suggests that central physiological impairment produces forms of perceptual regression in the aged (cf. Birren, 1959; Rajalakshmi & Jeeves, 1963; Welford & Birren, 1965).

REFERENCES

- BENUSSI, V. Zur psychologie der gestalterfassens. In R. S. Woodworth and H. Schlosberg, *Experimental psychology*. New York: Holt, Rinehart, & Winston, 1954.
- BIRREN, J. (Ed.), *Handbook of aging and the individual*. Chicago: University of Chicago Press, 1959.
- EYSENCK, H. J., & SLATER, P. Effects of practice and rest on fluctuations in the Müller-Lyer illusion. *British Journal of Psychology*, 1958, 49, 246-256.
- GIBSON, J. J., & GIBSON, E. J. Perceptual learning: Differentiation or enrichment? *Psychological Review*, 1955, 62, 33-40.
- KÖHLER, W., & FISHBACK, J. The destruction of the Müller-Lyer illusion in repeated trials: I. An examination of two theories. II. Satiation patterns and memory traces. *Journal of Experimental Psychology*, 1950, 40, 267-281, 398-410.
- MOED, G. Satiation-theory and the Müller-Lyer illusion. *American Journal of Psychology*, 1959, 72, 609-611.
- MOUNTJOY, P. T. Effects of exposure time and intertrial interval upon decrement to the Müller-Lyer illusion. *Journal of Experimental Psychology*, 1958, 56, 97-102.
- MUKERJI, N. Is "illusion" illusion? *Journal of Genetic Psychology*, 1957, 57, 209-212.
- NOELTING, G. L'apprentissage perceptif de l'illusion de Müller-Lyer chez l'enfant et l'adulte. Reported in Wohlwill, J. F., *Developmental studies of perception*. *Psychological Bulletin*, 1960, 57, 249-288.
- RAJALAKSHMI, R., & JEEVES, M. A. Changes in tachistoscopic form perception as a function of age and intellectual status. *Journal of Gerontology*, 1963, 18, 275-278.
- SANTOS, J. R., & FARROW, B. J. The influence of developmental level on perceptual learning. *Proceedings of the Indiana Academy of Science*, 1965, 75, 240-245.
- SEGAL, M. H., CAMPBELL, D. T., & HERSKOVITZ, M. J. *The influence of culture on visual perception*. New York: Bobbs-Merrill, 1966.
- SELKIN, J., & WERTHEIMER, M. Disappearance of the Müller-Lyer illusion under prolonged inspection. *Perceptual & Motor Skills*, 1957, 7, 265-266.
- WAPNER, S., WERNER, H., & COMALLI, P. E., JR. Perception of part-whole relations in middle and old age. *Journal of Gerontology*, 1960, 15, 412-416.
- WELFORD, A., & BIRREN, J. (Eds.), *Behavior, aging and the central nervous system*. Springfield, Ill: Charles C Thomas, 1965.
- WERNER, H. *Comparative psychology of mental development*. New York: Science Editions, 1948.
- WINER, B. *Statistical principles in experimental design*. New York: McGraw-Hill, 1962.

NOTES

1. This experiment was performed in partial fulfillment of the requirements for the Master's degree, Temple University.
2. Now at the Institute of Child Development, University of Minnesota.
3. The investigators gratefully acknowledge the following persons for their assistance in obtaining subjects: the Superintendent of Schools and the principals of the West Marshall Street and the Burnside schools, Norristown, Pennsylvania, and the staff of the Jewish Home for the Aged, Philadelphia, Pennsylvania.

Words functioning simultaneously as positive operant reinforcers and unconditioned stimuli

ANDREW T. ABELL, *Southeastern Louisiana College, Hammond, La. 70401*

Data that would allow a partial analysis of the results of several earlier studies were gathered from 64 undergraduates in an experiment of identical-Ss design. A recently introduced conditioning device (reinforcer form) permitted the presentation of pleasant and neutral words to be contingent upon motor responses to CVCs. As predicted, Ss tended to respond to the CVC followed by pleasant words rather than to the one followed by neutral words, and they subsequently tended to

rate the CVC preceding pleasant words as more pleasant than the other one.

