psychiat. Res. Rep., 1956, 5, 118-139. (Interim Tech. Rept. 3.)
6. Raines, G. N., Chairman. Discussion of paper presented by Ogden R. Lindsley. Psychiat. Res. Rep., 1956, 5, 140-153. (Interim Tech. Rept. 4.)
7. Skinner, B. F. What is Psychotic Behavior? In Theory and Treatment of the Psychoses: Some Newer Aspects. St. Louis, Mo.: Washington University Studies, 1956, 77-99. (Interim Tech. Rept. 5)
8. Mednick, M.T. & Lindsley, O.R. Some Clinical Correlates of Operant Behavior, J. Abnorm. Soc. Psychol., 1958, 57, 13-16. (Interim Tech. Rept. 6)
9. Lindsley, Ogden R. Characteristics of the Behavior of Chronic Psychotics as Revealed by Free-operant Conditioning Methods, Diseases of the Nervous System, In Press 1959. Read before Eastern Psychiatric Research Association, October 24, 1959, New York City.

12. LIST OF PREVIOUS PROJECT REPORTS

2	Status Report I	30 November 1953
	Status Report II	31 May 1954
	(Annual Technical Report I)	
	Status Report III	31 December 1954
	Status Report IV	31 August 1955
	(Annual Technical Report 2)	
	Status Report 5	15 May 1956
	Status Report 6	15 August 1956
	Annual Technical Report 3	15 November 1956
	Status Report 7	15 February 1957

13. LIST OF SCIENTIFIC PERSONNEL WHO WORKED ON CONTRACT:

B.F. Skinner, Ph.D., Director. Professor of Psychology, Harvard University

Harry C. Solomon, M.D., Director. Professor of Psychiatry, Harvard Medical School

Ogden R. Lindsley, Ph.D., Chief Investigator, Research Associate, Harvard  
Medical School

Martha Mednick, Ph.D., Clinical Psychologist

Nathan Azrin, Ph.D., Graduate Research Assistant

Malcolm Richards, A. B., Graduate Research Assistant

Richard Wylie, A.B., Graduate Research Assistant

Larry Fane, Undergraduate Research Assistant

Richard Flavin, Undergraduate Research Assistant

Lawrence Gilbert, Undergraduate Research Assistant

Herman Teitlebaum, Undergraduate Research Assistant

The following personnel have been of assistance to the contract:

Jack Ewalt, M.D., Commissioner of the Massachusetts Department of Mental  
Health, made available the facilities of the State  
Hospital system.

William F. McLaughlin, M.D., Superintendent of the Metropolitan State Hos-  
pital, provided the research space and hospital facilities.

Myer Asekoff, M.D., Director of Clinical Psychiatry at the Metropolitan State  
Hospital, assisted in the selection and care of the patients.

Sol Sherman, M.D., Senior Physician at the Metropolitan State Hospital,  
assisted in the care and medication of the patients who  
received pharmacological treatments.

Karl Theo Dussik, M.D., Research Fellow, Boston Dispensary, and Assistant  
Physician at the Metropolitan State Hospital, assisted  
in the selection, care and medication of the insulin  
patients.

ROBERT C. DALRYMPLE - 30 Wyman Road - Lexington 73, Massachusetts

DESIGN AND CONSTRUCTION OF APPARATUS FOR  
HUMAN OPERANT CONDITIONING

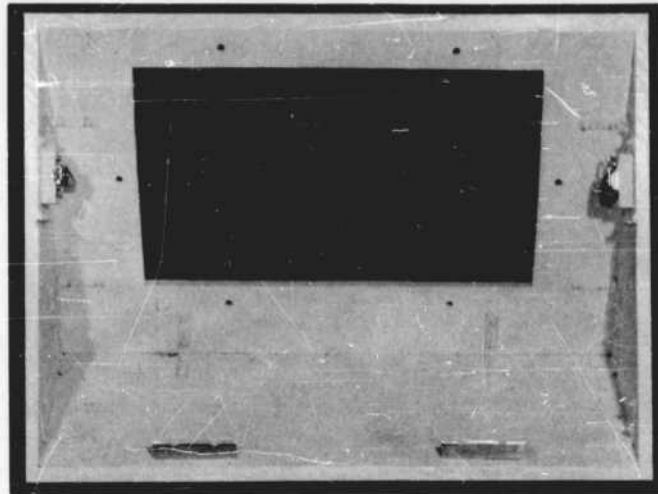
GENERAL DESCRIPTION OF ALL APPARATUS: The apparatus we supply has been designed and constructed from models tested in operation for over four years at the Behavior Research Laboratory, Metropolitan State Hospital, Waltham, Mass. Through our daily contact with the equipment in operation, it is possible to observe the necessary qualifications for efficiency and practicality to meet the demands of current experimental research in human operant conditioning.

