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Historical Background

In everyday life it is a common experience to find that some established response interferes with the learning of some new response. Thus the automobile driver finds it somewhat difficult to learn to shift gears using a control on the steering column after having shifted them by means of an older type control. The typist finds that she has trouble learning to type on a second keyboard in which the keys are located in relatively different positions. These are examples of a phenomenon known as proactive inhibition. This term is generally used to refer to a decrement in performance or rate of learning of one task resulting from the prior learning of some other task.

Examples might be cited to illustrate another similar phenomenon, retroactive inhibition. An individual learns a particular task. This we will term the original learning. He then learns some other task, which may or may not be related to the first one. This we will term the interpolated activity. Test trials are then given to measure his performance on the original task. This is compared with the performance in the original learning. A decrease is attributed to the influence of the interpolated activity. Such a decrement would be the result of retroactive inhibition.

Both these phenomena have been adequately demonstrated in the laboratory with meaningful and nonsense verbal materials. For verbal responses the more detailed problems of determining and analyzing the variables operating in such interference have been studied.

However, we have not as yet been able to deal with motor learning in the same concise manner that we have dealt with verbal learning. Perhaps the reason for this is the dearth of experimental data on associative interference in motor learning. Such phenomena have not been demonstrated for this material.

Britt (1) suggests that retroactive inhibition has been shown for both verbal and motor materials, basing his statement for motor learning on the findings of Webb (7) and Britt and Bunch (2). As Buxton and Henry (3) point out, both these studies are concerned with maze performance, which tends to be predominantly verbal or perceptual rather than motor. Once the subject has perceived or can verbalize which alley leads to what, it is very easy for him to execute the actual moving of the stylus through the maze. This movement of the stylus is the motor portion of maze learning. In other words, as Husband (5) has shown, the verbal factor appears to be predominant in maze learning.

If associative interference is to be demonstrated for motor learning, it is necessary to employ a task that lies on the motor end of

this verbal-motor continuum. We must choose a task which has a minimum of the verbal and a maximum of the motor factor. In other words, we want a task in which the subject immediately perceives what response is required but cannot make the perfect response on the basis of this knowledge alone. The learning then is primarily motor. Knowledge per se remains about the same, but performance improves with additional practice.

Realizing the necessity for using a task with a maximum of the motor factor, Buxton and Henry worked with the pursuit rotor as the original learning. A pursuit meter, spool packing, and a simple stylus maze learned by mirror vision were the interpolated activities. It was concluded that pursuit learning does not show a decrement in level of performance using these tasks as interpolated activities. While they did not show retroactive inhibition in the sense of an absolute decrement between test trials and original learning, they did note different amounts of gain for each interpolated task. This differential effect due to the relative influence of the different tasks was termed 'relative retroaction.' It still remained to show retroactive inhibition as an absolute decrement in motor learning. No further studies have been published on this problem.

Problem

There seemed to be two aspects to this general problem. First, a task had to be developed with a motor aspect constituting the main portion of the learning problem. Second, an interpolated task was required that would result in an absolute decrement in performance on the test trials.

Description of the Apparatus

Time does not permit the presentation of the various problems of design, stages of development, or tasks developed. It is sufficient to say that the following task gives what appears to be a stable measure of retroactive inhibition.

The task is a modification of the Two-Hand Coordination Test used by the National Research Council Committee on Selection and Training of Aircraft Pilots, as described by McFarland and Channell (6). This in turn was a revision of the Farmer-Chambers Coordination Test (4).

A black turntable of 7¼ inches diameter is driven in a clockwise direction at a speed of 1 R.P.M. Fastened to this is a ⅛ inch target which rotates with the turntable but which moves back and forth in a slot, its distance from the center being varied by an irregular cam located under the turntable.

The subject was required to keep a ⅛ inch button on the target by turning two handles of the type used in lathe operation. The handles are about 14 inches apart and operate in vertical planes at right angles to each other. In the present arrangement the left hand moves the button toward or away from the subject, while the right hand moves it to the right or left. When the subject adjusted the

controls so that the button was on the target, a microswitch was closed and the clock started. The score was the length of time that the button was on the target. The target was adjusted so that a range of ½ revolution was possible while on the target.