In an experiment that introduced a group verbal-conditioning device (reinforcer form), Abell (1969b) demonstrated that words can function concurrently as operant and respondent reinforcers. However, that preliminary study allowed for gross comparisons only, i.e., for determination of the effects of a "package" of variables, but not for the effects of individual ones alone.

As Abell suggested, an analysis of his findings is needed. For example, his results indicating that words functioned as

operant reinforcers may have reflected the operation of positive reinforcement or punishment or both. Similarly, his results showing the conditioning of evaluative meaning to consonant-vowel-consonant (CVC) trigrams do not permit an analysis that would indicate whether one of the CVCs acquired positive value, or the other one, negative value, or some combination of the two.

The present study was designed to initiate such analyses. The hypotheses were the following: (1) The tendency to respond to CVCs followed by pleasant words is greater than that to CVCs followed by neutral words; (2) CVCs preceding pleasant words are rated as more pleasant than those preceding neutral words.

SUBJECTS

A total of 64 students (25 males and 39 females) in two introductory psychology classes served as Ss during regular class periods. They were given no information about the experiment before serving in it.

MATERIALS

Four-page reinforcer forms, similar to those used before (Abell, 1969a), were constructed to present CVCs and eight evaluative words in an identical-Ss design. The CVCs, XIB and ZUJ, have the same scaled meaningfulness (m'), which is .73 (Noble, 1961). The eight evaluative words, four pleasant and four neutral, were chosen from words rated for pleasantness by students in general psychology classes. The words were rated on a 7-point scale ranging from *very pleasant* (7) through *neither pleasant nor unpleasant* (4) to *very unpleasant* (1).

From a preliminary rating by 41 students (18 males and 23 females) of the 71 neutral words used by Staats & Staats (1958), the 16 most nearly neutral ones (median ratings nearest 4.000) were determined. These neutral words, together with the 16 most pleasant words (highest medians) and the 16 most unpleasant ones (lowest medians) from earlier ratings (Abell, 1969b), were evaluated by another group of students (30 males and 52 females).¹ From this last set of ratings, the four most pleasant words and the four most nearly neutral ones were selected for use in the present study. These words, together with their medians, are the following: *love*, 6.914; *happy*, 6.839; *success*, 6.589; *mother*, 6.589; and *of*, 4.019; *those*, 4.013; *cord*, 4.000; *it*, 4.000.

A comparison of the format of a page or the form used in the present study (Fig. 1) with that of one used earlier (Abell, 1969a) will reveal only minor differences. For example, the overall dimensions of each undersheet of the present form are 7 x 14 in. rather than 8½ x 14 in. (The right and left margins that will not

Fig. 1. Part of a page of a reinforcer form.

mimeograph on 8½-in.-wide paper were removed.) Also, the staples securing the tabs were much smaller (crown ca 7.5 mm) than the standard staples used before. (These small staples were applied with a machine that will staple 5,000 times per loading, a Bates Model C stapler.) Finally, the tabs (15 x 47 mm) were 1 mm narrower than those used earlier (Abell, 1969b).

In Fig. 1, the first two overlying flaps have been removed (not done in the experiment) to reveal materials beneath. The trigram ZUJ mimeographed on a tab and the word MOTHER mimeographed on the undersheet are shown under the first flap. This would be the view of a S who chose XIB (by ripping off that tab) on the first presentation of the two CVCs. Both tabs are shown in place under the second flap.

As in earlier studies (see Abell, 1969b), two different sets of undersheets (A and B) were used in reinforcer forms. A sequence of 16 horizontal pairs of words was determined for each of the four undersheets of Set A through the use of a table of random numbers with the following restrictions: (1) that each pair contain a pleasant word and a neutral one, (2) that each of the eight different words occur four times per page, (3) that pleasant words and neutral ones be in left and right positions equally often. The arrangement of words in Set B was merely a reversal of the left-right positions of paired words in A.

