Reduced information feedback on a selection concept learning task

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A procedure to reduce information feedback on selection concept learning problems with nonfixed solutions is described. It has an advantage over similar procedures since it requires no electronic equipment. Female college students solved four concept problems under reduced or standard feedback conditions. The results showed more card choices to solution with reduced feedback and no differences on the other measures. Questionnaire data revealed no significant differences between feedback conditions in perceptions of the task.

Arenberg (1970) and Johnson (1971) have outlined computer-assisted procedures for administering selection concept learning tasks. The purposes of the two procedures differ somewhat, but both eliminate fortuitous gains in information that may result in premature termination of a problem and in greatly reduced behavioral output. Both techniques require costly equipment: a special-purpose computer, limited to problems with 24 two-attribute solutions unless modified (Thorne, Arenberg, & Baartz, 1970), or a small computer, such as a PDP-8 (Johnson, 1971).

The technique described in this paper does not yield equivalent information for logically equivalent selections, nor does it provide minimum information feedback; it does eliminate many fortuitous information gains, increases behavioral output, and can be used without electronic aids. This procedure relies on nonfixed solutions and is illustrated here for a six binary-dimension concept universe and three-attribute conjunctive problems.

An analysis of such problems reveals that the most fortuitous information gains result from selection of a positive instance differing from the focus instance in two or three attributes. The effect is most evident when the first selection is a positive instance. A two-attribute change eliminates 16 of the 20 possible hypotheses, and a three-attribute change, as always, eliminates all but one of the possible hypotheses. For subsequent selections, classification of two-attribute changes as positive will most often eliminate a greater proportion of hypotheses than will negative classification. Thus, the E was instructed to classify all two- or three-attribute changes as nonexamples. (Changes of four or more attributes must be nonexamples with a positive focus instance.)

Since the effect of classification on one-attribute changes is much more dependent on previous feedback history, the decision rule adopted was to classify the first one-attribute change as positive whenever it occurred. Subsequent one-attribute changes were classified as nonexamples to avoid reinforcing these changes. For all selections, positive or negative classification was used when necessary to avoid contradictory feedback. This pattern of responses from the E was designed to provide a mix of positive and negative examples, since Bruner, Goodnow, and Austin (1956) found changes in strategy for Ss who encountered unmixed examples. Finally, the S, who was required to offer a hypothesis after the feedback on each card choice, was always told his hypothesis was incorrect until he had logically eliminated all but one possibility.

If this reduced information feedback technique is to be useful, it should increase the number of card choices relative to the standard (fixed solution) procedure without influencing the processes, such as focusing strategy (Bruner et al, 1956), typically measured with this task. The present study tested this hypothesis.

METHOD

A 2 by 4 factorial design with repeated measures on the last factor was used. The variables were experimental condition (standard or reduced feedback) and problems (four for each S). The Ss were 30 female Texas Tech University students, who served as part of a course requirement. Fifteen Ss were assigned randomly to each experimental condition.

The stimulus display was an 8 by 8 array of 64 6.9 x 8.8 cm cards, representing all combinations of six plus and/or minus signs in a row. In order to facilitate reference to the six positions, each was a different color. Thus, the color name was the attribute; the plus or minus referred to the value of each attribute. The cards were arranged systematically, e.g., all cards with blue plus were in the top four rows, while all cards with blue minus were in the bottom four rows. All problems involved conjunctive concepts with three relevant attributes (e.g., blue plus, green minus, and red plus). For the standard feedback condition, concepts and initial positive instances were selected randomly. The same focus cards were used in the reduced feedback condition, in which the concepts were not preselected. All Ss solved four problems.

The nature of the task and the conjunctive concept rule were explained to the Ss, who were instructed to solve the problems in as few card choices as possible regardless of time. For all problems, the E indicated an initial card which was an example of the concept. The S then selected any card, and the E said, "Yes, that is an example of the concept," or, "No, that is not an example of the concept." The card was moved to an area of the table designated "examples" or "nonexamples," following which the S stated a hypothesis and the E provided feedback ("yes" or "no"). This cycle of card selection, feedback on the selection, a statement of the S's hypothesis, and feedback concerning the correctness of the hypothesis was repeated until the problem was solved.

In the standard feedback condition, the E provided the S with feedback congruent with the preselected concept. In the reduced feedback condition, the E said "yes" the first time the S's selection altered only one attribute from the focus card and "no" for all other selections, unless a "yes" was logically required on the basis of previous feedback.