The apparatus was geared so that the clockwise movement of the right-hand control can be made to move the button either to the left or to the right, the speed being the same in each direction. A similar gear-change is found on the left-hand control. Trials in which the clockwise movement of the right-hand control moves the button to the right are referred to as 'forward' (F); while those in which this movement moves the button to the left are referred to as 'backward' (B). A similar arrangement is noted for the left-hand control.

Subjects

The subjects were 34 men, volunteers from the Elementary Psychology class at the State University of Iowa. None had had any previous experience with this apparatus.

Experimental Procedure

The subjects were divided into 3 groups—2 experimental groups and 1 control group. The experimental design required the subject to appear on 3 consecutive days. The treatments were as follows:

	Day 1	Day 2	Day 3
Group A (N-10)	30 trials B	24 trials F	6 trials F 12 trials B
Group B (N-14)	30 trials B	30 trials F	12 trials B
Group C (N-10)	30 trials B	Rest	12 trials B

Trials were 30 seconds in length covering the same half of the pathway on each trial. During the 30 seconds after each trial the target completed the other half of the pathway under a metal cover. This resulted in 30 seconds practice and 30 seconds rest. At the end of each trial the subject placed the button in a position marked so that it would be ready to start the next trial. A light 3 seconds before the appearance of the target served as a ready signal.

After each block of 6 trials a rest period of 2 minutes was given. During this time the subjects ranked cartoons.

Complete instructions were given and each subject was reminded of the necessity for him to do his best at all times. It was felt that there was considerable interest in the task and that the motivation level was fairly high.

A masking noise having a thermal component and a low frequency-component from a relaxation oscillator provided a general masking noise for outside stimuli which might serve as distractors. The noise level was about 55 db at the subjects' ears and was sounded continuously throughout the experiment.

Results

In order to provide a more stable measure, results are presented

as means for blocks of six trials. The value given is the group mean in seconds for 6 trials of 30 seconds each.

	Day 1			Day 2		Day 3		
	A	B	C	A	B	A	B	C
1-6	57.5	57.4	49.2	72.8	54.1	114.8	131.7	124.0
7-12	83.4	88.9	93.3	113.2	90.9	154.2	169.1	155.5
13-18	102.3	120.3	120.3	122.6	118.3			
19-24	138.8	147.2	132.4	148.4	140.8			
25.30	154.2	153.4	148.5	(168.9)	165.6			

It should be noted that trials 25-30 for Group A shown under Day 2 were given at the beginning of Day 3. This group was run to eliminate the warm-up effect from the test trials.

Proactive inhibition would be indicated by a decrement between trials 1-6 for Days 1 and 2. This would assume that both tasks are equally difficult, and hence performance on forward trials would be as good as on backward, if not influenced by the previous backward trials. While equality of difficulty has not been experimentally established, it would appear from preliminary studies that the forward direction is easier. Group B showed such a decrement, but it was not statistically significant.

Retroactive inhibition would be demonstrated by the difference between trials 25-30 of Day 1 and trials 1-6 of Day 3. Since the difference between Groups A and B for the last forward trials (25-30 on Day 2 for Group B and 25-30 Day 3 for Group A) and the difference between Groups A and B for the first test trials backward were not significant, the groups were combined. The difference between the last of the backward trials (Day 1 trials 25-30) and the first of the backward test trials (Day 3 trials 1-6) for this combined group was significant at above the 1% level (t 3.87 while 2.8 is the 1% level). This is a decrement resulting from retroactive inhibition.

The decrement for Group C was not significant.

Summary and Conclusions

A brief description has been given of a modification of the revised Two-Hand Coordination Test in which only half the possible target pathway was used.

Two experimental groups and a control group were used. The combined experimental groups showed a significant decrement from the original learning to the test trials as a result of interpolated trials in a reversed direction.

No effort has been made to explain the data in detail or to show any effects other than the decrement due to retroactive inhibition. This apparatus does provide a means for further studies in the general area of associative interference in motor learning.

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