The apparatus has the following general characteristics:

- DURABILITY:** With similar apparatus, millions of responses have been collected from extremely disturbed psychotic patients through thousands of experimental sessions with virtually no repair or maintenance necessary.
- AVAILABILITY:** We can deliver the apparatus to any point in the continental U.S.A. within one month upon receipt of an order.
- VERSATILITY:** The easily replaced conditioning panels can be made to order to perform any conditioning experiment utilizing all of the commonly used reinforcers.
- SPECIAL DESIGNS:** We have had a great deal of experience in designing panels for special experimental use. By slightly altering the basic designs, special-order modifications can be made without loss of the advantages of standardization.
- STANDARDIZATION:** The pioneer laboratory in this area plus two other newer laboratories use our equipment exclusively. This permits inter- and intra-laboratory standardization of methods and results.
- LOW COST:** Since we produce this apparatus on an assembly line basis with small, difficult to manufacture parts sub-contracted, we can produce these items at a cost that few individual laboratories could equal by performing their own design and construction. The extremely low maintenance and repair costs are advantageous also.

ROBERT W. DALRYMPLE - 30 Wyman Road - Lexington 73, Massachusetts

DESIGN AND CONSTRUCTION OF APPARATUS FOR  
HUMAN OPERANT CONDITIONING



BL-11 UNIVERSAL BACK FOR CONDITIONING PANELS

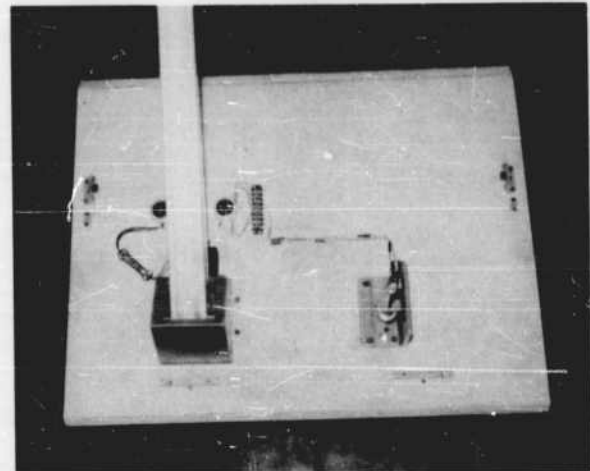
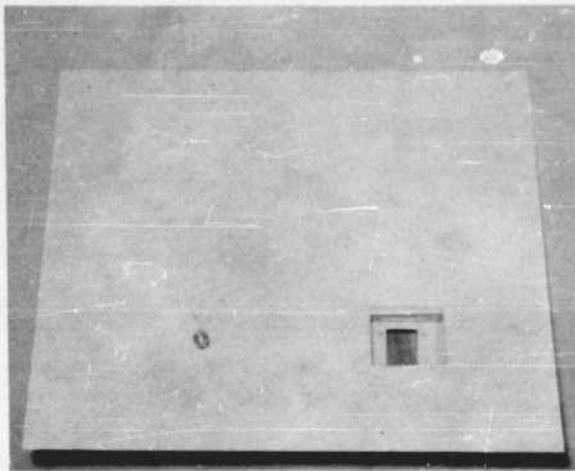
GENERAL DESCRIPTION: A universal back support for the variety of conditioning panels which we supply. This support has been designed so that any conditioning equipment can be mounted ideally for responding in either a standing or a sitting position. It can be bolted to one wall of the experimental room over a 21" x 12" opening in the wall which permits the wiring and magazine delivery chutes to enter the experimental chamber. Conditioning panels can be attached and removed readily by releasing from the back a spring-loaded latch at each side of the support. The opening at the rear of the support allows for inspection and servicing of the conditioning panels even while they are in operation.

SPECIFICATIONS: The back is 31 7/8" x 25 3/4" with a 21" x 12" opening. The sides support the panels at a 60° angle with the horizontal (30° out from the wall). Stock: 3/4" grade A fir plywood which is glued and bolted together with angle-iron supports and #10 machine screws. Finished in white enamel.

COST: ..... as of: ..... DELIVERY: .....

