

H A R V A R D M E D I C A L S C H O O L

Department of Psychiatry

B E H A V I O R R E S E A R C H L A B O R A T O R Y

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Status Report I	30 November 1953
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Publications:

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 Technical Rept. 2).
5. Lindsley, O. R. Operant conditioning methods applied to research in chronic schizophrenia. Psychiat.Res.Rep., 1956, 5, in press.

6. Skinner, B. F. What is psychotic Behavior? Chap. in Theory and Treatment of Psychosis: Some Newer Aspects., Washington University, 1956, in press.

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 Report 1 of PHS grant MH-977, 1 June 1956.

GENERAL STATEMENT

We have completed the methodological phase of our research and are now ready to spend our full research time on the analysis of psychosis. In the past three years we have investigated many aspects of psychotic behavior, but much of our time has been spent designing and constructing equipment, looking for suitable reinforcers, and testing the reliability and stability of our data. We now have suitable equipment for the free operant conditioning of psychotics. It can be used to study any individual from out-patient to the most severely disturbed violent patient. It has been tested in operation, is standardized and is commercially available.

The data generated are stable over long periods of time (years), and reveal striking individual differences between patients and unhospitalized individuals. We have located a few behavioral anomalies in our patients and now plan to search for other behavioral differences between our patients. Having located such anomalies, we plan to screen a sample of 25 patients to obtain a rough estimate of the frequency of occurrence of each anomaly in a hospital population. If we use the same sample of patients for each screening, inter-correlations of anomalies are possible and "behavioral disease syndromes" might be collected. It is becoming apparent that one of our most important assets here in Waltham is the large body of data we have on each of our fifty patients.

STATUS OF WORK IN PROGRESS

1. Observations on New Patients:

We have increased our adult chronic psychotic sample from 46 to 51 patients.

2. Quantification of "Psychotic" Properties of Records:

The analysis of the Sum and Number of inter-response times greater than ten seconds has been completed. The $\sum IRT > 10''$ is a more sensitive measure of the presence of psychosis than is the $\#IRT > 10''$ or the number of responses per hour. Both of these inter-response time measures are important to record, because there are experimental situations where one is more sensitive to experimental manipulation and individual differences than the other. The $\#IRT > 10''$ often changes drastically when there is a change in the rate of response (acting as the first derivative of the rate). The value of these measures is now assured and we will continue to analyze the data in these terms.

3. Quantification of "Fixed-Ratio Pauses":

The per cent of the Sum and Number of inter-response times greater than ten seconds that occur immediately after reinforcement ($\% \sum IRT > 10''$ and $\% \#IRT > 10''$) have been recorded and analyzed for 2 patients responding on fixed-ratio schedules. The values are very stable and appear to be approximately equal under most conditions. On the variable-interval schedule 40 to 80% of the long pauses occur immediately after reinforcement. On a fixed-ratio of 5 the percentage rose from 40 to 95%, taking approximately 50 experimental sessions to do so. This seems to be very slow according to the acquisition rate of lower animals. We have no data on unhospitalized individuals. It is clear that these values provide a stable quantitative measure of the pausing after reinforcement on ratio schedules.

These two measures are independent of the $\sum IRT > 10''$, the $\#IRT > 10''$, and the number of responses per hour. This independence was demonstrated when the $\% \sum IRT > 10''$ after SR and the $\% \#IRT > 10''$ after SR were markedly decreased during the first sessions on the fixed-ratio schedule, and the $\sum IRT > 10''$, the $\#IRT > 10''$, and the number of responses per hour were not significantly changed. We are continuing the analysis of these measures of the pauses that occur after reinforcement.

4. Intensive Analysis of Individual Patients:

This research continues with nine patients. A summary of these long term investigations follows:

Patient Number	Number of Experimental Sessions	Main Experimental Interest
1	350	Rate increase and cycles (Candy 1 st VI)
36	150	" " " "
7	250	Extinction after Variable-interval reinforcement
23	300	" " " "
32	250	" " " "
22	350	Fixed-ratio 5 (pauses and rate increase)
31	250	" " " "
35	250	Fixed-ratio 40 " " " "

Ratings of ward behavior are also being collected approximately every week for correlation with the long-term changes observed in the behavior of the above patients.

