Degrees of isolation and the Von Restorff effect in serial learning*

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Sixty college students learned by the study-recall method a serial list of 11 CVCs with the central item isolated in different degrees of perceptual enhancement: shape (Eb), shape and color (Ea), or shape, color, and size (E1); the middle three items isolated (E3); the middle five items isolated (E5); or none isolated (C) to a criterion of two consecutive errorless trials. Compared to the corresponding control items, significant facilitation of isolated item (I) occurred in all experimental conditions: The magnitude of facilitation of the I (sixth item) increased as (1) the degree of perceptual enhancement increased and (2) the number of surrounding Is decreased. The item immediately following I(s) was also significantly facilitated. The findings were accounted for in terms of Gibson's concepts of generalization and differentiation in verbal learning.

In 1933, von Restorff demonstrated that when an item in the middle of a list was uniquely emphasized or "isolated" against a relatively homogeneous list of items, Ss would learn the isolated item more quickly than the homogeneous items. The isolation effect was then explained by von Restorff as an example of the Gestalt principle of figure and ground perception. The isolated item (I) was thought to act as a vivid figure on the ground of nonisolated items (NI).

Subsequent findings in a variety of contexts have been quite consistent in confirming that isolation facilitates learning of the I. The I was learned better than an equivalent item in a homogeneous list (Bone & Goulet, 1968; Green, 1956; Jensen, 1962; McLaughlin, 1966; Newman & Saltz, 1958; Saltz & Newman, 1959; Steil & Hynum, in press).

Two important methodological factors which limit the generality of some previous findings are noted here. The first concerns the method of producing isolation through direct manipulation of the item. A qualitatively different dimension, or type of an isolated item, was employed in a list of homogeneous items. For example, a digit was employed among nonsense syllables (Pillsbury & Raush, 1943), a low-meaningful nonsense syllable among high-meaningful nonsense syllables (Newman & Saltz, 1958; Saltz & Newman, 1959), or a meaningful word among nonsense syllables (Jenkins & Postman, 1948). With the isolation by material method, either the isolated item differed from the item that occupied the corresponding position in a control nonisolated condition or the isolated and the corresponding control items were identical but appeared in different contexts (lists). It is clear that, in either situation, the Ss in experimental and control conditions were not learning the same responses. Therefore, the isolation effect would be confounded with the differences in ease of learning the qualitatively different materials. Second, the effect of various degrees of isolation on the von Restorff phenomenon has not yet been parametrically investigated without the confounding mentioned in the preceding discussion. Only in one recent study (McLaughlin, 1966) was the degree of isolation manipulated in terms of the number of nonisolates in a list. McLaughlin did find a significant facilitation of an isolated item relative to the control item, but a differential facilitation effect was not obtained as the number of NIs varied. Increasing the number of NIs would presumably enhance the degree of isolation, and thus increase the facilitation effect of the I. However, increasing the list length, in turn, increases the difficulty of mastering the whole list. A direct statistical assessment of the interaction between isolation and list length is questionable.

The purpose of the present study was to investigate the parametric relationship between degrees of isolation and the magnitude of the von Restorff effect without creating the confounding problems discussed above. The degree of isolation was manipulated in terms of (1) the degree of perceptual enhancement, i.e., the I was different from NIs in terms of shape, shape and color, or shape, color, and size; (2) the number of isolated items within a fixed-length list, i.e., one, three, or five isolates in an 11-item list. It was hypothesized that the critical isolated item occupying the middle position in a list would be learned faster if the perceptual enhancement increased or if the number of surrounding isolates decreased.

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SUBJECTS

Sixty college students, naive to a verbal learning experiment, from introductory psychology classes at Wisconsin State University, Whitewater served as Ss.

PROCEDURE

A serial list consisting of 11 CVC trigrams with 53.33% association value (Glaze, 1928) was employed. No two items began or ended with the same consonant. With the exception of y, each of the five vowels occurred twice in the list. The 11 items were: dup, kib, fov, miq, zul, vay, ler, wys, baj, noh, and ceg.

The degree of isolation was maniuplated in two ways: (1) in terms of perceptual enhancement and (2) the number of isolated items within the 11-item list. The NIs in all conditions were typed in lower-case red letters. In the perceptual enhancement condition, the middle (sixth) item of the list was typed either in upper-case red (shape, Eb), upper-case black (shape and color, Ea), or large upper-case black (shape, color, and size, E1). In E1 the I was produced using Instantype (12 pt., L1019, Instantype, Inc.). In the number of I condition, one (E1, the same E1 in the perceptual enhancement condition), three (E3), or five (E5) isolates occupying the sixth, the fifth, sixth, and seventh, or the fourth, fifth, sixth, seventh, and eighth positions were isolated in the same manner as was E1. A control condition (C) without an isolated item was included to evaluate the differential facilitation effect of the Is in the perceptual enhancement condition by comparing among C, Eb, Ea, and E1 and the Is in the number of isolated items condition by comparing among C, E1, E3, and E5. To control the possible confounding of serial-position effects by item difficulty, three lists involving different random orders of the 11 CVCs were constructed.

