Negative transfer as a function of preliminary learning and degree of first task mastery¹

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This study investigated negative transfer between code-symbol tasks as a function of degree of first task mastery and preliminary learning. Preliminary learning was provided in large amounts, small amounts, or not at all for 384 college students. Where no preliminary learning was given, the finding of most earlier studies was obtained (i.e., as first task learning level increased, negative transfer first increased then decreased, becoming positive transfer when the first task was learned to a high degree.) For Ss given either one or six preliminary learning tasks, no decrease in negative transfer was found with increases in first task learning level. The results are interpreted as support for the applicability of Postman's two process analysis of transfer to code-symbol learning.

This study investigated negative transfer on a code-symbol task as a function of (a) amount of preliminary learning and (b) amount of practice on a first task.

In a classic study of code-symbol learning, Siipola & Israel (1933) reported that under conditions where intertask interference would be expected, the difficulty with which a second code was learned varied with the level of learning of a first code. They found that as first-task learning level was increased, negative transfer first increased then decreased, becoming positive transfer when the first code was learned to a high degree. Similar findings have been reported in a host of paired-associate verbal learning studies (e.g., Bruce, 1933; Underwood, 1951; McGeoch & Irion, 1952, p. 336).

Recently, Postman (1962) and Postman & Schwartz (1964) have hypothesized that, in the case of verbal learning, the tendency for negative transfer to first increase then decrease as first-task mastery increases results from the simultaneous operation of two processes: specific transfer (response competition), and nonspecific transfer (warm-up and learning-to-learn). Both processes gain strength as first-task practice increases, but nonspecific transfer is thought to approach asymptote later (Mandler, 1962). One result of the slower growth rate of the nonspecific transfer function is that little nonspecific transfer is observed until first-task mastery is at a high level. Since nonspecific transfer facilitates later learning, reduced negative transfer or increased positive transfer would be expected as first-task mastery increases, if no control is imposed on nonspecific transfer.

Postman (1962, 1964) has tested this hypothesis by evaluating transfer for experimental group Ss against that of a "control baseline" group, which learned two unrelated lists. He found that relative to the control baseline group, Ss exposed to the A-B, A-C or A-B,

A-Br transfer paradigms did not show decreased negative transfer with increased first task practice.

An alternate approach to the control baseline method could be to capitalize upon the exponential function which describes nonspecific transfer as a function of the number of tasks learned (Mandler, 1962). If it could be shown that following the acquisition of material on Task N and before learning Task N+3, no differences are observed in the rate of learning new material, one could assess the effects of level of first task mastery by providing S with practice at N tasks, varying the degree of learning of Task N+1, and observing the effect of this variation on Task N+2. Any change in rate of learning on Task N+2 could be ascribed to the operation of specific transfer. This approach will be recognized as a modified version of the "method of completed practice," a technique long used in psychophysical research to control practice effects.

This latter approach was utilized in the present experiment which employed a three sequential phase procedure: (1) Preliminary learning (PL) where S learned either zero, one, or six code-symbol tasks. The stimuli for each task differed from those used in every other task in this phase. Pilot work had shown no differences in rate of mastery between the fifth and the tenth of these PL tasks; (2) first task learning of a standard symbol-letter code; and (3) second task learning where the symbols and letters were the same as in the first task, but the code was different. This will be recognized as the A-B, A-Br transfer paradigm (old stimuli and responses in rearranged pairings).

This study extended Postman's work (a) to the study of transfer between code-symbol tasks, and (b) by controlling nonspecific transfer through the method of completed practice rather than the control baseline technique.

Method

Data were obtained from 384 college students, all of whom were enrolled in an introductory psychology course.

The S's task was to write an English letter response under each of 12 Greek letter stimuli using a code. Presentation of the Greek symbols was accomplished in two ways on each trial. (1) S was given a 45 sec work period in which a page of 72 symbols was presented, with a key showing the complete code. During the work period, S was instructed to (a) use the key as a guide to write as many responses in sequence as he could in 45 sec, and (b) put a diagonal line through

Fig. 1. Number of correct responses on the first three trials of the second task for each of the PL groups after 0 (control), 1, 3, and 15 trials of first task practice.

the letter written 15 sec after the start of the work period as indicated by a signal from E. (2) S was given a 30 sec test after each work period in which he was asked to write the correct letter under each symbol in the absence of the key. Each trial, then, was of 75 sec duration; a 45 sec work period followed by a 30 sec test period.

The Ss were treated in groups of 16 by providing each with a booklet containing the stimulus material. Two pages were provided for each trial, one page for the work period and one page for the test period. During the first phase of the experiment (PL), S was given 10 trials of practice on each of 0, 1, or 6 PL tasks. This was followed by 0, 1, 3, or 15 trials of practice on the first task in Phase 2, and by 15 trials of practice on the second task in Phase 3.

Results

Analysis of variance was used to evaluate the number of correct responses on the post signal (last 30 sec) of work and on the test scores from each task. It was found that the PL and first task data were consistent with the expectations of current theory in that (1) an exponential function was found describing rate of learning as a function of number of PL tasks; and (2) the number of correct responses in both work and test portions of the first task varied as a function of first task practice and degree of PL.

The number of correct responses on the first three trials of the second task are shown in Fig. 1 as a function of degree of first task learning for each of the PL groups. The interaction of PL with first task learning level was significant ($p < .01$) for work ($F = 6.3$, $df = 6/383$) and test ($F = 3.9$, $df = 6/383$) scores. Duncan's new multiple range test showed significant ($p < .01$) differences between the 0 and 15 trial first task groups. This indicates positive transfer for the PL-0 groups, but negative transfer for the PL-1 and PL-6 groups.

Discussion

These results are consistent with the prediction that negative transfer following high first task learning would be greater when Ss were exposed to preliminary learning. For Ss in the PL-0 group, the traditional finding was observed (i.e., increases in first task learning led to decreased negative transfer). The Ss in the PL-1 and PL-6 groups showed negative transfer in increasing amounts with work scores and in undiminished amounts with test scores as first task learning was increased. One account of these results would ascribe reduced negative transfer for PL-0 Ss to increased nonspecific transfer which accompanies increased first task learning. Such an account is supported by the divergent positions obtained in second task performance for the control (no first task practice) Ss in each of the PL groups. The finding that second task response rate of control Ss is greatest for PL-6, intermediate for PL-1, and worst for PL-0 would be predicted by a two process account of transfer and cannot be explained by any attempt to account for these results in terms of work decrement.

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Note

1. This research was completed in partial fulfillment of the dissertation requirements of the Doctor of Philosophy degree at the University of Cincinnati.