The role of positive conditioned reinforcement in the maintenance of keypecking which prevents delivery of primary reinforcement*

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When a pecking key is briefly illuminated prior to the presentation of a grain reinforcer, keypecking is reliably developed and maintained in pigeons, even when pecking extinguishes the keylight and prevents reinforcement (negative automaintenance). This experiment assessed the role of response-produced key offset as a possible conditioned positive reinforcer of keypecking. Pigeons responded in a substantial proportion of the trials (50%-66%) on a procedure in which key illumination coterminated with reinforcer availability, and in which keypecks prevented reinforcement but did not extinguish the keylight. Thus, the notion that negative automaintenance keypecking is a function of conditioned positive reinforcement must be rejected.

Brown & Jenkins (1968) reported a method for the automatic shaping (autoshaping) of keypecking in pigeons. If a pecking key is illuminated for several seconds prior to the operation of a feeder, experimentally naive pigeons will begin to peck the key. Williams & Williams (1969) followed up this observation by exploring whether a positive response-reinforcer contingency was necessary to support sustained responding in this situation. In their procedure, trials in which no peck occurred terminated with reinforcement, as in the Brown and Jenkins procedure. However, pecks to the illuminated key immediately turned it off and terminated the trial without reinforcement. Despite this negative response-reinforcer contingency, pecking was maintained at substantial levels for an extended series of trials ("negative" automaintenance).

The primary failure of contingent control evidenced by the negative automaintenance phenomenon places the burden of inquiry on the question of whether response-reinforcer contingencies play any role at all in the determination of automaintained pecking. Thus, the experiment reported here was undertaken to examine whether evidence for *any* involvement of response-produced offset of the key (a standard feature of the Williams and Williams negative automaintenance procedure) was acting as a conditioned reinforcer in maintaining keypecking. In the negative automaintenance procedure, when the keylight is followed by feeder operation, the offset of the key is directly paired with food. Conceivably, these pairings might make stimulus offset a conditioned reinforcer which would then maintain pecks emitted to the key in the face of the negative contingency. Trials where no pecking occurs serve to establish the conditioned reinforcer; trials where pecks occur might reinforce the peck at the same time that they extinguish the conditioned reinforcer. As the reinforcer weakens and pecking subsides, stimulus offset is again paired with food, and its power as a conditioned reinforcer might be reestablished. The waxing and waning pattern of responding that would be expected from this set of circumstances was actually in evidence in the Williams and Williams experiment.

The influence of this variable can be examined in a straightforward way. If the keylight stays illuminated until reinforcement is terminated (not only until it is presented), then the offset of the keylight will be paired with termination of reinforcement. The effect of the pairing would be to make stimulus offset, if anything, aversive, so that production of stimulus offset would not be expected to maintain responding. A second means of controlling possible conditioned reinforcement effects involves simply leaving the key on when pecking begins and turning it off after the normal time (6 sec), but without reinforcement. In this case, pecking prevents reinforcement but has no influence on keylight duration. By combining these manipulations, the consequences of response-key offset relationships should be entirely removed. To the extent that this variable contributes to responding under the negatively contingent procedure, pecking should be reduced well below the levels previously reported.

SUBJECTS

Four naive Silver King pigeons (1062, 1149, 1303, 1322), deprived to 80% of their free feeding weights, served as Ss.

APPARATUS

One wall of a standard pigeon chamber contained a three-key pigeon panel with keys that could be illuminated by various colored lights. The keys were about 20 cm above the floor of the chamber and about 10 cm