The assignment of Ss to conditions was determined by a prearranged random list of numbers as they appeared for the experiment. Each S was instructed to learn his list by the study-recall method, with a 2-sec presentation rate and a 60-sec recall period. Instructions essentially similar to Steil & Hynum's (in press) were given. All Ss were required to learn the list to a criterion of two consecutive errorless trials. On each recall period, the correct responses, intrusion errors (misplaced items), and errors were recorded. Four Ss' data were discarded: two were color anomalies, one did not follow the instructions, and the other failed to reach the learning criterion with 25 study trials and had to attend a class. Four more Ss were run to equalize the size for each group.

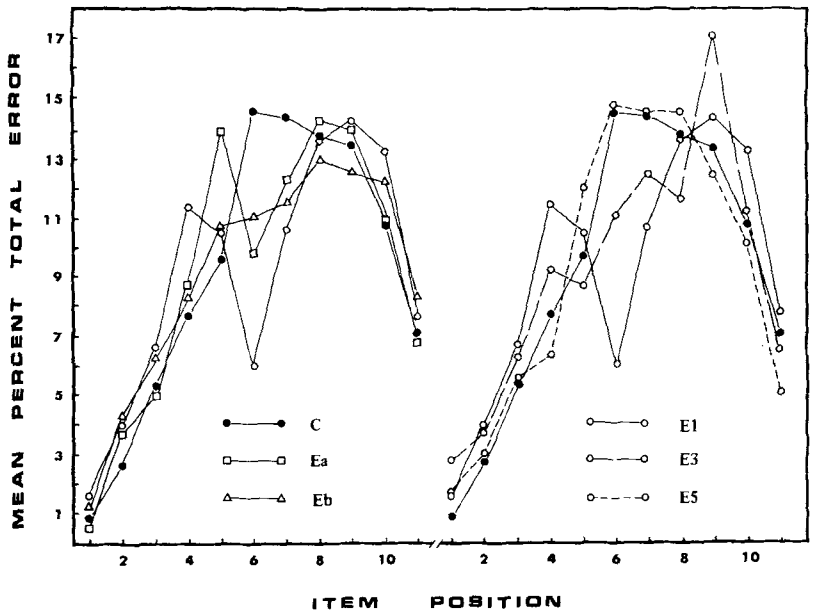

Fig. 1. The serial-position curves for the control and the experimental groups of one isolate, with various degrees of perceptual enhancement on the left, and of various numbers of isolate on the right.

RESULTS AND DISCUSSION

Figure 1 presents essentially the serial-position curves of the six groups, Ea, Eb, E1, E3, E5, and C. For the purpose of indicating separately the effect of the two different ways of producing isolation on learning the Is, the four curves on the left side of Fig. 1 present the perceptual enhancement condition and the four curves on the right present the number of isolate condition. Consequently, Groups C and E1 are shown in both conditions in order to provide an appropriate comparison. Each point on the curves represents a group mean of the percentage of total error, based on 10 Ss, plotted against the ordinal position of the item. The typical bow-shaped serial-position curve (McCrary & Hunter, 1953) has been clearly replicated in the present study. In terms of the total number of trials required to reach the learning criterion for the six groups, isolation did not facilitate the learning of the list as a whole, $p > .05$. It was consistent with most previous findings concerning the von Restorff phenomenon, that isolation did not enjoy any superiority in overall learning (Bone & Goulet, 1968; Jensen, 1962; Newman & Saltz, 1958; Steil & Hynum, 1970).

First, consider the effect of the degrees of perceptual enhancement on learning the I. An analysis of variance of the percent total error scores of the sixth item in C, Ea, Eb, and E1 indicated the facilitation effect of this independent variable, $F(3,36) = 12.247$, $p < .005$. Further orthogonal comparisons revealed a significant difference between: (1) E1 + Ea + Eb vs C, $F(1,36) = 23.142$, $p < .01$; (2) E1 + Ea vs Eb, $F(1,36) = 6.246$, $p < .025$, and (3) E1 vs Ea, $F(1,36) = 7.355$, $p < .025$. The mean percent total error of the sixth item in E1, Ea, Eb, and C was 5.96, 9.86, 11.02, and 14.58, respectively. Clearly, the findings suggested that the magnitude of facilitation of I increased as the degrees of perceptual enhancement increased (see the four curves on left of Fig. 1).

To see the effect of the number of Is on learning the Is, the Is in E1, E3, or E5 were compared with their corresponding control items in C. The presence of the facilitation effect on the learning of the Is is also obvious. For E1 vs C, the isolation effect was significant, $F(1,18) = 31.509$, $p < .005$; for E3 vs C, both the isolation, $F(1,54) = 4.482$, $p < .05$, and position effects, $F(2,54) = 6.586$, $p < .05$, were significant, with a trivial Isolation by Position interaction, $F < 1$; however, with five isolates in the list, the learning of Is in E5 was essentially identical to that in C, $F < 1$ (see the four curves on right of Fig. 1). To evaluate the differential facilitation effect, an examination of the performance on the middle and sixth item in the four groups, C, E1, E3, and E5, was performed. It should be noted that the differential facilitation effect would be contaminated by the different ordinal positions the Is held, if all Is had been compared between the experimental groups. The significant differences between E1 + E3 + E5 and C, $F(1,36) = 10.527$, $p < .005$; E1 + E3 and E5, $F(1,36) = 23.311$, $p < .005$; and E1 and E3, $F(1,36) = 11.733$, $p < .005$, suggested that the magnitude of facilitation of the I increased as the number of surrounding Is decreased. The mean percent total error of the sixth item in E1, E3, E5, and C was 5.96, 11.09, 14.79, and 14.58, respectively.

