



# The Effects of Tests on Learning and 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** <sup>1, 2, 3, 4, 5</sup>
- Does the testing effect reflect an increase in the amount of information originally learned, or a decrease in the amount of information forgotten over time?

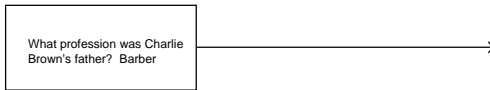
## METHOD

**Stimuli:** 60 obscure facts (Experiments 1 and 2), 60 Swahili-English word pairs (Experiment 3).

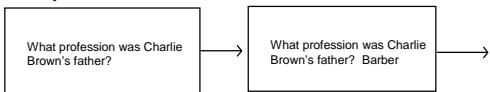
**Design:** 2 x 6 within-subjects design.

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

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



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



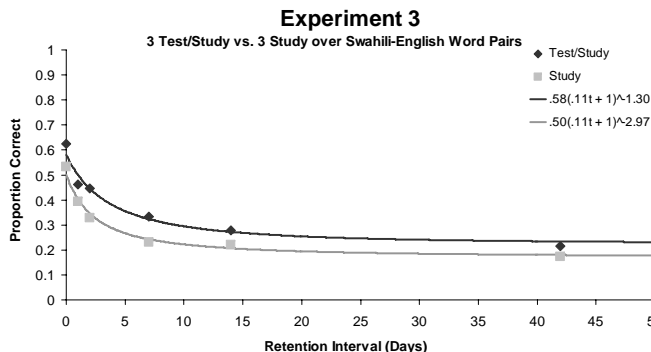
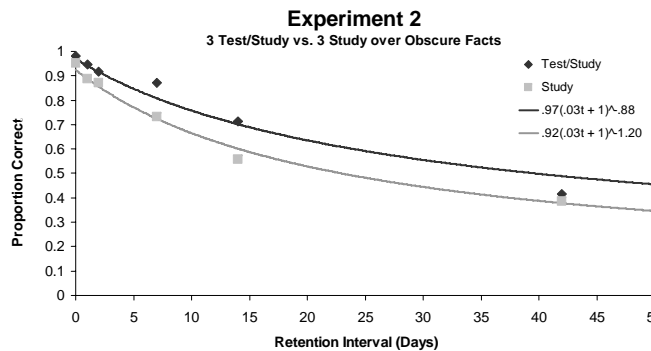
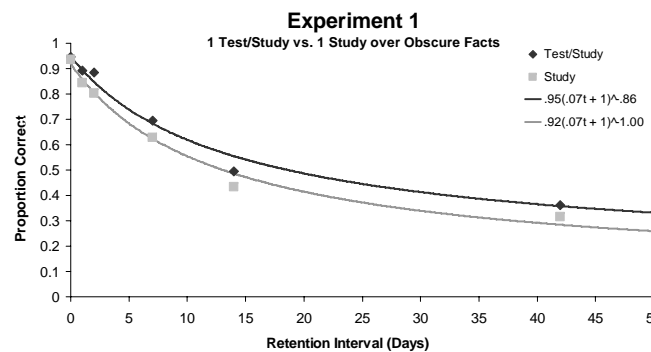
0.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10.....  
**Time (seconds)**

- 6 Retention Intervals:** a final test was given over 10 items (5 Study and 5 Test/Study) at each time interval below.  
5 min, 1 day, 2 days, 7 days, 14 days, 42 days.

**Subjects:** 55 subjects completed Experiment 1, 57 completed Experiment 2, and 48 completed Experiment 3.

**Analysis:** Each subject's data were fit to the power function  $y = a(b + 1)^{-c}$  where  $a$  = degree of original learning,  $b$  = scaling constant, and  $c$  = rate of forgetting. The scaling constant was constrained to be equal across subjects and across test conditions.

## FINAL TEST PERFORMANCE



## RESULTS

(1) **Forgetting occurred.** In all 3 experiments, the amount of information correctly recalled decreased significantly over time (all  $ps < .001$ ).

(2) **Tests enhanced learning.** In all 3 experiments, the amount of information recalled at time = 0 was significantly greater for Test/Study than for Study (all  $ps < .01$ ).

(3) **Tests reduced forgetting.** In all 3 experiments, the rate of forgetting parameter was significantly lower for Test/Study than for Study (all  $ps < .02$ ).

## 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 increases the amount of original learning, and decreases the rate of forgetting over time <sup>6, 7</sup>

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