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YOKED CONTROL VERSUS RANDOM REINFORCEMENT:  
A COMPARISON OF EXPERIMENTAL DESIGNS<sup>1</sup>

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ABSTRACT

In verbal-conditioning studies, difficulty has been encountered in providing a control group with noncontingent reinforcement. Because randomly providing reinforcements to controls has proved unsatisfactory, Harmatz and Lapuc (1968) suggested a yoked control paradigm for equating controls with experimentals who were reinforced on a response class. In this study comparing the two methods in a verbal-conditioning paradigm, the yoked control was found to be equivalent to random reinforcement. Reasons for this seemingly contradictory finding are discussed.

Verbal behavior can be manipulated by reinforcing certain response classes, such as plural nouns. Greenspoon (1955) was one of the early investigators to

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apply operant conditioning toward such ends. Operant conditioning is a procedure which modifies a behavior if it occurs. Greenspoon (1955) used operant conditioning to reward people after they said a plural noun. The reward of hearing an experimenter say "Mmm-hmm" increased the number of plural nouns people emitted.

While many variations have been applied to Greenspoon's (1955) basic technique of operant verbal-conditioning, problems of inadequate control for total verbalizations, and the number and placement of reinforcements still remain. Operant rate (level of responding) in verbal learning has been assessed first by preexperimental sessions, and then attempts have been made to control for subject (*S*) variations (Babladelis, 1961). An alternate method of attaining control has been the use of a nonreinforced control group. However, in verbal-conditioning research, direct comparisons between experimentals and nonreinforced controls become difficult because experimenters are often interested in *S* reaction to the reinforcement of specific responses, not reinforcement versus nonreinforcement. Accordingly, completely random reinforcement in regard to specific responses has been utilized as a control (Sidowski, 1954).

Harmatz and Lapuc (1968) revealed flaws in the random-reinforcement schedule, when applied to verbal conditioning, showing that timing of rewards and the number of rewards given to a randomly reinforced group may be markedly different from the control group's schedule. To circumvent this problem, Harmatz and Lapuc (1968) applied the yoked-control technique, ensuring that the control *S* would receive the same number, spacings, and type of reinforcements as an experimental *S* reinforced for emitting the response class "positive self-references."

Traditional use of the yoked procedure has been applied to *Ss* operating at the same time and/or receiving the treatments together (Church, 1964). This analysis, however, followed that of Harmatz and Lapuc (1968), and attempted to expand the method by recreating the time intervals for rewards at latter date. The present stratagem was to evaluate more closely modifications in the yoked-control technique versus a random-reinforcement procedure.

#### METHODS

Twelve female undergraduates were randomly selected from an introductory psychology course at The University of Akron to serve as subjects in this study. Four of these *Ss* were randomly placed in each of three groups designated Vowel (VG), Yoked Control (YCG), and Random Reinforcement (RRG), and then tested individually. Subjects in all three groups were not reinforced for the first 15 words that they uttered; then the next 70 words were reinforced by "Mmm-hmm" for *Ss* in the VG when they said a word beginning with the letters a,e,i,o,u. The number of each response so reinforced for this group was noted so that the matched YCG *S* would also be reinforced on the same response number. The matched RRG *S* was given the same total number of reinforcements randomly between response number 15 to 86. The last 15 words (responses 86 to 100) were not reinforced for any group.

Each *S* was given Greenspoon's (1955, p. 410) instructions: "What I want you to do is to say all the words that you can think of. Say them individually. Do not use any sentences or phrases. Do not count. Please continue until I say stop. Go ahead." The criterion of saying at least one word beginning with a vowel during the first 15 trials was a prerequisite to being considered a *S* but any *S* able to verbalize this or the response-reinforcement contingency was identified and eliminated through a post-conditioning interview of questions similar to those used by Greenspoon (1955).

## RESULTS AND DISCUSSION

Members of the groups emitted the following median number of words beginning with vowels during critical trials 86-100; Vowel=2.50, Yoked Control=1.16, Random Reinforcement=1.16. These differences were found to be statistically significant [ $Pr(H \geq 5.69) = .049$ ] when treated by the Kruskal-Wallis One Way-Analysis of Variance procedure. Subsequently computed Mann-Whitney U tests indicated significant differences between VG and YCG, and between VG and RRG ( $Pr < .05$ ). There were no significant differences between YCG and RRG ( $Pr > .05$ ).

The finding that there were no significant differences between YCG and RRG did not lend support to Harmatz and Lapuc's (1968) tenet that yoked control was more suitable than random reinforcement for control purposes in verbal learning. Although Harmatz and Lapuc found the yoked technique valuable for control of rate of speech, number and percentage of reinforcements, this similar study suggests that the yoked design may have no advantage over random reinforcement.

One possible reason for these apparently contradictory findings is that Harmatz and Lapuc (1968) reinforced a broad group of behaviors that they defined as "positive self references." This study attempted comparisons on a small segment of a highly structured response class where the number of responses was controlled. To determine when the yoked *S* was to receive reinforcement, Harmatz and Lapuc (1968) looked to the experimental *S*'s rate of responding. For example, if the experimental *S* was rewarded after a length of time lasting "x" minutes, the yoked *S* would also be rewarded on the next response he made after time "x". This means that the yoked *S* did not receive reinforcements spaced exactly the same way as the original *S* because, although the same time interval "x" might occur, the experimenter could not reinforce the yoked *S* until he made the next response, which was emitted over an uncontrolled period of time. Because the yoked *S* did not receive reinforcements spaced exactly the same way as the original *S*, a criterion of the yoked-control technique, similar spacing of reinforcements, did not take place. The present plan of reinforcing yoked *S*s on the analogous response numbers on which VG *S*s were rewarded eliminated that difficulty. Inclusion of a third group (RRG) allowed direct comparison between yoked and random reinforcement, a procedure not attempted in the Harmatz and Lapuc (1968) design.

The response class, words beginning with vowels, seemed suitable for verbal learning research. The VG *S*s reinforced on this class emitted significantly more of these responses than did either the YCG or RRG *S*s. This scheme of reinforcing words beginning with vowels eliminated ambiguity in deciding whether responses were in classes such as "plural and nonplural responses" (Sidowski, 1954), "plural nouns" (Greenspoon, 1955), or "positive self-references" (Harmatz and Lapuc, 1968).

## REFERENCES

- Babladelis, G. 1961. Personality and verbal conditioning effects. *J. Abnorm. Social Psychol.* 62: 41-43.
- Church, R. M. 1964. Systematic effect of random error in the yoked control design. *Psychol. Bull.* 62: 122-131.
- Greenspoon, J. 1955. The reinforcing effect of two spoken sounds on the frequency of two responses. *Amer. J. Psychol.* 68: 409-416.
- Harmatz, M. G. and Lapuc, P. S. 1968. A technique for employing a yoked control in free operant verbal conditioning experiments. *Behav. Res. and Therapy* 6: 483.
- Sidowski, J. B. 1954. Influence of awareness of reinforcement on verbal conditioning. *J. Exp. Psychol.* 48: 355-360.