

Promoting Transfer with the Testing Effect

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Psychology Honors Thesis

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Outline

- Key definitions
 - Transfer
 - Testing effect
- Prior research
- Present study
 - Method
 - Results
 - Discussion

Transfer

- The extent to which a learned behavior or cognition in one situation influences a behavior or cognition in another situation (Blume, Ford, Baldwin, & Huang, 2009)
- Why is transfer important?
- Near transfer to far transfer (Barnett & Ceci, 2002)



Learning a list of words in a new language for a vocabulary test



Learning a list of words in a new language in order to speak fluently

Testing Effect

- The phenomenon that shows that a combination of studying and testing can enhance a memory more than pure studying over that same amount of time, as measured by a test afterwards (e.g., Karpicke & Roediger, 2008)

Classic Testing Effect Paradigm

Condition	Day 1	Day 2
Study Condition	- Study a list of words for 5 minutes	- Free recall test on same list of words
Test Condition	- Study a list of words list of word for 2.5 minutes - Take a recall test on same list of words for 2.5 minutes	- Free recall test on same list of words

- Prior research on the testing effect has focused on rote memorization

Transfer: Aided by Testing?

- Prior research suggests that transfer is aided by testing
 - Near transfer example:
 - Reading comprehension: learn about lightning formation from a slideshow, test on learned information (Johnson & Mayer, 2009)
 - Farther transfer example:
 - Informed inferences: read a passage about bird wings, answer questions about how bird and plane wings might be structurally related (Butler, 2010)
- Importance of investigating testing-enhanced transfer
 - Rote memorization is rarely sufficient in education

The Present Study

- The search for an even farther measure of transfer that can be investigated with the testing effect
- Consideration of educational implications
 - Modeled after mathematics courses: learning principles and solving new problems
- Probability word problems to examine transfer (Ross, 1987)
 - Four probability principles
- Hypothesis
 - Test condition would outperform study condition

Method

Condition	Learning Phase: 4 Trials Same 4 Word Problems Per Trial	Time Interval	Transfer Phase 8 New Word Problems
STST (Test Condition) 32 Participants	<u>Study</u> (1 minute per problem) <u>Test</u> (2 minutes per problem) <u>Study</u> (1 minute per problem) <u>Test</u> (2 minutes per problem) (Crossword puzzle distractor task between each trial for 1 minute)	24 hours	Test (unlimited time)
SSSS (Study Condition) 32 Participants	<u>Study</u> (1 minute per problem) <u>Study</u> (2 minutes per problem) <u>Study</u> (1 minute per problem) <u>Study</u> (2 minutes per problem) (Crossword puzzle distractor task between each trial for 1 minute)	24 hours	Test (unlimited time)

Learning Phase Presentation

- For all study trials (each S in SSSS and STST), participants saw:
 - Word Problem
 - Solution
 - Explanation

- For all test trials (each T in STST), participants saw:
 - Word Problem
 - Prompted for Solution

Storyline and Object Roles

- The motor pool at IBM repairs the cars the company salespeople use. The IBM mechanics randomly choose which car to repair, with the best mechanic choosing first. There are 4 mechanics and 12 company salespeople who have cars. What is the probability that the best mechanic gets to work on the car of the best salesperson, that the second best mechanic gets to work on the car of the second best salesperson, and that the third best mechanic gets to work on the car of the third best salesperson? (Ross, 1987)
 - **Storyline:** Mechanics from the IBM motor pool are ensuring that specific company cars are serviced
 - **Object Roles:** IBM mechanics are choosing which cars they will work on based on how skilled they are as mechanics.

Storyline and Object Roles

- For each learning phase problem: three problem types during the transfer phase

+ / +
same storyline, same object roles

Storyline: Mechanics from the IBM motor pool are ensuring that specific company cars are serviced.

Object Roles: IBM mechanics are choosing which cars they will work on based on how skilled they are as mechanics.

+ / -
same storyline, opposite object roles

Storyline: Mechanics from the IBM motor pool are ensuring that specific company cars are serviced.

Object Roles: Salespeople, who use the company cars, get to choose which mechanic repairs their car, with the best salesperson choosing first.

0 / 0
unrelated storyline, unrelated object roles

Storyline: Teachers at the high school are willing to help sports teams sell tickets.

Object Roles: The basketball team gets to choose a teacher to help them sell tickets first, followed by the soccer team and then the swim team.