Reduced feedback for hypotheses statements consisted of a "no" answer to these responses until all but one had been eliminated. The E had a coded list of the 20 possible solutions in order to carry out the reduced feedback procedure. Upon

Table 1
Means for Standard and Reduced Feedback for Four Problems on Three Measures

	Problem				
	1	2	3	4	Total
Card Choices					
Standard	5.87	4.80	4.00	3.60	4.57
Reduced	7.07	6.20	5.40	5.93	6.15
Total	6.47	5.50	4.70	4.77	5.36
Focusing					
Standard	.40	.53	.60	.51	.51
Reduced	.46	.52	.69	.58	.56
Total	.43	.52	.64	.55	.54
Untenable Hypothesis Ratio					
Standard	.29	.24	.07	.15	.19
Reduced	.37	.19	.14	.18	.22
Total	.33	.22	.11	.16	.20

completion of the final problem, Ss answered an eight-item questionnaire (Johnson, 1971) adapted for noncomputerized administration of the task.

RESULTS

An analysis of variance was performed for each of three measures. Means for standard and reduced feedback conditions and four problems are presented in Table 1. Ss required more card choices to solution in the reduced feedback condition than in the standard condition [$F(1,28) = 6.45$, $p < .05$]. The effect of successive problems was significant [$F(3,84) = 4.05$, $p < .01$]. Tukey tests revealed that Problem 1 required more card choices than Problem 3 or Problem 4 ($p < .05$). Other interproblem differences and the Condition by Problems interaction were statistically nonsignificant.

Focusing strategy was scored by rules enumerated elsewhere (Laughlin, 1968), and no significant difference between conditions was found. The effect of problems was reliable [$F(3,84) = 3.24$, $p < .05$], Tukey tests showing significantly more use of focusing on Problem 3 than on Problem 4 ($p < .05$). Other interproblem differences and the Condition by Problems interaction were not significant.

Any hypothesis that contradicted available information was considered untenable. The total number of untenable hypotheses was divided by the total hypotheses less one (the correct hypothesis was tenable by definition and was not counted) to obtain an untenable hypothesis ratio. This measure showed no reliable difference between feedback conditions, but the effect of problems was significant [$F(3,84) = 5.36$, $p < .01$]. Tukey tests revealed that the ratio was lower on Problem 3 than on Problem 1 ($p < .01$). No other significant effects were found.

Analysis of the questionnaire items indicated that Ss did not differ in their perceptions of the experimental situation. The items concerned the difficulty of the task, the suspicion of deception, the use of a strategy, and whether the S felt she was having good or back luck.

DISCUSSION

The results support the hypothesis that the reduced information feedback procedure results in a greater number of card selections than the standard procedure without influencing the measures of focusing strategy and untenable hypotheses. The last finding indicates that the increased number of selections is due to reduced feedback rather than an increase in the proportion of negative instances, which might make the problems more difficult. Furthermore, the Ss exhibited typical positive interproblem transfer on all measures, and the nonsignificance of the Condition by Problems interactions indicates that the feedback procedure does not influence the course of improvement across problems. In addition, the questionnaire data indicating that Ss perceived the feedback conditions as essentially the same gives some confidence that other measures of strategy and problem solving processes would be equivalent for reduced and standard feedback.

The reduced feedback procedure could be generalized to more complex problems without overtaxing the human E. (With these relatively simple concepts, the second author ran all 30 Ss without erroneous feedback. An undergraduate was easily trained to run a similar experiment and ruined only one set of data out of 36.) Any preprogramming of E responses that eliminates very lucky guesses and increases the quantity of the S's behavior without influencing its quality will do. The technique thus enables a researcher to achieve many of the benefits of computer-assisted procedures for experiments that do not require complex problems. For example, Laughlin and McGlynn (1967) and McGlynn (1972) used problems like those in the present study (with standard feedback) since social variables were of primary interest. Moreover, studies comparing selection and reception paradigms in a yoked design (e.g., Laughlin, 1969) might benefit from the increased behavioral output of Ss in the selection condition. Using standard feedback, it is likely that a number of Ss would solve a problem with one selection, leaving the yoked reception partner almost no information. With reduced feedback, yoked partners would be assured of receiving sufficient information to solve the problem logically.

REFERENCES

Arenberg, D. Equivalence of information in concept identification. Psychological Bulletin, 1970, 74, 355-361.

Bruner, J., Goodnow, J., & Austin, G. *A study of thinking.* New York: Wiley, 1956.

Johnson, E. S. Objective identification of strategy on a selection concept learning task. Journal of Experimental Psychology Monograph, 1971, 90, 167-196.

Laughlin, P. R. Focusing strategy for eight concept rules. Journal of Experimental Psychology, 1968, 77, 661-669.

Laughlin, P. R. Selection versus reception concept-attainment paradigms as a function of memory, concept rule, and concept universe. Journal of Educational Psychology, 1969, 60, 267-273.

Laughlin, P. R., & McGlynn, R. P. Cooperative versus competitive concept attainment as a function of sex and stimulus display. Journal of Personality & Social Psychology, 1967, 7, 398-402.

McGlynn, R. P. Four-person group concept attainment as a function of interaction format. Journal of Social Psychology, 1972, 86, 89-94.

Thorne, P., Arenberg, D., & Baartz, G. An electronic aid for presenting equivalent information in concept identification. Behavior Research Methods & Instrumentation, 1970, 2, 186-188.

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