5. Exploration of Useful Reinforcers:

One of our most important observations to date is that some patients respond at very low, erratic rates of response compared to other patients and to unhospitalized individuals. Since low, erratic rates of response are characteristic of inappropriate reinforcers, it was necessary to try many different reinforcers with a group of patients to determine whether the low, erratic rate was a general characteristic of the psychotic's behavior or if some reinforcer could be found which would produce a high, even rate for each patient. Such an exploration of reinforcers is also necessary in the attempt to produce enough behavior to study from the patients with very low rates (in order to "gain control" of their behavior), and to determine the best general reinforcer to use in the large-scale investigation of the behavior of chronic and acute psychotics.

A large portion of our experimental time has been spent

on this exploration over the past three years. Although we will continue developing new reinforcers, we have completed our major exploration. Twenty-three male chronic psychotics have responded for 10 hours on a one-minute variable-interval schedule for each of the following reinforcers: 1) candy, 2) female nude pictures, 3) male nude pictures, 4) five-cent pieces, and 5) feeding a hungry kitten (see below). An operant level was the 6th condition. In general, patients who responded at a low rate for candy-reinforcement tended to respond at low rates for the other reinforcers. Candy was the most effective general reinforcer. Other relations between the reinforcers and individual differences between the patients are being analyzed. We are continuing this study to include the escape of intense pure tones and punishment with mild electric shock.

6. Experimental Altruism - a Social Reinforcer:

Some of the patients might not respond to produce a positive reinforcer for themselves, but they might produce one for another organism. In lay terms, even though they have "guilt", they will respond to give "charity" to another organism. Also, it is a common observation that some of the sickest mental patients will not eat themselves, but will not let an animal pet die - they continue to feed it. In an attempt to utilize such reinforcing properties in our investigations, we conditioned a small, hungry kitten to drink milk when a dipper was automatically presented. The kitten was in a cage with a plexi-glass front behind the manipulandum panel and was visible to the patients as they responded inside one of the experimental rooms.

Feeding the kitten acted as a reinforcer for only 5 (12%) of the 23 patients studied. An intensive investigation with 2 patients showed that the altruistic reinforcer did not lose its strength over 50 hours of reinforcement, and that a characteristic extinction curve followed the termination of reinforcement. Feeding the kitten was clearly a reinforcer for a small number of patients (12%). Three patients responded at their highest rate to feed the kitten, and three patients responded at a rate lower than their operant level (suggesting that feeding the kitten was aversive to them).

7. Duration of Experimental Session:

Our longest continuous experimental session to date has been 8 hours without the patient leaving his chair. Such long sessions are not feasible with some patients who become agitated and knock on the door after an hour or so, but it is clear that we have not reached the upper limit with other patients. It is important in this connection to note that we have used no food deprivation as yet, therefore we are using reinforcers of low strength by lower organism standards (satisfying conditioned and specific hungers).

PLANS FOR FUTURE WORK

We will continue the following investigations:

1. Observations on New Patients.
2. Further Analysis of Inter-response times greater than 10 seconds.
3. Quantification of "Fixed-Ratio Pauses."
4. Intensive Analysis of Individual Patients.
5. Exploration of Aversive Stimuli.
6. Duration of Experimental Session.

We will initiate the following investigations:

7. Analysis of "responding through" period of conditioned reinforcement.

This analysis of the responses during S^r will provide a measure of the discriminative ability of each patient studied to date.

8. Analysis of Refusals and Withdrawals.

An analysis of the refusals to leave the wards or enter the experimental rooms and the withdrawals from the rooms will permit the inter-correlation of these measures to see if they tend to occur together. It is possible that some

patients differ markedly with respect to these measures. (In an earlier study we found that children diagnosed "autistic" had to be conditioned to stay alone in the rooms. Without this training they withdrew from the rooms.) It should also be possible to demonstrate that these measures increase in frequency under certain experimental conditions (ie: operant level, and extinction).

9. Analysis of Immediate Use of Reinforcer.

We have collected enough data to compare rates of response, etc., between patients that ingest each reinforcer immediately upon presentation and those patients who hoard the reinforcers and take them back to the wards. The frequency of hoarding and ingestion might vary with respect to the different schedules of reinforcement used, as well.

10. Differential Reinforcement of Low Rates.

With patients who respond at high rates and with the patient who will not extinguish (P23) we will reinforce only those responses that occur after long pauses in an effort to decrease the rate of responding. If the rate is thus decreased, it will be clear that the patient is controlled by reinforcing stimuli, even though he fails to extinguish when reinforcement is terminated.