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Short report

Disruptive effects of prefeeding and haloperidol administration on multiple measures of food-maintained behavior in rats

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ABSTRACT

Four rats responded under a choice reaction-time procedure. At the beginning of each trial, the rats were required to hold down a center lever for a variable duration, release it following a high- or low-pitched tone, and press either a left or right lever, conditionally on the tone. Correct choices were reinforced with a probability of .95 or .05 under blinking or static houselights, respectively. After performance stabilized, disruptive effects of free access to food pellets prior to sessions (prefeeding) and intraperitoneal injection of haloperidol were examined on multiple behavioral measures (i.e., the number of trials completed, percent of correct responses, and reaction time). Resistance to prefeeding depended on the probability of food delivery for the number of trials completed and reaction time. Resistance to haloperidol, on the other hand, was not systematically affected by the probability of food delivery for all dependent measures.

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1. Introduction

Resistance to change is a measure of behavioral persistence when disruptive events are introduced. In a prototypical study (e.g., Nevin, 1974), the schedule components differed in terms of reinforcement rates. Resistance to change, as expressed by performance during disruption relative to that during baseline, is typically greater in the component with higher reinforcement rates. This finding, replicated in a wide variety of studies using different procedures, has led to the development of behavioral momentum theory (Nevin, 1992).

A challenge to behavioral momentum theory comes from studies examining effects of pharmacological disruptors. Although some researchers (e.g., Egli et al., 1992; Harper, 1999a, 1999b; Hoffman et al., 1987; Poling et al., 2000; Yoo et al., 2003) have obtained results consistent with behavioral momentum theory with drugs from several pharmacological classes such as stimulant (e.g., cocaine), antipsychotic (e.g., haloperidol), and opioid (e.g., morphine), others have found that pharmacological disruptors do not operate in the same manner as non-pharmacological disruptors (e.g., Cohen, 1986; Jimenez-Gomez and Shahan, 2007; Lamb and Ginsburg, 2005; Pinkston et al., 2009). For example, Cohen (Experiment 3) investigated resistance of food-maintained responses by rats to *d*-amphetamine, sodium pentobarbital, haloperidol, and cholecystokinin, and found that behavior was not necessarily more resistant to disruptive effects of these drugs in the component with higher reinforcement rates.

It is important to note that, except for Yoo et al. (2003), previous studies have measured resistance to pharmacological disruptors on response rates. Drugs of various classes can affect some dimensions of behavior and not others (e.g., Blokland and Honig, 1999); thus, resistance to disruption may manifest itself in other measures. To account for the aforementioned discrepant data sets, it is worthwhile to examine effects of pharmacological disruptors on multiple behavioral measures to better characterize their effects.

Yoo et al. (2003) showed that disruption of both response rate and conditional discrimination accuracy by the atypical antipsychotic resperidone was greater under the leaner reinforcement condition in a woman with intellectual disabilities. Along with this study, one possible behavioral measure of interest is conditional discrimination accuracy. The use of this measure not only extends the scope of behavioral momentum theory to something other than response rates (Nevin et al., 2003), but also allows us to detect degradation in stimulus control caused by drug administration that could obscure effects of differential stimulus–reinforcer relations on resistance to change (e.g., Harper, 1999a, 1999b).

Another possible measure is reaction time. Brockel and Fowler (1995) examined disruptive effects of haloperidol on reaction time in rats and found that reaction time increased as a function of the doses of haloperidol administered. This suggests that reaction time can be a useful measure to examine disruptive effects of haloperidol in the context of behavioral momentum theory.

The purpose of this study was twofold: (1) to develop a procedure with multiple behavioral measures that are sensitive to disruptive effects of environmental manipulations (e.g.,

