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FURTHER EVALUATION OF REINFORCER MAGNITUDE EFFECTS IN NONCONTINGENT SCHEDULES

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We closely replicated the procedures of a previous study that showed a positive relationship between reinforcer magnitude and the response-rate-reducing effects of noncontingent schedules (NCS). NCS reduced response rates, as expected, but the NCS-magnitude effect was not reproduced, illuminating possible weaknesses of current arbitrary-response procedures and suggesting avenues for future research.

DESCRIPTORS: noncontingent schedules, reinforcer magnitude, developmentally disabled adults

Noncontingent schedule (NCS) interventions can weaken unwanted behavior without serious side effects or extensive staff effort (Vollmer, Ringdahl, Roane, & Marcus, 1997), but many factors may influence NCS efficacy. Carr and colleagues may have identified one such factor in the size (magnitude) of the reinforcer delivered (Carr, Bailey, Ecott, Lucker, & Weil, 1998). During baseline, developmentally disabled adults earned small, edible reinforcers by placing poker chips into a container. Next, reinforcers were delivered independently of behavior, with their size varied across sessions. Response-rate reductions were more pronounced and reliable with larger reinforcers, suggesting that NCS interventions work best when reinforcer magnitude is high. As a test of generality, we closely replicated the procedures of Carr et al. in the context of an expanded experimental design.

METHOD

Three adults with severe to profound mental retardation, ages 18 to 53, worked individually in an office-sized room at a day treatment facility. Prior to the study, a paired stimulus preference assessment (see Carr et al., 1998) identified preferred edible items for use as reinforcers: peanut butter candies for Mel (low and high magnitudes were one and three candies, respectively), mint wafers for John (one quarter of a wafer and one full wafer), and chocolate cereal for Janet (one and three pieces).

Participant and experimenter sat across from one another at a table supporting a box of 150 poker chips and a plastic container. During 10-min sessions, conducted approximately 2 hr after a meal, the experimenter sat motionless except to record data and place edible items in front of the participant as required by the research protocol. Prior to the study, an arbitrary response (dropping a poker chip into the plastic container) was

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established using modeling, verbal prompts, and continuous reinforcement. Modeling and prompts ceased and, over several sessions, the reinforcement schedule was gradually extended to variable-ratio (VR) 4. At the start of each new contingent reinforcement condition, this process was repeated as necessary to reestablish responding. No preliminary training data are presented here. During the study, responses were recorded by the experimenter and by an independent observer on at least 35% of each participant's sessions. Percentage agreement (the lower of two counts divided by the higher multiplied by 100%) averaged above 98% for all participants (session range, 92% to 100%).

Phase 1 involved separate NCS tests involving high-magnitude and low-magnitude reinforcers. Reinforcer magnitude (high or low) was constant within each test, which consisted of a contingent reinforcement baseline condition, using a VR 4 schedule, and an NCS condition, using a fixed-time (FT) schedule with reinforcement rate set equal to that of the preceding baseline condition. Schedule values are shown as condition labels in Figure 1. Conditions lasted until visual inspection of graphed response rates showed no pronounced trend over four consecutive sessions. John was dropped from Phase 1 due to experimenter errors in setting schedule values. In Phase 2, stable performance on VR 4 (using high-magnitude reinforcers for Mel and low-magnitude reinforcers for Janet and John) served as baseline for an alternating-treatments NCS condition, lasting at least 18 sessions, in which the low- and high-magnitude reinforcers alternated across sessions.

RESULTS AND DISCUSSION

Figure 1 shows that contingent reinforcement maintained substantial responding, and NCS reduced response rates. Decreases sometimes were modest, as expected given that, for experimental control purposes, NCS frequency was yoked to baseline reinforcement rate, rather than maximized, as in many therapeutic interventions. We found no systematic evidence of the NCS-magnitude effect, regardless of whether reinforcer magnitude was manipulated across conditions (Phase 1, top and middle panels of Figure 1) or across sessions within a condition (Phase 2, bottom row of panels in Figure 1). To evaluate NCS efficacy during Phase 1, response rates during the last four sessions per NCS condition were considered as a percentage of the median rate during the last four sessions of baseline. Bar-graph inserts in Figure 1 show median percentage reductions. The decrease was greater during low-magnitude NCS for Mel and was similar during the two NCS conditions for Janet. During Phase 2, which closely replicated the experimental design of Carr et al. (1998), no differences were evident in response rates as a function of reinforcer magnitude. Thus, we replicated standard rate-reducing effects of NCS, but could not verify that reinforcer magnitude is a reliable predictor of NCS efficacy.

