The effect of KR on ratings of pattern similarity[1,2]

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Two groups of Ss judged the similarity of pairs of patterns representing two different populations of stimuli. Pairs were composed of patterns drawn from either the same stimulus population or different stimulus populations. One group received nonspecific KR after rating the similarity of each pair. Nonspecific KR can only inform the S that the patterns are "similar" or "dissimilar," not the degree of similarity. A control group received no KR. Both groups were able to differentiate the stimulus populations. The main effects of KR and of the same-different pattern pair classification variable were significant. There was also a significant KR by Trials interaction. Analysis of KR over trials suggested that KR caused a shift in mean similarity judgments on the response scale. An explanation of this shift was offered in terms of frequency matching by the KR group.

A number of studies have shown that perceptual discrimination in the visual or auditory mode can occur without knowledge of results (KR) or externally applied reinforcement (Evans, 1964; Evans & Arnoult, 1967; Evans & Edmonds, 1966; Miller, 1966a, b; Rosser, 1967). Studies by Brown, Walker, & Evans (1968) and Tracey & Evans (1967) have also indicated that the ability to categorize visual patterns is not appreciably facilitated by KR. Miller (1966a, b) found that KR was not facilitative in learning a visual pattern discrimination and suggested that KR may be detrimental when the task is difficult and consists primarily of perceptual differentiation. Edmonds, Mueller, & Evans (1966) did, however, find that KR facilitated performance during the initial stages of learning to categorize visual patterns. Wright & Dixon (1968) reported that KR in an oddity test using VARGUS-7 (Evans, 1967) stimuli, has a small facilitory effect upon classification accuracy early in training but no apparent effect in later trials. Brown, Walker, & Evans (1968) have found KR to have a significant detrimental effect upon performance using the VARGUS-7 stimuli. The data indicate that the effect of KR upon perceptual categorization is somewhat tenuous with no clear evidence to support a facilitative or detrimental effect.

Prior research in the area has used a dichotomous correct or incorrect dependent variable. However, Rankin & Evans (1968) have suggested that a continuous or graded response of subjective pattern similarity might be a more sensitive dependent measure of learning in a perceptual discrimination task. The purpose of this study was to determine the effect of KR on the learning of a perceptual discrimination task. It was hypothesized that KR would cause similarity ratings to more accurately reflect the true state of pattern pairing over blocks of trials. This hypothesis would be supported by a significant interaction between KR, blocks of trials, and "same" vs "different" pattern pairing.

SUBJECTS

The Ss were 24 students enrolled in the introductory psychology course at Texas Christian University. There were 12 Ss in each group. The Ss were randomly assigned to treatments as they came to the experiment. More than one treatment group were run simultaneously, but each individual S performed in a private cubicle.

STIMULI

Patterns were produced by a computer system, VARGUS-9, described in detail elsewhere (Evans & Mueller, 1966). The VARGUS-9 system produces patterns of numbers randomly sampled from a defined population. The sequences of numbers are mapped into patterns with varying column heights. These patterns resemble frequency polygons. Examples of these patterns may be found in the study by Rankin & Evans (1968).

Two sets of patterns were sampled and designated as Schema 1 and 2. With these patterns the most probable column height occurred 84% of the time: a deviation in height of ±1 unit occurred 10.67% of the time; and a deviation of ±2 units occurred 5.33% of the time.

PROCEDURE

The Ss' task was to rate the similarity of randomly constituted pairs of stimuli on a five-point similaiity scale. The end points of the scale were labeled "highly dissimilar" and "highly similar." The Ss were given 10 sec to look at a pair of stimuli and rate their similarity. After responding the S removed the answer sheet from the answer booklet. For the Ss receiving KR, the word "similar" or "dissimilar" was exposed when the answer sheet was removed. The other group received no KR (NKR). The word "similar" was given to the KR group when the pair of stimuli presented were drawn from the same schema, while the word "dissimilar" was presented when each of the pairs of stimuli was drawn from different schemata. This task consisted of a discrimination among 24 same-schema and 24 different-schema pairings.

DESIGN

A 2 by 2 by 2 design (Winer, 1962, p. 319) was used with repeated measures on two of the factors. The factors were: (a) KR vs NKR, (b) classification, i.e., same schema pairs vs different schema pairs; and (c) first 24 trials vs last 24 trials.

RESULTS

Judgments of similarity on examples of same schema pairings were significantly different $[F(1,22) = 279.356,\ p < .001]$ from judgments on different schema pairings. Same pairs were judged more similar than different pairs. The means were 3.174 and 1.712, respectively. This difference accounted for 69.5% of the total variance and 84.9% of the within variance. The KR factor was significant $[F(1,22) = 6.420,\ p < .025]$ where KR was associated with a higher mean similarity judgment. The KR by Trials interaction was also significant $[F(1,22) = 8.133,\ p < .01]$. No other Fs were found to be significant in the overall analysis.

In a test of the simple main effects of KR over blocks of trials it was found that high similarity ratings were associated with the presentation of KR on the second block of trials $[F(1,22) = 11.279,\ p < .01]$. Judgments of similarity did not, however, differ significantly $[F(1,22) = 1.758,\ p < .25]$ during the first block of trials. These data are presented in Fig. 1. This same interaction, using smaller blocks of 12 trials each, appears in Fig. 2 also.