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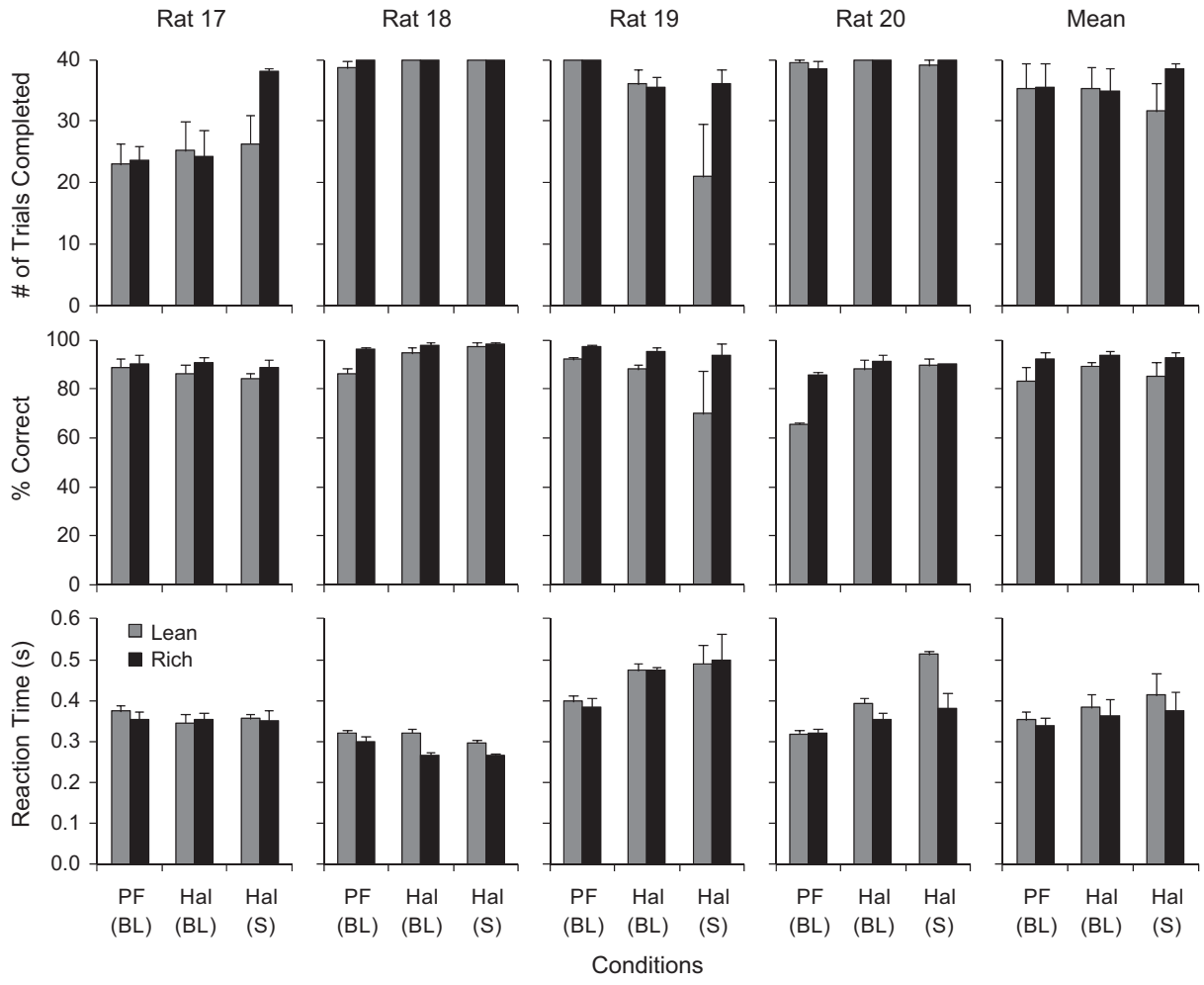

Fig. 1. Mean number of trials completed (top panel), mean percent of correct responses (middle panel) and mean of median reaction times (bottom panel) during the baseline (BL) and saline (S) sessions preceding the prefeeding (PF) and haloperidol (Hal) tests. The baseline data are the average from the five sessions prior to the disruption test. The saline data are the average of the three sessions prior to each dose of haloperidol administration. The gray and black bars represent performance during the lean and rich conditions, respectively. The error bars represent the standard error of the mean.

prefeeding) and (2) to investigate whether haloperidol disrupts food-maintained behavior in the same manner as a non-pharmacological disruptor. Haloperidol, a typical antipsychotic, was chosen based on its disruptive effects on reaction time reported in Brockel and Fowler (1995). Three behavioral measures were employed: conditional discrimination accuracy, reaction time, and the number of trials completed in a session.

2. Materials and methods

2.1. Subjects

Four male Sprague-Dawley rats, each experienced with a reaction-time task (Blokland, 1998), were maintained at 85% (±5%) of their predicted free-feeding body weights based on the procedure described by Davenport and Goulet (1964). They were housed individually in a temperature-controlled room with a 12:12 h light/dark cycle. The National Institute for Occupational Safety and Health (NIOSH) animal facility is specific-pathogen free, environmentally controlled, and accredited by the Association for Assessment and Accreditation of Laboratory Animal Care International. All animal procedures have been reviewed and approved by the NIOSH Animal Care and Use Committee.

2.2. Apparatus

Experimental sessions were conducted in four standard operant-conditioning chambers 22 cm high, 29 cm wide, and 24 cm deep. On the front panel of the chamber were two retractable levers 7 cm above the grid floor. Two white cue lights were positioned above each lever. Between the two levers were a response lever and a rectangular opening centered 8.5 cm above the floor. Food pellets (45 mg, Research Diets) were dispensed into the opening. A click sound accompanied each pellet delivery. A photocell detected the rat's head in the opening. General illumination was provided by a house light positioned at the rear of the chamber. High- (10 kHz; 90 dB) and low-pitched (2.5 kHz; 90 dB) tones were presented from a speaker positioned at the back panel of the chamber. Experimental events were controlled and recorded by MED-PC® (Version 4.0) for Windows® software and interfacing.

2.3. Procedure

2.3.1. Baseline

Sessions usually were conducted 5 days per week at approximately the same time each day. A trial began with the illumination of the houselight that was either static or blinking at 0.2 s interval. The rats were required to hold down the center lever for a variable duration, ranging from 0.6 to 1.5 s (with steps of 0.1 s; chosen