ROBERT C. DALRYMPLE - 30 Wyman Road - Lexington 73, Massachusetts

DESIGN AND CONSTRUCTION OF APPARATUS FOR  
HUMAN OPERANT CONDITIONING



BL-21 BASIC CONDITIONING PANEL: (SINGLE MANIPULANDUM - SMALL-  
OBJECT REINFORCERS)

GENERAL DESCRIPTION: This panel provides all of the equipment that con-  
tacts the experimental space for the most simple operant conditioning experi-  
ments. One standard Lindsley #3 manipulandum is mounted on the panel in the  
most accessible location. An aluminum magazine delivery chute permits the  
gravity-fed delivery of small-object reinforcers (candies, coins, tokens, toys,  
cigarettes, food bits, etc.) into an illuminated tray. The tray is illuminated from  
above by two bulbs through an opaque plexi-glass window. The probability of light  
failure is reduced by having the two bulbs. In addition, the lights may be used as  
discriminative stimuli or conditioned reinforcers. The chute and tray are easy  
to clean and have no sharp surfaces which might injure subjects or block the pas-  
sage of reinforcers. With the panel mounted on our universal back (BL-11), ab-  
solutely no bolts or screws appear on any outside surface to attract attention or  
invite destruction by subjects. A clip at each side and two at the bottom engage  
with the latches on the universal back.

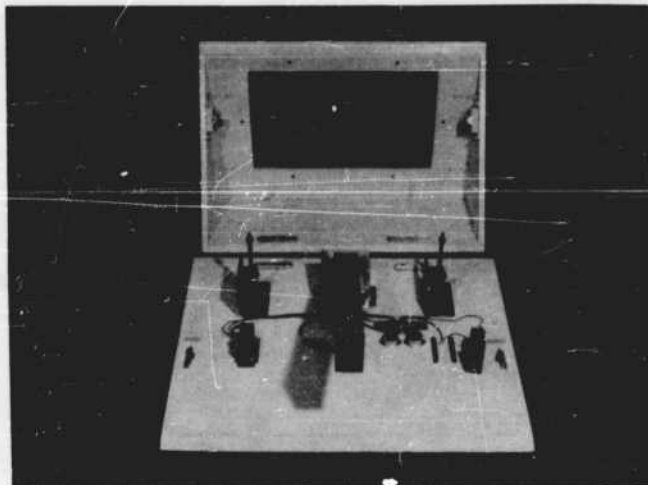
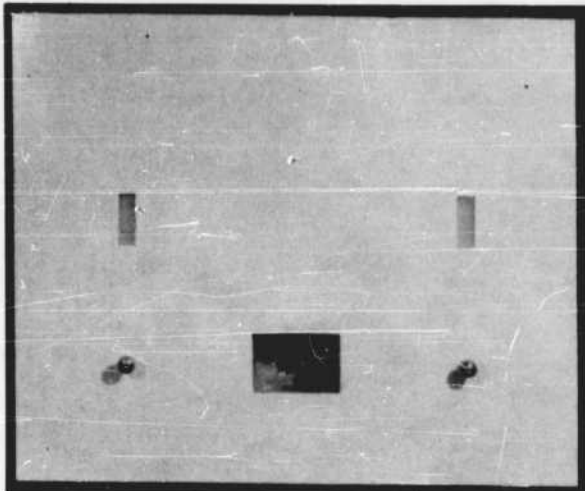
SPECIFICATIONS: The magazine tray and delivery chute are constructed of pre-  
formed, metal-locked heavy aluminum stock. The panel stock is 3/4" grade A fir  
plywood, 31 7/8" x 25 3/4".

FINISH: Front: Easy-to-clean, medium-gloss white formica. Back: White  
enamel.

COST: ..... as of: ..... DELIVERY: .....

ROBERT C. DALRYMPLE - 30 Wyman Road - Lexington 73, Massachusetts

**DESIGN AND CONSTRUCTION OF APPARATUS FOR  
HUMAN OPERANT CONDITIONING**



**BL-31 DISCRIMINATION AND DIFFERENTIATION PANEL: (TWO MANIPULANDA, TWO STIMULI, SMALL-OBJECT REINFORCERS)**

**GENERAL DESCRIPTION:** This panel provides all of the equipment necessary to perform a wide variety of discrimination and differentiation experiments. Two standard Lindsley #3 manipulanda are mounted at each side of the standard small-object delivery chute and tray. The tray is illuminated by two bulbs through an opaque plexi-glass window above it. Over each manipulandum is an opaque plexi-glass window with two bulbs (6 W) behind each for use as discriminative stimuli. The windows are flush with the panel front and no screws or bolts appear on the surface. The bulbs can be replaced easily from the back without using tools by sliding out bakelit holders and unscrewing the bulbs. The two micro-switches on each manipulandum, the four discrimination bulbs, and the two conditioned reinforcer bulbs are pre-wired with the leads brought out through a Jones strip to an octal amphenol plug and a standard polarized A-C plug.