Following Gibson's (1940) application of the concepts of generalization and differentiation in verbal learning, the isolation effect found in the present study could be accounted for by postulating that the I was removed from the interference generalized from other list members. The I was made more distinct perceptually and, thus, was differentiated from the homogeneous items. Consequently, one may expect the degree of interference to decrease when the perceptual enhancement increases. The present data support this contention. Furthermore, the present findings of reduced magnitude of facilitation with increased number of Is would be explained in terms of interisolates interference.

Unlike the Newman & Saltz (1958) finding, the present study produced no significant differences between percentage scores of total intrusions of Is in experimental groups and the corresponding items in the control. For example, with various degrees of perceptual enhancement of one I (E1, Ea, Eb, and C), the overall analysis of the sixth item as an intrusion error in other positions resulted in $F(3,36) = 1.523$, $p > .05$. When the number of I increased, the intrusion error of Is did not differ from their controls; specifically, the isolation effect was not significant,, and nor was the Position by Isolation interaction, all $ps > .05$. Only the position effect contributed essentially the major portion of the variance, all $ps < .005$.

Gibson's hypothesis also predicts the facilitation of the item immediately following the I in the series (FI). Since the I item, functioning as a stimulus, was less affected by generalized interference, the response to that stimulus would be facilitated. The present findings on FI supported this prediction. With various degrees of the perceptual enhancement of the I, the FIs in the E1, Ea, and Eb were all learned significantly faster than their control, $F(1,36) = 4.693$, $p < .05$; however, the differential facilitation effect on the FIs as a result of various degrees of perceptual enhancement was not obtained, all $ps > .05$. Considered the effect of varying the number of Is on the FI, the FIs (7th, 8th, and 9th items in E1, E3, and E5, respectively) were also learned significantly faster than their controls, $F(1,54) = 5.740$, $p < .025$; however, the position effect and the Position by Isolation interaction were

not significant. It is interesting to note that the prediction of this particular effect was based on the specificity hypothesis (Young, 1962) that the I functions as the effective stimulus for the FI. Consequently, the present findings on FIs suggested that learning in accordance with the specificity hypothesis occurs in the middle, or at least the isolation manipulation alters the use of the position the item holds as the effective stimulus.

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Racial meaning with a mediated generalization procedure*

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Seventy-eight white and black college Ss, divided equally into white, Negro, and control mediation groups, were tested for generalized responses along a color dimension ranging from medium brown to light tan. Control (no racial meaning implied) and mediational (racial meaning implied) gradients were derived with five colors, two lighter and two darker than the CS. On the control gradient, (1) Ss generalized more to lighter colors than to darker colors, and (2) black Ss generalized more to darker colors and less to lighter colors than did white Ss. No significant mediation or Race by Mediation effect was found.

The techniques available for studying stimulus generalization may be used to investigate perceptual processes. Despite their frequent use in learning studies, particularly those concerned with stimulus control, these techniques have not been applied to the problem of person and racial perception. The present investigation was undertaken to study the skin color perception of white and black Ss with a human stimulus-generalization procedure. A specially constructed color dimension which resembled Negroid flesh tones was used for this purpose. In addition, semantic generalization was investigated by deriving both control (no racial meaning implied) and mediated (racial meaning implied) gradients. Several studies have shown that the generalization of a voluntary finger-lift response to a monochromatic stimulus is influenced by the mediational effect of color labeling (Thomas & Bistey, 1964; Thomas & Decapito, 1966). These studies would predict that there would be increased generalized responding to colors that were appropriate to the label (e.g., darker colors for Ss given a "Negro" label) and reduced generalized responding to stimuli for which the label was inappropriate.

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SUBJECTS

The Ss were 39 black and 39 white college students from the University of Nebraska at Omaha. Thirteen Ss from each race composed the white, Negro, and control mediation groups described below.

APPARATUS

Ss were tested for generalization with a 2 x 5 ft perceptual alley, constructed from black cloth and divided into two sections, a right- and a left-hand alley. The manipulandum was a modified telegraph key mounted beneath the alley. The key was wired so that its release activated a signal light to the E, thus signifying a response.

The stimuli consisted of five colors painted on 6-in. square cards. The series was constructed from a base mixture of acrylic (polymer emulsion) paint consisting of two parts burnt umber mixed with one part raw siena. Ten grams of base were mixed with 2, 4, 6, 8, and 10 g of white paint to yield five different colors ranging from medium brown to light tan. The intermediate color served as the CS.

PROCEDURE AND CONDITIONS

Two gradients were derived for each S. For each gradient the standard