- These three problem types require use of the same probability principle as corresponding learning phase problem

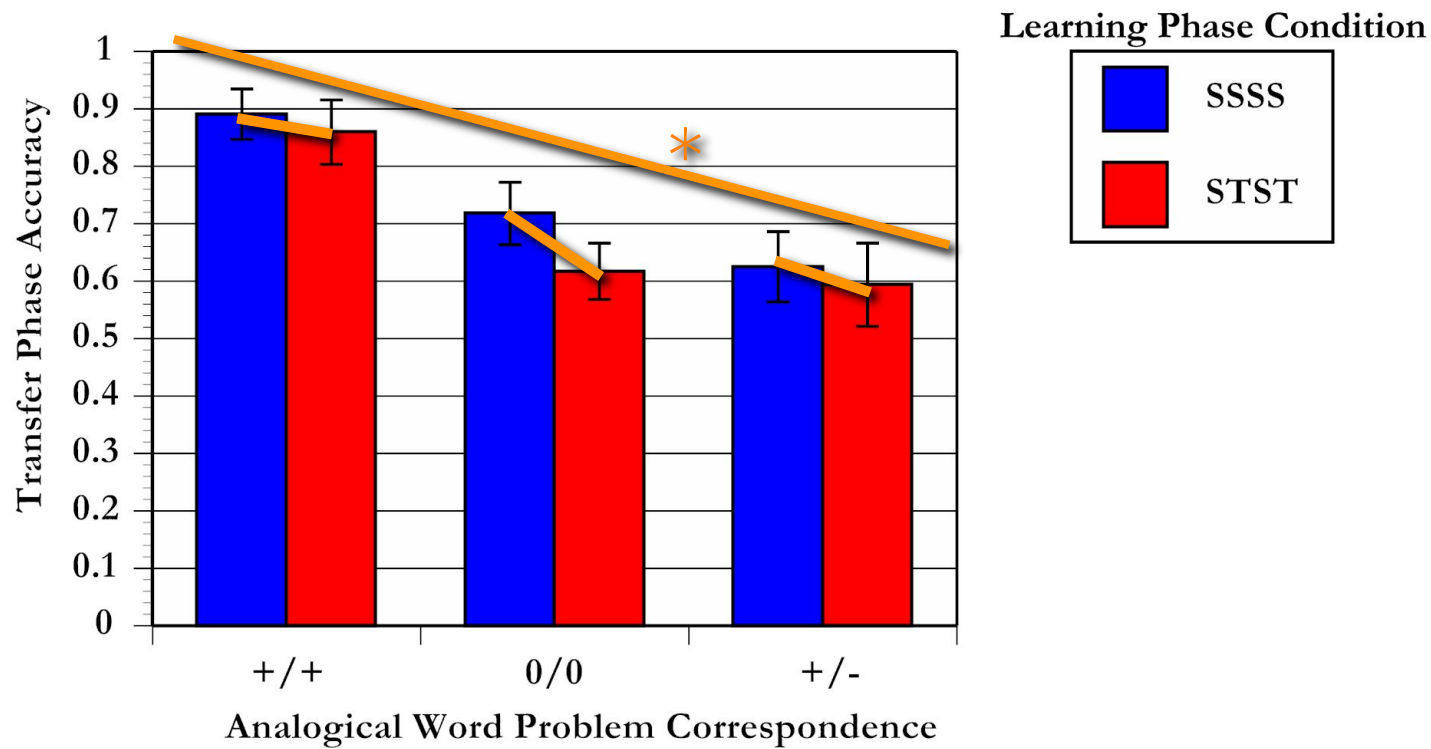
WHY?

Expected Results

- If transfer is successful, equal performance is expected for $+/+$, $+/-$, and $0/0$ problems
- Expected hierarchy of performance if transfer is not successful, as seen in prior studies (Ross, 1987)
 - $+/+$ (most similar)
 - $0/0$ (most unrelated)
 - $+/-$ (most potentially confusing)

