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ABSTRACT

The purpose of this study was to determine the effects of three treatments of knowledge of results on the acquisition of an open complex motor skill requiring speed and accuracy (coincidence-anticipation). The 75 volunteer male subjects were randomly assigned to one of three treatment groups. One group was given informative knowledge of results; another group, positively reinforcing knowledge of results; while the third group was given no supplementary knowledge of results. All subjects were given 30 trials on a coincidence-anticipation task which required the subject to make a motor response at the time a moving object coincided with two separated, stationary objects. Two responses were made on each trial. A fine motor movement was required on the first response, but a large motor movement was required for the second response. Results showed no significant differences in performance among the treatment groups on the first or second response. It was concluded within the limitations of the study that informative and reinforcing knowledge of results were no more beneficial to the performance of the present coincidence-anticipation task than was the intrinsic feedback inherent to the task. There appeared to be no tendency for the treatment groups to improve in performance over trials. (Author/HMD)

RELATIVE EFFECTS OF THREE KNOWLEDGE OF RESULTS TREATMENTS ON THE ABILITY TO PERFORM A COINCIDENCE-ANTICIPATION TASK by Kathleen Marie Haywood

ABSTRACT

The purpose of this study was to determine the relative effects of three treatments of knowledge of results on the acquisition of an open complex motor skill requiring speed and accuracy (coincidence-anticipation). Seventy-five male undergraduate students enrolled at Washington University volunteered as subjects. The subjects were randomly assigned to one of three treatment groups. One group was given informative knowledge of results, another group positively reinforcing knowledge of results, while the third group was given no supplementary knowledge of results. All subjects were given thirty trials on a coincidence-anticipation task which required the subject to make a motor response at the time a moving object coincided with two separated stationary objects. Two responses were made on each trial, a fine motor movement was required on the first response, but a large motor movement was required before the second response. A three-way analysis of variance, with one between-groups variable and two within-group variables, was performed by the NYBMUL computer program. Results showed no significant differences in performance among the treatment groups on the first or second response, based on either trial means or total-group means. There was only a .52 correlation between performance on the first and second responses. It was concluded, within the limitations of this study, that informative and reinforcing knowledge of results were no more beneficial to the performance of the present coincidence-anticipation task than the intrinsic feedback inherent to the task. Based on trial means, there appeared to be no tendency for the treatment groups to improve in performance over trials.

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RELATIVE EFFECTS OF THREE KNOWLEDGE OF RESULTS TREATMENTS ON THE ABILITY TO PERFORM A COINCIDENCE-ANTICIPATION TASK

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(Paper read at the American Association for Health, Physical Education, and Recreation Convention, March 30, 1974, Anaheim)

Research has established the value of providing supplemental knowledge of results during learning and performance. Unfortunately, the most desirable type of knowledge of results to utilize in the learning of motor skills remains to be identified. This is especially true of open complex motor tasks where accuracy is a definite requirement.

Adams (1) recognizes two classes of stimuli important to feedback research in motor learning. One class is the stimuli to which responses are learned, while the second class, and the one at issue in the present study is reinforcing stimuli. Reinforcing stimuli have been researched under the heading of knowledge of results. In practical terms, however, there may be a great deal of variance in the type of knowledge of results. Should a teacher or coach supplment a student's intrinsic feedback, which is always available to him, with informative knowledge of results statements, such as "you swung a half-second too late?" Or, should that teacher use positive, reinforcing knowledge of results statements, such as "very good," when the student does well? Research has not yet proven either informative knowledge of results or reinforcing knowledge of results to be more beneficial in the acquisition and performance of an open complex motor skill requiring speed and accuracy. It is possible that augmented knowledge of results may be of no benefit to this type of task, despite its proven benefit to other kinds of performance.

Studies on the effects of knowledge of results on the performance of open complex motor tasks are almost nonexistent. Roberts and Martens (2) studied effect of four social reinforcement treatments on acquisition of a coincident-timing task. Christina (3) had subjects respond at the coincidence of a moving pointer with a stationary pointer under high or low feedback conditions. Schmidt and Christina (4) tested subjects on a variation of the same task, but varied the amount of proprioception.

The purpose of this study was to determine the relative effects of informative knowledge of results, reinforcing knowledge of results, and the absence of augmented knowledge of results on the acquisition of an open complex motor skill requiring speed and accuracy.

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Seventy-five undergraduate male volunteers enrolled at Washington University, St. Louis, Missouri during the Spring Semester of 1973 served as subjects for this study.

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The coincidence-anticipation apparatus used was designed and constructed by Harold L. Glad, Associate Professor of Physical Education, Washington University.

The stable portion of the apparatus consisted of two pieces of metal conduit, welded side-by-side horizontally, formed in a rectangle with rounded corners. The length of 16'8" and the width 30". This stable track was suspended horizontally from the ceiling and stabilized by guy wires. Five ft. of one end was sloped 40° from the horizontal.

The mobile portion of the apparatus was a 7-wheeled car which ran on the stable track in the manner of an inverted monorail. A rod with an orange styrofoam ball attached to its end was suspended from the bottom of the car. A 2-inch piece of metal protruded horizontally from the top of the car and tripped microswitches at 3 points on the track. The car was pushed up one side of the elevated portion of the track, released at the top, and easily traveled the track in less than 2 seconds.

Microswitches were located at 3 distinct points on the track: at the foot of the elevated portion, just before the first turn, and just out of the second turn. The second and third microswitches were marked by yellow flags suspended below the track. The front edge of the ball coincided with the front edge of the flag as the second and third microswitches were tripped.

