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Training, Retention, and Transfer of Data Entry Perceptual and Motoric Processes Over Long Retention Intervals

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ABSTRACT

Subjects trained in a standard data entry task, which involved typing numbers (e.g., 5421) using their right hands. At an initial test (6 months after training), subjects completed the standard task, followed by a left-hand variant (typing with their left hands) that involved the same perceptual, but different motoric, processes as the standard task. At a second test (8 months after training), subjects completed the standard task, followed by a code variant (translating letters into digits, then typing the digits with their right hands) that involved different perceptual, but the same motoric, processes as the standard task. For each of the three tasks, half the trials were trained numbers (old) and half were new. Repetition priming (faster response times to old than new numbers) was found for each task. Repetition priming for the standard task reflects retention of trained numbers; for the left-hand variant reflects transfer of perceptual processes; and for the code variant reflects transfer of motoric processes. There was thus evidence for both specificity and generalizability of training data entry perceptual and motoric processes over very long retention intervals.

BACKGROUND

In the data entry task, subjects typically see four-digit numbers, read them silently, and type them into the computer. (For training principles derived from the data entry task, see Healy, Kole, Wohldmann, Buck-Gengler, & Bourne, 2011). The task is a sequential task with both cognitive and motoric requirements that can be examined separately through the different components of response time. For example, response *execution time* (which is the average time to type the second, third, and fourth digits after typing the first) has been shown to reflect the motoric aspects of the task (e.g., Chapman, Healy, & Kole, 2016; Fendrich, Healy, & Bourne, 1991).

At training, 26 subjects were given the standard version of the data entry task, in which they were shown four-digit numbers presented as numerals and entered them using the keyboard with their right hand.

At Test 1, 6 months after training, subjects were given the standard task along with a left-hand variant. The left-hand variant involves different motoric processes because the numbers were entered with the left hand rather than with the right hand, but the perceptual aspects of the task did not change.

At Test 2, 8 months after training, subjects were given the standard task along with a code variant. The code variant involves different perceptual processes because participants see letters and enter digits, but the motoric aspects of the task did not change.

The numbers entered during Tests 1 and 2 were either the same as during training (old) or numbers entered for the first time during the test (new). Repetition priming (old faster than new) at test for the standard task reflects specificity of training. Repetition priming for the left-hand task implies motoric transfer and for the code task implies perceptual transfer.

METHOD

Training

2 sessions (3 months apart)
3 blocks, 100 trials per block, each session
Standard

Stimulus:	Response:
2154	2154 (right hand)

Test 1 (6 months after training)

Standard (50 new and 50 old)

Stimulus:	Response:
2154	2154 (right hand)

Left-hand (50 new and 50 old)

Stimulus:	Response:
2154	2154 (left hand)

Test 2 (8 months after training)

Standard (50 new and 50 old)

Stimulus:	Response:
2154	2154 (right hand)

Code (50 new and 50 old)

Stimulus:	Response:
baed	2154 (right hand)

Design

Within-subject variables
Task (standard, left-hand) or (standard, code)
Trial type (new, old)

Dependent variable
Execution time (average time to type the second, third, and fourth digits)

RESULTS: Execution Time at Training

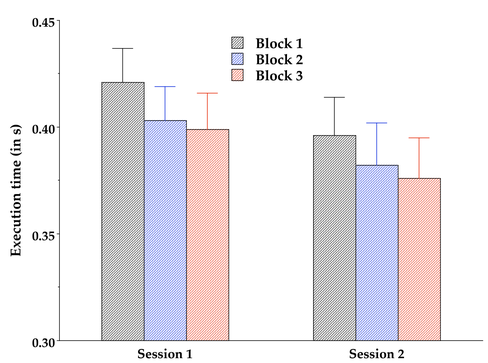

Figure 1: There were significant main effects of both session and block of training.

RESULTS: Execution Time at Test 1

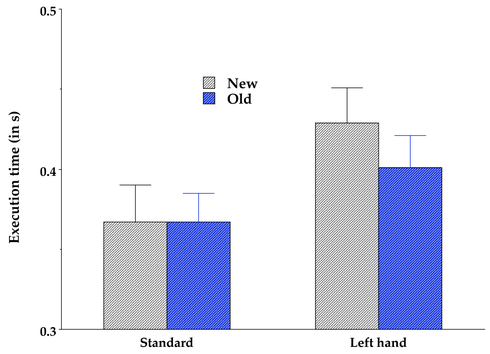

Figure 2: There were significant main effects of task and trial type and a significant interaction between task and trial type. In separate analyses of each task, there was significant repetition priming (old faster than new) for the left-hand task but not for the standard task.

RESULTS: Execution Time at Test 2

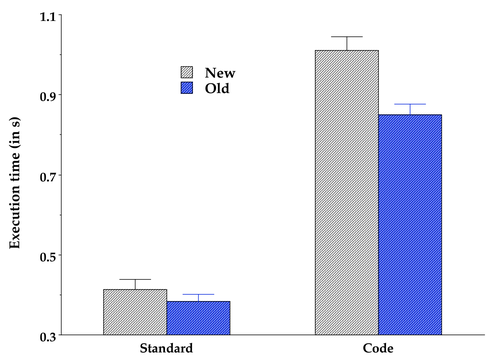

Figure 3: There were significant main effects of task and trial type and a significant interaction between task and trial type. In separate analyses of each task, there was significant repetition priming for both tasks, but repetition priming was larger for the code than for the standard task.

Note. All error bars in the figures are between-subjects standard errors of the mean.

CONCLUSIONS

The observed repetition priming in the standard task at Test 2 (advantage for old relative to new stimuli) provides evidence both for specificity of training and for retention of the trained stimuli over the very long retention interval of 8 months.

The observed repetition priming on the left-hand and code tasks at Tests 1 and 2 (which was significantly larger than that for the standard task) provides evidence for generalizability of training from the standard task to other conditions. For the left-hand task there was transfer of perceptual processes despite changes in motoric processes, and for the code task there was transfer of motoric processes despite changes in perceptual processes.

In previous work with other tasks and measures (Healy, Schneider, & Barshi, 2015), either specificity or generalizability was found, but not both. Nevertheless, there was evidence here for both specificity and generalizability of training for both perceptual and motoric processes of data entry even over very long delays.

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AUTHOR NOTE

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