Most aspects of the present study (i.e., subjects, setting, and procedures) were similar to those of Carr et al. (1998), but functional differences between the studies cannot be ruled out. For example, in both studies reinforcer magnitude was defined structurally, in terms of physical units, rather than functionally, in terms of documented effect on behavior. In examining NCS effects of reinforcers that differed by a magnitude of about three, Carr et al. found magnitude-specific NCS effects (4 of 5 subjects), but we did not. We also found no systematic magnitude-specific effects during contingent reinforcement baselines (Phase 1), suggesting that, in an important way, the low- and high-magnitude reinforcers of the present

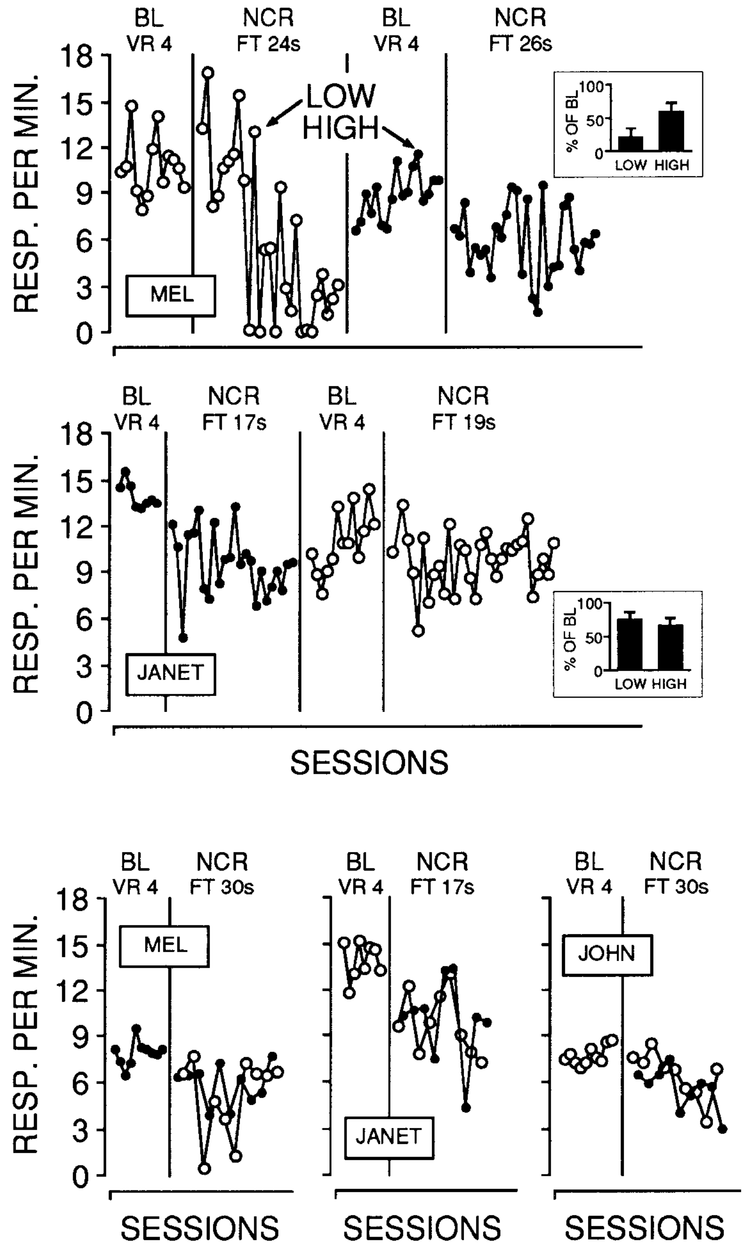

Figure 1. Response rates under contingent reinforcement baselines (BL) and noncontingent schedules (NCS), as a function of reinforcer magnitude manipulated across conditions (Phase 1, top and middle panels) and across sessions (Phase 2, bottom row of panels). Inserts (Phase 1) show response rate under NCS as a proportion of the contingent reinforcement baseline, with error bars equal to one standard deviation. VR = variable ratio, VT = variable time.

study were not functionally different. The implications of this observation remain unclear, because Carr et al. did not manipulate reinforcer magnitude in baseline. It seems reasonable, however, to propose that, in future NCS studies, reinforcer magnitudes should be considered to be different only insofar as they produce differential effects on behavior when used contingently. This precaution would greatly simplify the task of comparing results across studies.

It is also worth noting that, despite formal similarities to laboratory research, arbitrary-response experiments (like ours and that of Carr et al., 1998) often fail to fully document the variables that contribute to response maintenance. Typically unknown, for example, is the extent to which behavior is influenced by factors such as instructional control or automatic reinforcement. As a result, NCS is inserted into a response-strength context that can differ across subjects and studies, producing variance that could magnify or obscure reinforcer-magnitude effects. Treatment studies, by contrast, begin with a functional analysis that illuminates sources of control. An analogous step for arbitrary-response studies would be to include an extinction (i.e., instructions only) condition to assess response-rate decreases in the absence of the experimenter-selected reinforcer. The greater the decrease, the clearer the role of the experimenter-selected reinforcer in response maintenance, and the tidier the test of NCS effects.

Basic research reveals complex determinants of reinforcer-magnitude effects (e.g., Reed, 1991). Our failure to replicate the results of Carr et al. (1998) suggests a need to move beyond the question of whether reinforcer magnitude matters in NCS to the more difficult question of "under what conditions?" Arbitrary-response procedures, which are relatively unconstrained by treatment goals and related practical constraints, can, with procedural improvements as suggested above, allow the detailed analyses and parametric manipulations (e.g., of magnitude and schedule density; see Carr et al., 1998) needed to pursue this agenda.

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