The microswitches operated a system of 4 one-hundredths of a second clocks. Two of these clocks were started by the car tripping the first microswitch; one was turned off at the second microswitch, while the second was turned off by the subject, operated a telegraph key. The remaining two clocks were started at the second microswitch, one being turnned off at the third microswitch and the other by the subject operating a second telegraph key. A system of 4 latch relays allowed continuous operation of the apparatus without resetting the microswitches.

The car and stable track were hidden from the subject by curtains, as was the assistant who started the car. The experimenter was located at a table at the side of the apparatus and in full view of the subject.

The telegraph keys were located on a table 10' from the lower end of the track. These keys were 38" apart, center-to-center. The subject was required first to anticipate the coincidence of the appraoching ball and the first flag and press the first telegraph key with his preferred hand at the time of coincidence. He was then required to anticipate the coincidence of the ball as it traveled away from him with the second flag, at which time the second telegraph key was pressed with the same hand that was used on the first switch.

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The apparatus was thus designed to permit 2 recordings of the real time versus the subject's time on each trial. The closer the subject's time to the real time, the better his performance. The separate circuits, one providing real time and the other providing the subject's time, allowed for any variation of the speed of the mobile apparatus.

The subject had the sensation of seeing a ball move in space; the ball approached the subject on the right, passed the first flag, reverse its direction, then passed the second flag as it traveled away from him.

Subjects were randomly assigned to 1 of 3 treatments as they reported to the testing area. All subjects were given a standard explanation of the task and all questions were answered. Subjects were then shown the apparatus and positioned at the testing station. Each subject was allowed to familiarize himself with the telegraph keys and practice moving from the first to the second. When it was determined that the subject understood the task, one practice trial was given and then testing was begun.

Each subject was given 30 trials. The average speed of the mobile apparatus between the first and second microswitches was 10.7 ft/sec. Of 2,250 trials administered only 1.2% were more than 5 hundredths of a second above or below the average time.. Between the second and third microswitches the average speed was 8.3 ft./sec. Of all trials administered only 6% were more than 5 hundredths of a second above or below the average.

Inter-trial periods were the legnth of time required for the experimenter to record the results, give knowledge of results to the subjects where appropriate, reset the clocks, and for the assistant to reset the mobile apparatus. The maximum inter-trial period was 15 sec. All trials began with the experimenter saying to the subject "ready."

Subjects in the First Treatment Group were given no knowledge of results, the only comment to the subject being the "ready" signal before each trial.

Subjects in the Second Treatment Group were given (positive) reinforcing knowledge of results after each trial. If the real time--subject's time difference was 5 hundredths of a second or less, or his score represented an improvement over the previous trial, he was given one of the following statements: "good," "very good," "you did (well, a great job, a nice job) on that one," "that was a (good, great) trial." When the subject met this criterion on one of the anticipations, but not on the other, the following comment was made: "you were (a little) off on the (first, second) one, but you did (well, a good job) on the (first, second) one." On the first trial or thereafter if the subject did not reach the criterion the following comments were made: "OK." "you were (a little) off, but (you'll do better, it will come, you'll get it)." All comments were randomly distributed according to the condition met by the subject.

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Subjects in the Third Treatment Group were given informative knowledge of results: the difference between their time and the real time in hundredths-of-a-second, and the direction of their error.

Each subject's performance was recorded in hundredths of a second early or late, a positive number indicating a late response and a negative number indicating an early response. Scores were the difference between the mobile apparatus real time and the subject's estimation of the mobile apparatus' time. The lower the score, the better the score.

Scores were analyzed by the NYBMIL computer program on an IBM 360 computer. Means and standard deviations for each trial and for all groups were calculated. Almost all means for the "away" level of the scores per trial were negative for all treatment groups. "Toward" scores, however, tended to be nagtive only for the First Treatment Group, which received no knowledge of results. The standard deviations for all groups tended to decrease in the later trials. The correlation coefficient between scores on "toward" responses, which required a fine motor response, and "away" responses, which required a gross motor response, was .52.

Multivariate tests of equality of the mean vectors for the "toward" scores and for the "away" scores yielded nonsignificant F-ratios at the .01 level. A multivariate test for all trials also yielded an F-ratio which was nonsignificant at the .01 level. The F-ratio for a multivariate test of equality of mean vectors between all "toward" scores and all "away" scores was also nonsignificant at the .01 level.

Univariate F-ratios for trials were performed for the "toward" responses and the "away" responses. Only the "toward" level of Trial 21 was significant at the .01 level. Univariate F-ratios for all "away" responses were nonsignificant.

The findings of this study do not support the belief that provision of knowledge of results, either informative or reinforcing, is more beneficial than the intrinsic feedback already available during motor learning and/or performance.

The finding that there were no significant differences in performance among the groups may lead to several conclusions. The first is that informative and reinforcing knowledge of results are no more beneficial to the performance of the present coincidence-anticipation task than the intrinsic feedback inherent in the task. Secondly, the variation in individual performance was large. Thirdly, the coincidence-anticipation task may not have been capable of showing significant differences. Lastly, for the present task more than thirty trials may be necessary to show significant differences.

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A strong possibility exists that the intrinsic feedback available during performance of this task may be adequate for an optimum performance by the subject. In fact, the subject may have been relying on a variety of other cues in addition to visually-perceived cues. Since the car itself made noise, the subject could have been relying heavily on auditory cues. He may also have been attending to kinesthetic cues, especially for the second (gross) motor response.

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Note: This paper has been typed for the purpose of reducing reprinting cost, which is absorbed by the author.