Rotary pursuit performance as a function of watching demonstrations at slower speeds[1]

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Previous studies found that passive watching of an untracked rotary pursuit (RP) target did not affect final practice.[1] *A similar finding was obtained from the present experiment, using a different method. S actively watched a demonstrator achieve 50% time on target (TOT) at any one of three speeds. Results suggested that reactive inhibition was generated in discriminative processes rather than in eye movements.*

Adams (1955) required S to (a) track the RP, (b) actively watch another person track the RP, and (c) resume tracking. Active watching consisted of pressing a button whenever another person contacted the target. Adams found that the active watcher performed more poorly during final practice than a control S who, instead of watching, sat in a waiting room. Adams' watching period was nearly 15 min long, but Rosenquist (1965) obtained similar results for 3, 6, and 9 min watching periods.

Both authors interpreted their findings by Hull's reactive inhibition concept. During initial practice, reactive inhibition was generated in the visual response component of the RP skill. Throughout the watching period, inhibition dissipated at two rates, rapidly for Ss who rested, but slowly for Ss who continued active watching. During final practice, the performance of Ss with a greater burden of inhibition was impaired.

The visual response can be analyzed logically into (a) movements of the eyes as they track the target, and (b) discriminations between contact and noncontact of stylus and target. Ammons (1951) and Duncan (1957) required S to watch a moving target, between practice periods, but without need to make discriminations or to press a button since no demonstration of tracking by another person occurred. They found no significant difference in final practice between watchers and nonwatchers. This finding indicated that the locus of inhibition was not in eye movement.

The purpose of the present experiment was to determine if the same finding could be obtained when a different methodology was used. Whereas Ammons and Duncan compared eye movement vs nonmovement, the present study would systematically vary the extent of required eye movement by using three turntable speeds. Whereas Ammons and Duncan held the visual discrimination requirement constant by eliminating altogether a tracking demonstration by another person, the present study would hold it constant by a demonstration which achieved approximately the same TOT regardless of differences in turntable speeds. Under all conditions, Adams' active watching method was applied by requiring S to press a button whenever the demonstrator contacted the target.

METHOD

Sixty volunteer undergraduates from The University of Akron were randomly assigned to one of three treatment groups, which differed only in RP speed used during the watching period, 30, 45, or 60 rpm. Six additional Ss were voided for improper procedure or failure to achieve a minimum criterion of three out of a possible 300 sec of time on target (TOT) during final practice.

The RP apparatus used was manufactured by Lafayette Instrument Corp., Catalogue No. 867, Item 2203, featuring a control setting for 30, 45, or 60 rpm and a 1.9-mm diam target with a rotation radius of 8.3 mm. The apparatus was modified to run continuously at a given speed setting. Daily calibration revealed that actual speeds differed from values of the control settings. The average rpm for the "30" setting was 29.2, for the "45" setting, 43.1, and for the "60" setting, 57.6. Although these depressed values, which persisted despite frequent oiling, were unfortunate, they were not considered crucial to the purpose of the experiment. Total TOT for each practice period was measured to .1 sec by a Hunter Klockounter, Model 120A, Series D.

During the watching period S was required to push a button whenever E contacted the target and to release the button when contact was lost. A 1-in. diam pushbutton, connected to a ball-point pen spring, was mounted on a small box located to the right of the RP apparatus.

In preparation for his demonstration, E practiced on the RP at each speed to standardize the movements and to make contact with the target approximately 50% of the time (150 sec). During testing sessions, E measured his daily demonstration time, achieving at various speeds the following average TOT, ±1 standard deviation: at 30 rpm, 55% ±6%; at 45 rpm, 54% ±4%; and at 60 rpm, 51% ±4%.

The S was required to (a) track a 60-rpm target, (b) actively watch E track at one of three speeds, and (c) resume tracking at 60 rpm. Each period was 5 min long. Instructions for S and the timing for all periods were administered by tape recorder after the manner described by McBain (1956). S commenced initial practice with the preferred hand but resumed final practice with the nonpreferred hand. Irion & Gustafson (1952) used this procedure to measure bilateral transfer, but it was used here to prevent the effect of inhibition generated in the preferred arm from confounding the expected inhibition generated in the visual response.