**SPECIFICATIONS:** The magazine tray and delivery chute are constructed of pre-formed, metal-locked heavy aluminum stock. The panel stock is 3/4" grade A fir plywood, 31 7/8" x 25 3/4".

**FINISH:** Front: Easy-to-clean, medium-gloss white formica. Back: White enamel.

**COST:** ..... as of: ..... **DELIVERY:** .....

ROBERT C. DALRYMPLE - 30 Wyman Road - Lexington 73, Massachusetts

DESIGN AND CONSTRUCTION OF APPARATUS FOR  
HUMAN OPERANT CONDITIONING

GENERAL INFORMATION PERTINENT TO SPECIAL ORDERS OF CONDI-  
TIONING PANELS:

Any number of manipulanda (up to five in a row) can be supplied, along with any number or type of stimulus display.

More than one magazine chute and tray can be added to the panels.

Blank panels can be provided for fitting with your own devices, although we strongly suggest that you use the standard manipulandum which has been tested in practice and which will furnish data which can be directly compared with those from other laboratories.

We have designs for liquid reinforcement devices, projected slide-image screens for use of pictures as discriminative or reinforcing stimuli, and coin delivery devices for use of stacked coins as reinforcers.

Circuits for recording approaches to the manipulanda and for delivering shocks to the manipulanda are available upon request.

Apparatus for the observation of the behavior of a small animal or the manipulation of small dolls has been constructed and can be supplied upon request.

If you send us a general description of the apparatus in which you are interested, we will send you a cost estimate and delivery date along with design suggestions, if desired.

HARVARD MEDICAL SCHOOLBEHAVIOR RESEARCH LABORATORY

Metropolitan State Hospital  
Waltham 24, Massachusetts

January 1, 1959

GILBERT R. LINDBLERT, Ph.D.

SECOND LIST OF INVESTIGATORS NOW CONDUCTING OR PLANNING HUMAN FREE  
OPERANT CONDITIONING PROGRAMS USING FULL ENVIRONMENTAL  
CONTROL.

Full environmental control exists when: (1) an experimental enclosure isolates subject or subjects from all except experimental variables; (2) responses are recorded automatically; (3) reinforcing and other stimuli are presented automatically.

We have restricted this list to those using a free operant with full environmental control, since if we included other techniques (such as class room), the list would become unwieldy. Also, human operant conditioning with full environmental control poses unique problems (such as withdrawal from the experimental enclosure) which are not often present when an experimenter is in the room with the subject.

Where more than one investigator is involved in a particular research program, only the name of the senior investigator is included in this list. A few investigators are not at this particular time working in the area listed, but their past experience should be valuable to other investigators with similar interests. Also, former research interests are listed for some investigators.

F--The letter "F" before the area of interest indicates a former research interest which the investigator is familiar with, but upon which he is not currently working.

\*--A single asterisk before an investigator's name indicates that he is using or plans to use a standard manipulandum which is available from Ralph Gerbrands, 96 Ronald Road, Arlington, Massachusetts.

\*\*--A double asterisk before an investigator's name indicates that he is using or plans to use the standard manipulandum incorporated in a standard manipulandum and stimulus panel assembly which is available from Robert C. Dalrymple, 30 Wyman Road, Lexington 73, Massachusetts.

We are also compiling a bibliography of human operant conditioning articles. If you have any reprints or know of any unpublished material (theses, etc.) which we might overlook, please send the references to us in Waltham. A comprehensive bibliography is needed at this time. When it is completed we will distribute copies to all on this list.

INVESTIGATORS WHO HAVE DATA:

<u>Name and Address</u>	<u>Subjects</u>	<u>Area of Interest</u>
**Azrin, Nathan H., Ph.D. <i>Anna State Hosp.</i> <i>Anna, Indiana</i>	Normal adults (Army enlisted men) Psychotic children and adults.	F. Aversive control (noise)  Discrimination
Bijou, Sidney, Ph.D. Institute of Child Development University of Washington Seattle 5, Washington	Normal children 2-12 yrs.	Schedules of rein.