DISCUSSION

These data do not support the hypothesis that KR will interact with "same" and "different" pattern pairs over trials. While this hypothesis was not supported, Rankin & Evans' (1968) suggestion that a continuous similarity measure might provide a more sensitive dependent measure of perceptual differentiation appears to be tenable. This is supported by the large proportion of variance accounted for by the same-different pattern pair classification. Further research with this dependent measure will require using stimuli that are more difficult to differentiate.

It is important to note that KR did not interact with the same-different pattern-pair classification. Instead, KR appears to increase the judged similarity of both "same" and "different" pattern pairs. This effect becomes significant in the last 24 trials. An analysis over smaller blocks of trials might provide more information about the effect of KR, but the stimuli

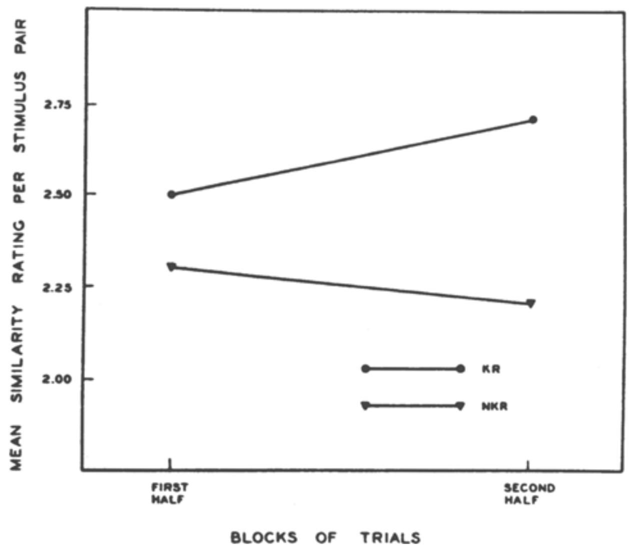

Fig. 1. A plot of the KR by Blocks of Trials interaction using blocks of 24 trials.

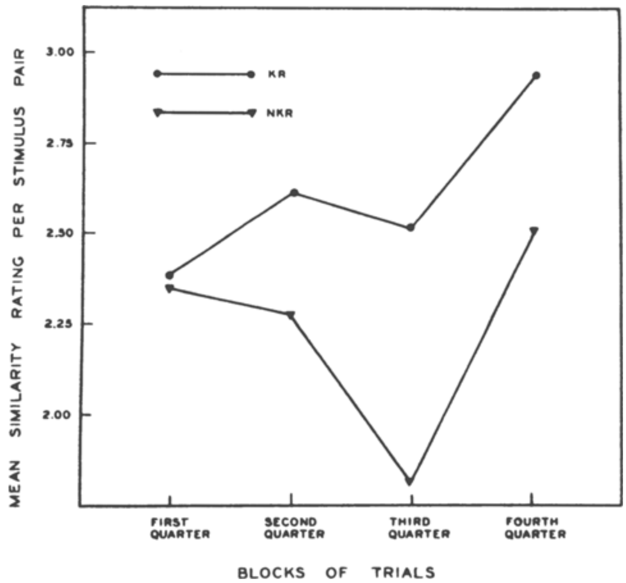

Fig. 2. A plot of the KR by Blocks of Trials interaction using blocks of 12 trials.

randomization procedure does not permit an unbiased test for smaller blocks of trials. A post hoc inspection of these data, using smaller blocks of 12 trials, suggests that this effect could have become significant as many as 12 trials earlier.

Knowledge of results has been found to influence performance in a complex fashion. It has been found to be both facilitative and detrimental, depending upon the task and the nature of the KR provided. Presentation of KR which informs the S only that he is "correct" or "incorrect" or that the patterns are "similar" or "dissimilar" in a perceptual differentiation task provides no specific information as to the nature of the differentiations to be made. The KR provided is assumed to affect the strategies that the S may have been using or the hypotheses that he may have been testing. In the case where there may be a number of possible alternative strategies employed by the Ss and the correct hypothesis is relatively obscure, the complex effect of KR may be explained by a frequency matching hypothesis such as that suggested by Estes (1959). The application of KR in this situation embodies the characteristics of the frequency matching paradigm. Where no control is provided to evaluate the differential effects of KR as information and KR as the basis for probability matching, the effect of KR on performance is confounded. It would seem reasonable to assume that the degree of confounding increases as the difficulty of the differentiation task increases. If the differentiation is simple and straightforward, KR is primarily confirmatory and is not detrimental. If the task is difficult, i.e., as manifested by (a) complex stimulus populations, (b) heterogeneous group performance, or (c) relatively long acquisition times, then the confounding of KR effects can occur.

On the basis of the performance of the NKR group, there is a clear bias toward judging the stimuli as dissimilar. A frequency matching model would predict displacement of a graded response toward the particular distribution of the probabilities associated with the occurrence of the type of KR. In this experiment, 50% of the pairs were same-pairs and 50% were different. Where there is an initial bias away from the neutral point of the scale, Ss who were probability matching would move their mean judgments toward the neutral point of the scale. Inspection of the data indicates that this is what did, in fact, occur. While there was no difference between the KR and NKR on the first block of trials, the KR group mean was displaced in the direction of the neutral response and differed significantly from the NKR group in the later trials. Future research is planned to distinguish between the effects of KR in the role feedback for differentiation tasks or KR as the basis for response probabilty matching.

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NOTES

1. This research was supported by the Department of Defense, Project THEMIS contract (DAAD05-68-C-0176), under the Department of the Army, to the Institute for the Study of Cognitive Systems through the TCU Research Foundation.

2. The assistance of Professor Selby H. Evans is gratefully acknowledged.

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