RESULTS AND DISCUSSION

The data for the three treatments was subjected to analysis of covariance, in which the effect of initial practice on final practice was taken into account. The adjusted means in final practice for 30, 45, and 60 rmp were, respectively, 63.4, 58.4, and 80.1 sec. But no significant differences were found among them, with $F(2,56) = 1.53$, $p > .05$. Thus, the null results support earlier findings by Ammons (1951) and Duncan (1957), even when the methodology differed.

Two theoretical interpretations are possible. Invoking the reactive inhibition concept of Hull (1943), we conclude that the eye movement component of the visual response is not the source for the generation of inhibition; had it been so, we would have predicted that the reduced eye movements required at slower speeds would have permitted greater inhibition dissipation, thereby leading to better performance in final practice.

Invoking the activation concept of Catalano (1967), we conclude that the slower turntable speeds were not sufficiently novel to raise activation level; had these stimulus changes been capable of arousal, they would have resulted in better final practice performance. Since both theories would have led to similar predictions in the present experimental situation, we have no basis for selecting one over the other. However, the author has a general bias favoring inhibition theory.

The exclusion of eye movement as the source of decrement should lead to an interest in central discriminative processes as the probable source. A future experiment, in which turntable

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Table 1
Mean Correct Anticipations on List 2 for Trials 1-2 and Trials 1-5

Presentation Rate	0% ORM	50% ORM	100% ORM	Total	Total
	Paradigm A-B, A-C				A-B, C-D
Trials 1-2					
1:1	.92	1.08	1.25	3.25	6.23
2:2	1.08	1.50	1.42	4.00	4.42
Trials 1-5					
1:1	4.58	4.42	5.08	14.08	23.25
2:2	5.25	5.75	6.42	17.42	20.50

RESULTS AND DISCUSSION

List-1 Learning

All analyses involved the pooling of data over lists. As expected, the mean trials to criterion on List 1 varied directly with presentation rate [$F(1,44) = 36.38$, $p < .001$]. The mean trials to criterion for the 1:1 rate was 35.79, and for the 2:2 rate, 14.08.

List-2 Learning

The primary data relate to acquisition on List 2 as a function of List-1 % ORM and presentation rate. Table 1 presents mean correct anticipations for the A-B, A-C, and A-B, C-D paradigms for these treatments on Trials 1-2 and Trials 1-5. It should be noted that the pairs for the A-B, C-D treatments could not be subdivided according to List-1 %-ORM level and therefore only the pooled mean for the nine pairs is presented for this treatment. Inspection of Table 1 reveals no systematic effects attributable to List-1 %-ORM level. However, negative transfer was more pronounced for fast List-1 presentation rate. The statistical analysis for these data involved difference scores. That is, the mean correct anticipations of each S at each level of List-1 % ORM in the A-B, A-C treatment was subtracted from the mean correct anticipations/3 (Table 1) under the relevant A-B, C-D treatment. The "mixed" factorial design (rate by % ORM) revealed a statistically significant main effect for List-1 presentation rate for the data from Trials 1-2 and Trials 1-5 [$F(1,22) = 6.24$, $p < .025$, and 5.39, $p < .05$, respectively]. The data provide support for the assumption of transfer on List 2 being a direct function of the number of List-1 practice trials. The main effect for % ORM was not statistically significant ($Fs < 1$) for Trials 1-2 and Trials 1-5, respectively. The interaction also did not approach significance in either analysis ($Fs < 1$) suggesting equivalent negative transfer at each level of % ORM for the two rates of presentation. Statistical analyses were performed to determine whether statistically significant amounts of negative transfer were obtained under both rates of presentation for the A-B, A-C treatment. The analysis involved t tests where the mean difference scores (A-B, A-C–A-B, C-D and pooled over % ORM) were compared to the $S\bar{X}$ derived from the within-cell variance for the appropriate treatment in the above analysis of difference scores. For Trials 1-5, $t(11) = 4.83$, $p < .01$ at the 1:1-sec rate, $t(11) = 1.50$, $p < .10$ for the 2:2 rate. The analyses for Trials 1-2, $t(11) = 4.67$, $p < .01$ for the 1:1-sec rate, and $t(11) = 0.50$ (NS) for the 2:2 rate.

