

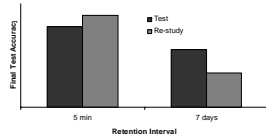


# Testing Effect: Enhanced Retention or Attenuated Forgetting?

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## INTRODUCTION

- Information is remembered better after being tested as opposed to being re-studied for a similar amount of time, a phenomenon referred to as the **testing effect** (1, 2).
- The benefits of testing are often non-existent at immediate retention intervals, but apparent at longer retention intervals (3, 5).



- Potential explanations for this interaction:
  - Tested items could be at a disadvantage after 5 min, because not all of them were retrieved (and feedback was not provided) on the intervening test.
  - Tested items could be forgotten at a slower rate than re-studied items (4).

## METHOD

**Subjects:** 55 adults were paid \$20 to participate in one 20-min learning session, followed by five 1-min test sessions. Subjects participated from home through the Internet.

**Stimuli:** 60 obscure facts (e.g., Charlie Brown's father was a barber).

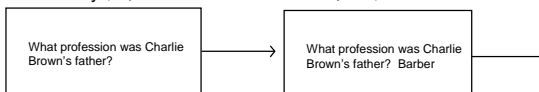
**Design:** 2 x 6 within-subjects design.

- 2 Test Conditions:** Pure Study vs. Test-Study.

**Pure Study** (subjects have the answer available for 10 sec)



**Test-Study** (subjects have the answer available for only 5 sec)



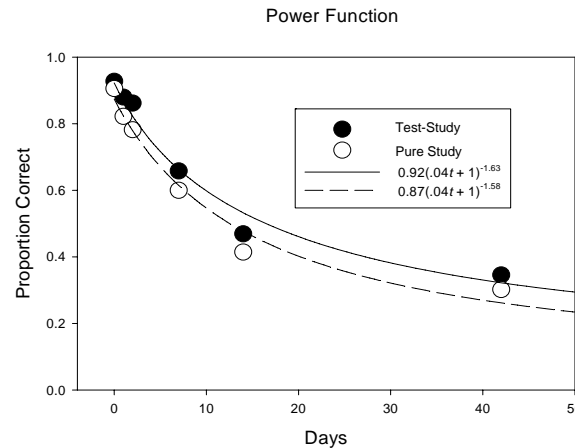
0.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

Time (seconds)

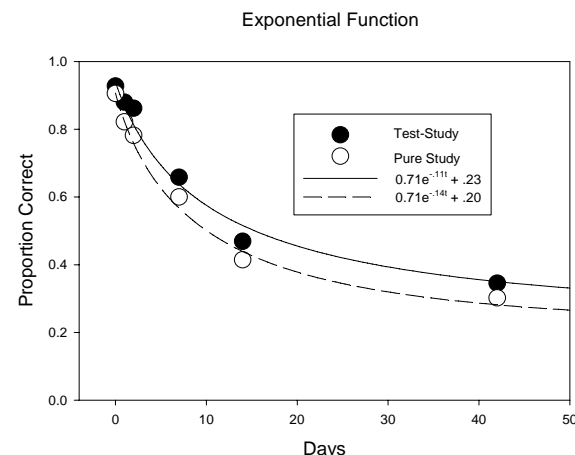
- 6 Retention Intervals:** a final test was given over 10 facts (5 Pure Study and 5 Test-Study) at each time interval below.

5 min, 1 day, 2 days, 7 days, 14 days, 42 days.

## FINAL TEST PERFORMANCE



**Figure 1.**  $p = a(b \cdot t + 1)^{-c}$  where  $a$  = degree of learning,  $b$  = scaling constant,  $c$  = rate of forgetting. The function was fit to each subject's data with  $b$  constrained to be equal across subjects and across conditions. There was a significant effect of test condition on degree of learning (.92 vs. .87), but not on rate of forgetting (1.63 vs. 1.58). Smooth curves represent the average of the 55 individual forgetting functions.



**Figure 2.**  $p = ae^{-bt} + c$  where  $a$  = proportion of to-be-forgotten items,  $b$  = rate of forgetting,  $c$  = asymptote. The function was fit to each subject's data with all 3 parameters free to vary across subjects and across conditions. There was a marginally significant effect of test condition on degree of learning (.94 vs. .91), but no significant effect on rate of forgetting (.11 vs. .14). Smooth curves represent the average of the 55 individual forgetting functions.

## RESULTS

### (1) Forgetting occurred

- Main effect of retention interval ( $F(5, 270) = 168.73, p < .001$ ).

### (2) Tests enhanced retention

- Main effect of test condition ( $F(1, 54) = 14.36, p < .001$ ).
- Effect of degree of learning parameter in power function ( $t(54) = 2.45, p < .02$ ) and exponential function ( $t(54) = 1.87, p = .066$ ).

### (3) Tests did not attenuate forgetting

- No significant Retention Interval x Test Condition Interaction ( $F < 1$ ).
- No significant difference between forgetting rate parameters for Test-Study vs. Pure Study.

## CONCLUSIONS

- A test enhanced retention more than a re-study opportunity at all retention intervals, from 5 min to 6 weeks.
- The act of testing seems to enhance retention, but *not* to attenuate forgetting, relative to re-studying the same material over again.
- Did not replicate the Test x Retention Interval Interaction found in some past studies.
  - This interaction could have been driven by less-than-perfect retrieval rates on the intervening test, which could cause re-studied items to out-perform tested items at 5 min.
  - Perhaps tests do attenuate the rate of forgetting, and a single test vs. re-study opportunity was not a strong enough manipulation to detect such an effect.

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