Results

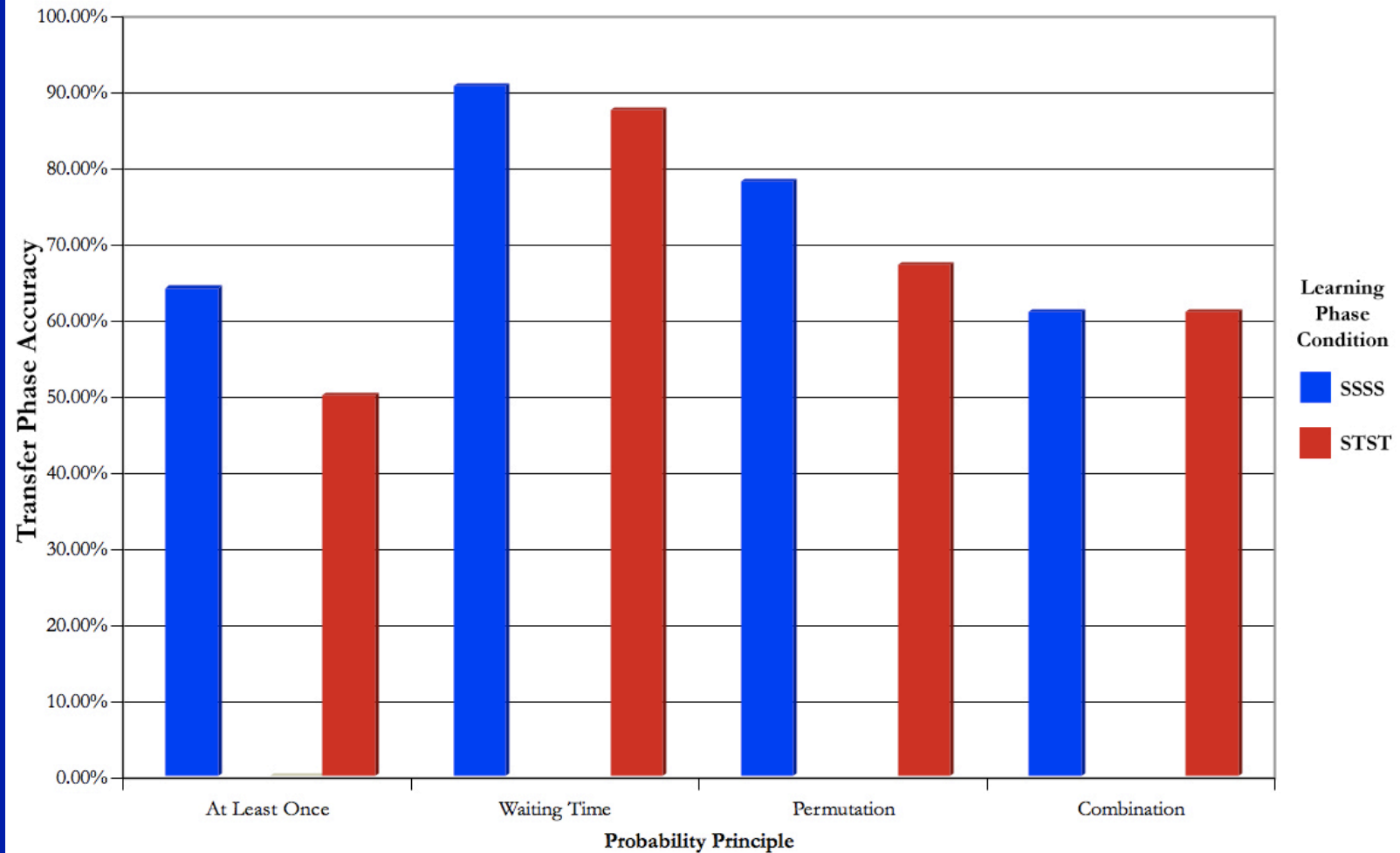
Accuracy on Transfer Phase Analogical Word Problems



- * One significant main effect of problem type regardless of condition: +/+, 0/0, +/-
 - $F(2,124) = 16.99, MSE = .074, p < .001$, supports Ross' (1987) findings
- No testing effect
- Non-significant trend: SSSS condition did better overall

Additional Statistics

Accuracy Rates According to Probability Principle



Discussion

- Why no testing effect?
 - Degree of transfer too far?
- Limitations during learning phase
 - STST participants wrote solutions, not explanations
 - After STST participants wrote solutions, they waited without re-reading problem
- Future directions to address limitations
- Educational implications of future research
 - Future studies have the potential to develop subject-specific ways of enhancing transfer with non-evaluative testing
 - Many benefits of enhancing transfer in all academic areas

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