A final comment should be made regarding the effects of List-1 % ORM on transfer. The 0% pairs did prevent Ss' associating a specific response to these stimuli, but did not restrict the possibility of some inadvertant associative learning during List-1 practice. As an example, any intralist errors that occur to the 0% stimuli could result in some associative learning. As a check on this possibility, the total intralist errors on List 1 were compared as a function of % ORM and rate of presentation. The main effect for % ORM was statistically significant [$F(2,88) = 5.32$, $p < .025$]. The mean errors at the three levels of % ORM (pooled over paradigm and rate) were 13.92, 10.00, and 9.75 for the 0%, 50%, and 100%-ORM pairs. These differences were attributable primarily to the differential opportunities to learn the pairs at the three levels of % ORM. However, the mere occurrence of these errors to the stimuli under 0% ORM does provide a possible explanation for the occurrence of negative transfer on List 2 for these pairs. In any event, the present data suggest that the occurrence of negative transfer is independent of *specific* associative (A-B) learning on List 1.

REFERENCES

ARCHER, E. J. A re-evaluation of the meaningfulness of all possible CVC trigrams. Psychological Monographs: General & Applied, 1960, 74, (10, Whole No. 497).

BATTIG, W. F. A shift from "negative" to "positive" transfer under the A-C paradigm with increased number of C-D control pairs in a mixed list. Psychonomic Science, 1966, 4, 421-422.

CERASO, J. Specific interference in retroactive inhibition. Journal of Psychology, 1964, 58, 65-77.

GOULET, L. R. Interlist response meaningfulness and transfer effects under the A-B, A-C paradigm. Journal of Experimental Psychology, 1965, 70, 264-269.

GOULET, L. R. Degree of learning and transfer of training. Psychonomic Science, 1967, 8, 245-246.

GOULET, L. R., MELTZER, R. A., & O'SHAUNESSY, K. K. Further data on degree of learning and transfer of training. Psychonomic Science, 1967, 9, 469-470.

HAAGEN, C. H. Synonymity, vividness, familiarity, and association values for 400 pairs of common adjectives. Journal of Psychology, 1949, 30, 185-200.

JUNG, J. Effect of response meaningfulness (m) on transfer of training under two different paradigms. Journal of Experimental Psychology, 1963, 65, 377-384.

POSTMAN, L., KEPPEL, G., & STARK, K. Unlearning as a function of the relationship between successive response classes. Journal of Experimental Psychology, 1965, 69, 111-118.

NOTE

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speed is held constant, but in which E would vary TOT achievement, should provide some evidence on this possibility. Using inhibition theory as a guide, it would be predicted that reduced TOT would permit greater inhibition dissipation, leading to better performance in final practice.

REFERENCES

ADAMS, J. A. A source of decrement in psychomotor performance. Journal of Experimental Psychology, 1955, 49, 390-394.

AMMONS, R. B. Effects of pre-practice activities on rotary pursuit performance. Journal of Experimental Psychology, 1951, 41, 187-191.

CATALANO, J. F. Arousal as a factor in reminiscence. Perceptual & Motor Skills, 1967, 24, 1171-1181.

DUNCAN, C. P. Visual and kinesthetic components of reactive inhibition. American Journal of Psychology, 1957, 70, 616-619.

HULL, C. L. *Principles of behavior.* New York: Appleton-Century, 1943.

IRION, A. L., & GUSTAFSON, L. M. Reminiscence in bilateral transfer. Journal of Experimental Psychology, 1952, 43, 321-323.

McBAIN, W. N. The use of magnetized tape recording in psychological laboratories. American Psychologist, 1956, 11, 202-203.

ROSENQUIST, H. S. The visual response component of rotary pursuit tracking. Perceptual & Motor Skills, 1965, 21, 555-560.

NOTE

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