GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF RESEARCH ADMINISTRATION

RESEARCH PROJECT INITIATION

Date: 18 April 1973

Project Title: "The Effects of Alcohol on Schedule-Controlled Behavior in the Rat"

Project No: G-42-620

Principal Investigator: Dr. M. J. Marr

Sponsor: Public Health Service

Agreement Period: From April 1, 1973 Until May 31, 1973

Type Agreement: Internal Grant

Amount: $4,725

Reports Required: Summary Report to be submitted to the Biomedical Sciences Support Grant Committee by 8/1/73.

Sponsor Contact Person (s):

Dr. J. W. Crenshaw, Jr.
Chairman, Biomedical Sciences Support
Grant Committee
School of Biology
Campus

Assigned to: Psychology

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Patent Coordinator	Other

RA-3 (6-71)

GEORGIA INSTITUTE OF TECHNOLOGY

OFFICE OF RESEARCH ADMINISTRATION

no action asked

RESEARCH PROJECT TERMINATION

Date: December 7, 1973

Project Title: "The Effects of Alcohol on Schedule-Controlled Behavior in the Rat"

Project No: G-42-620

Principal Investigator: Dr. M. J. Marr

Sponsor: Public Health Service

Effective Termination Date: May 31, 1973

Clearance of Accounting Charges: by December 31, 1973

Note: Internal grant supported by funds from G-32-604

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Photographic Laboratory
Terminated Project File No. _____
Other Dr. J. W. Crenshaw
G-32-604

RA-4 (5/70)

THE EFFECTS OF ALCOHOL ON SCHEDULE-CONTROLLED BEHAVIOR IN THE RAT

M. Jackson Marr, Ph.D.

School of Psychology

Georgia Institute of Technology

Progress Report on G42-620

August 1, 1973

THE EFFECTS OF ALCOHOL ON SCHEDULE-CONTROLLED BEHAVIOR IN THE RAT

The purpose of this study is to explore, using rats as subjects, the value of schedules of reinforcement to the study of the effects of alcohol on behavior.

A schedule is a procedure for presenting certain reinforcing events, e.g., food, to an organism in time and in relation to responding. Behavior pharmacology has focused much attention upon the effects of various drugs on schedule-controlled behavior. This research has led to certain general principles of drug-behavior interactions which, among other things, have been valuable in the classification of drugs. However, alcohol has been relatively neglected in this regard. One possible reason for this is that alcohol is somewhat difficult to administer to experimental animals. Injection can result in tissue necrosis and administration by stomach intubation tends to be awkward. The method used in the present study involves the phenomenon of schedule-induced polydipsia, i.e., a tendency under certain schedules of reinforcement for a subject to consume large amounts of fluid. Thus we are able to study the effects of alcohol on schedule performance, while the schedule itself induces alcohol intake.

The principal schedule chosen for study was the fixed interval (FI). Under an FI schedule the first

designated response to occur following a fixed time period is reinforced. Responses occurring before the time has elapsed have no programmed consequences. The fixed-interval schedule has a number of advantages for the analysis of alcohol effects. First, there is a large body of literature on the effects of many drugs on fixed-interval performance so that comparisons of effects of alcohol with other drugs are easily made. Second, the fixed-interval schedule generates a pattern characterized by a pause following the reinforcing stimulus presentation, after which positively accelerated responding occurs, terminating in the next reinforcer delivery. Thus, the schedule by generating a wide range of response rates (from zero to over one response/sec.) allows for an assessment of how alcohol might interact with the on-going frequency of responding. There is ample evidence that rate of responding is an important determinant of the effects of many drugs. The relationship between frequency of responding and alcohol effects is not clearly known, even though the existence of such a relationship has important implications for the designation of alcohol as a "stimulant" or "depressant." Finally, the fixed-interval schedule of appropriate parameter value is a powerful inducer of polydipsia and therefore can lead to significant alcohol intake.

PROCEDURE

The rats were trained to press a lever for food pellets (97 mg Noyes pellets), and stable performance ultimately developed under a fixed-interval of 180-sec. (FI 180-sec). Thus, the first lever press to occur after 180-sec was followed by the delivery of a food pellet. The 180-sec was timed from the previous pellet delivery (or from the beginning of an experimental session). An experimental session consisted of 26 food pellet deliveries, i.e., 26 intervals. For purposes of measurement, the interval was divided into ten 18-sec segments and the rate of responding per session was determined for each segment. The overall rate was also measured.

Polydipsia was established initially with water. The subjects consumed from 20 to 30 cc of water during an experimental session of approximately 80 minutes duration. This is equivalent to 5 - 10% of their body weight. After a stable day-to-day intake of water was established, alcohol was introduced at 0.5% V/V and increased 0.5% each day. At 8%, intake was about half of the original water intake and the concentration was reduced to 6%. At that value, intake was about two-thirds that of water. Alcohol or water was provided during the session on alternate days, water on Mondays, Wednesdays, and Fridays, and alcohol on Tuesdays and Thursdays. Rates and patterns of responding under the fixed-interval schedule were compared in the presence

of alcohol and water.

RESULTS

Data now being collected indicate that session consumption of alcohol on the order of 1 gm/kg clearly decreases rates of responding. The decreases occur particularly during the later portion of the fixed interval where the rates are highest under control conditions. The effects of alcohol on the normally very low rates during the initial portions of the interval are more complex. In those subjects in which the rates are zero or very near zero, alcohol does not increase responding. However, if there is some minimal tendency to respond near the beginning of the interval, then alcohol increases those rates above their control value. In all these actions, alcohol resembles both d-amphetamine and pentobarbital. These drugs show rate-dependency effects on fixed-interval performance in that they tend to increase low rates of responding while decreasing high rates of responding. Alcohol appears to have less rate-increasing and greater rate-decreasing tendencies than either d-amphetamine or pentobarbital. More data must be collected to substantiate this; however, it is clearly an oversimplification to label alcohol a "depressant" or a "stimulant." Its effects in altering behavior appear to be a function of the frequency with which that behavior occurs.

Future directions of this research involve the study of the effects of alcohol on punished responding, and comparisons in this respect with pentobarbital, a drug known to enhance responding suppressed by punishment. Alcohol and the barbituates share a number of actions in common. Perhaps effects on punished responding will be added to that list.

Funding requests for this project involved only equipment and supplies. However, while receiving no direct financial support, two graduate students in experimental psychology have been actively involved with this research in design, equipment and drug preparation, data handling, and animal care. The project has therefore provided them with beneficial training and experience in the conduct of behavior experiments. The equipment and supplies will, of course, be useable for other behavioral experiments.

EXPENDITURES

Initial funds for equipment and supplies: $4,725.00

			Balance
	Stepping switch	$168.40	4,556.60
	Power supply	228.56	4,328.04
3.	Relay panels	406.60	3,921.44
4.	Clocks, pulseformers, relay racks, snap leads	2,234.85	1,686.59
	Probability generator, flip-flops, print-out counter	782.00	904.59
	Cumulative recorder paper, pens, feeders	327.00	577.59
7.	Syringes	11.25	566.34
8.	Counters	405.44	160.90
9.	Timers	90.00 (estimated)	70.90

Items not yet received as of 7/31/73.