As an additional control, in half of the reinforcer forms, XIB concealed a pleasant word and ZUJ, a neutral one (Tab Placement P); in the other forms, the reverse was true (Tab Placement N).

As before (Abell, 1969b), a page requesting evaluations of the trigrams on a 7-point scale (rating sheet) was included with each 4-page reinforcer form. As a control for a possible space error, half of the Ss received a rating sheet (1) in which XIB was printed above ZUJ; the other half received a rating sheet (2) in which the CVCs were in the opposite sequence.

Thus, different combinations of tab placements (P and N), undersheets (A and B), and rating sheets (1 and 2) yielded eight different booklets or control conditions: P-A-1, P-A-2, P-B-1, P-B-2, N-A-1, N-A-2, N-B-1, and N-B-2. The 64 Ss were divided equally among these conditions.

The Ss' responses—opening a flap, choosing a trigram, and closing the flap—were paced by the recorded sequence, "open," "choose," and "close," as described elsewhere (Abell, 1969a).

PROCEDURE

In each class, E merely asked the students to "take part" in a study. In order to have a multiple of eight Ss from each class, two students in one class and six in the other were eliminated through the use of a set of random numbers.

In each class, the eight different types of booklets, which had been stacked previously in a sequence randomized within each block of eight, were distributed by rows. Thus, a total of eight Ss were assigned to each of the eight control conditions.

The rest of the procedure was like that of a previous study (Abell, 1969a). Ss were first instructed about the use of a reinforcer form and about the pacing of their responses by means of the recording. They were allowed a 1-min rest after

finishing each page of a form. Following the completion of the last page, they were asked to follow the instructions on the rating sheet.

RESULTS AND DISCUSSION

The CVC on tabs covering pleasant words was selected more frequently than the other one by 40 Ss and less frequently by 22; the two were chosen equally often by 2. The sign test for large samples (Siegel, 1956) indicated a z of 2.16 (one-tailed $p < .02$). The CVC on tabs covering pleasant words was evaluated subsequently as the more pleasant by 45 Ss and as the less pleasant by 17; the two were judged the same by 2. The sign test produced a z of 3.43 (one-tailed $p < .0003$).

Consequently, both hypotheses were confirmed, showing that words can function simultaneously as positive operant reinforcers and UCSs. The immediate implications regarding earlier findings (Abell, 1969a,b,c) are the following: (1) Positive operant reinforcement was at least a source of the earlier results which showed that Ss tend to choose CVCs followed by pleasant words rather than those followed by unpleasant words; (2) conditioning of evaluative meaning to CVCs preceding pleasant words at least contributed to the previous demonstrations that Ss subsequently tend to judge CVCs associated with pleasant words as more pleasant than those paired with unpleasant words.

REFERENCES

- ABELL, A. T. A test of reinforcer forms with flaps. *Perceptual & Motor Skills*, 1969a, 29, 984-986.
- ABELL, A. T. Words functioning simultaneously as operant and respondent reinforcers: Preliminary study. *Psychological Reports*, 1969b, 24, 123-133.
- ABELL, A. T. Words functioning simultaneously as operant and respondent reinforcers: Replication. *Psychological Reports*, 1969c, 25, 974.
- NOBLE, C. E. Measurements of association value (a), rated associations (a'), and scaled meaningfulness (m') for the 2100 CVC combinations of the English alphabet. *Psychological Reports*, 1961, 8, 487-521.
- SIEGEL, S. *Nonparametric statistics for the behavioral sciences*. New York: McGraw-Hill, 1956.
- STAATS, A. W., & STAATS, C. K. Attitudes established by classical conditioning. *Journal of Abnormal & Social Psychology*, 1958, 57, 37-40.

NOTE

1. A one-page table (Table A) giving median and mean ratings for each of these 48 words has been deposited in the files of this journal. A copy will be supplied without charge on request to Psychonomic Science, 1200 West 34th St., Austin, Tex. 78703. Please give full citation—E981, Table A, title, and author.