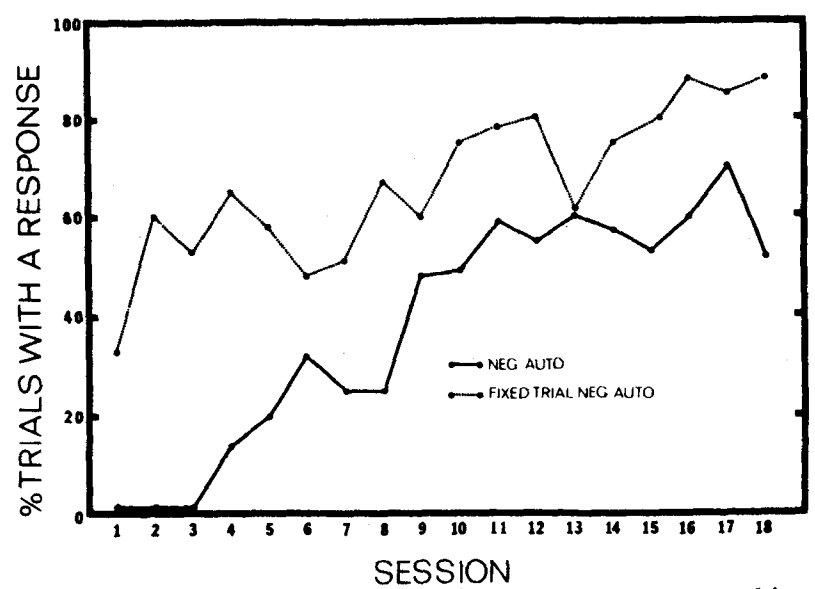

Fig. 1. Proportion of trials in which at least one response occurred in each experimental session. Data for the two pigeons in each group are averaged for each session.

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apart center-to-center. A food magazine was centered 12.5 cm below the center key. A deflector was placed on the houselight, located about 7 cm above the center key, so that the light was directed toward the ceiling of the chamber. Only the center key was ever illuminated.

PROCEDURE

The pigeons were first trained to eat from the food magazine. On the following day, negative automaintenance training was begun. For one pair of pigeons (1062 and 1149), the center key was illuminated with white light for 6-sec trials, followed by 4-sec access to grain, during which the key remained lit. Keypecks during the trial turned off the stimulus and ended the trial without reinforcement (negative automaintenance-stimulus overlap). For the other pair (1303 and 1322), conditions were the same on trials on which no peck occurred. However, on trials in which the pigeons pecked, the stimulus remained on until the 6 sec elapsed, after which the trial terminated with no reinforcement (fixed-trial negative automaintenance stimulus overlap). Trials were separated for both groups by an intertrial interval (ITI) of 10-90 sec, with a mean of 30 sec.

RESULTS

Figure 1 shows the proportion of trials on which at least one response occurred during the entire course of training under the two conditions. Contrary to prediction, substantial levels of responding were maintained by both groups throughout the experiment. Individually, over the entire experiment, Pigeon 1062 responded in 50% of the trials, Pigeon 1149, in 47%, Pigeon 1303, in 66%, and Pigeon 1322, in 65%. The lowest level of responding maintained by any pigeon in this stimulus-overlap condition was higher than the level maintained by 10 of the 13 Ss in the Williams and Williams procedure. Thus, stimulus overlap appeared to enhance the effect of pairing key and grain rather than diminishing it, and the conditioned reinforcement analysis suggested above is clearly inadequate. Although there is a consistent difference between fixed-trial negative automaintenance and negative automaintenance groups, the difference is well within the range of inter-S variability that has been observed in previous negative automaintenance experiments (Williams & Williams, 1969).

DISCUSSION

The present experiment established three points. First, darkening the key contingent on pecking is not critical for sustained behavior under the negative automaintenance procedure. Second, the use of "fixed-trial" procedures, where the key stays on for a determined period of time regardless of behavior, seems feasible for further work. The advantage of this procedure over the previous one (Williams & Williams, 1969) is that it permits the measurement of rates of responding, and hence a more detailed assessment of strength of responding on the negative automaintenance procedure. Finally, as a consequence, both of the overlap manipulation and of the fixed-trial manipulation, it is apparent that negative automaintenance is not dependent on the artifactual presence of conditioned reinforcing stimuli.

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