

AN IMAGE VS. A THOUSAND WORDS: EVALUATING INTRODUCTORY PSYCHOLOGY STUDENTS' GRAPH-READING ABILITIES

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General Introduction

Understanding graphs is important to understanding scientific information. (Lai et al., 2016)

The ability to interpret graphs is affected by:

- Level of expertise (Peebles & Ali, 2015)
- Format of graph (e.g. line vs. bar) (Shah & Freedman, 2009)
- Familiarity with type of graph (Xi, 2010)
- Familiarity with material (Shah & Hoeffner, 2002)

Purpose of current studies:

Directly compare students' abilities to understand the same information presented in text and in a graph. (Study 1)

Examine changes in students' graph-reading ability over time. (Study 2)

Study 1

Hypothesis: Students would be more accurate on exam questions when the material in lecture had been presented as text compared to when it had been presented as a graph.

METHOD

Participants:

531 students enrolled in 2 sections of Introductory Psychology in Fall 2018

Materials:

2 versions of target lecture slide

Graph: results from the study were presented as a graph (Figures 1 & 2)

Text: results from the study were written in text (Figures 3 & 4)

Figure 1

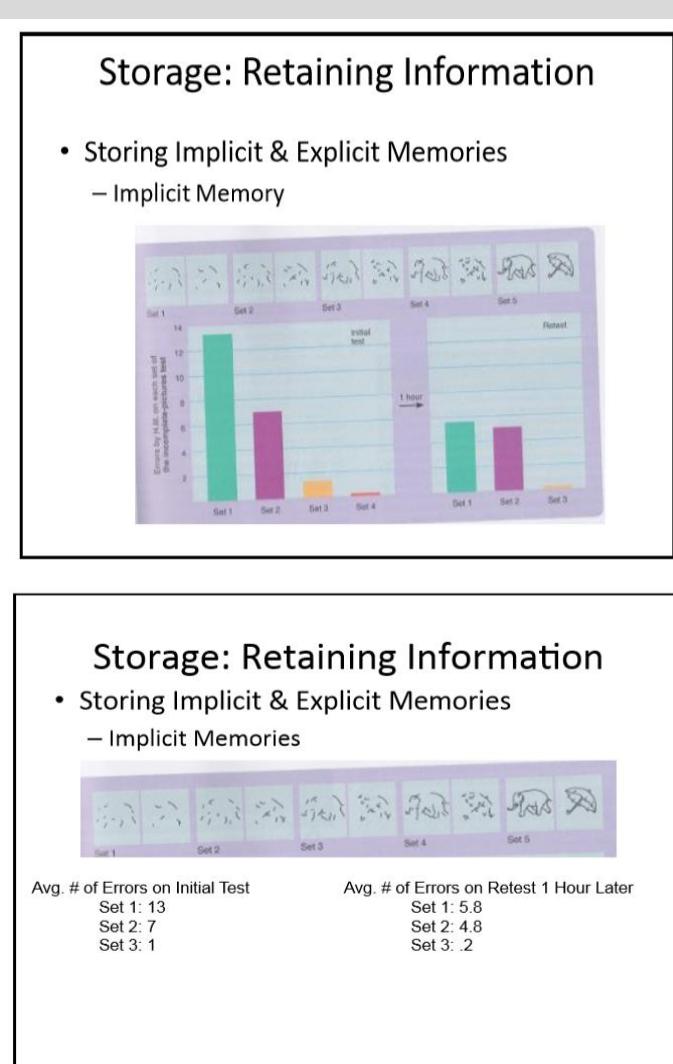


Figure 2

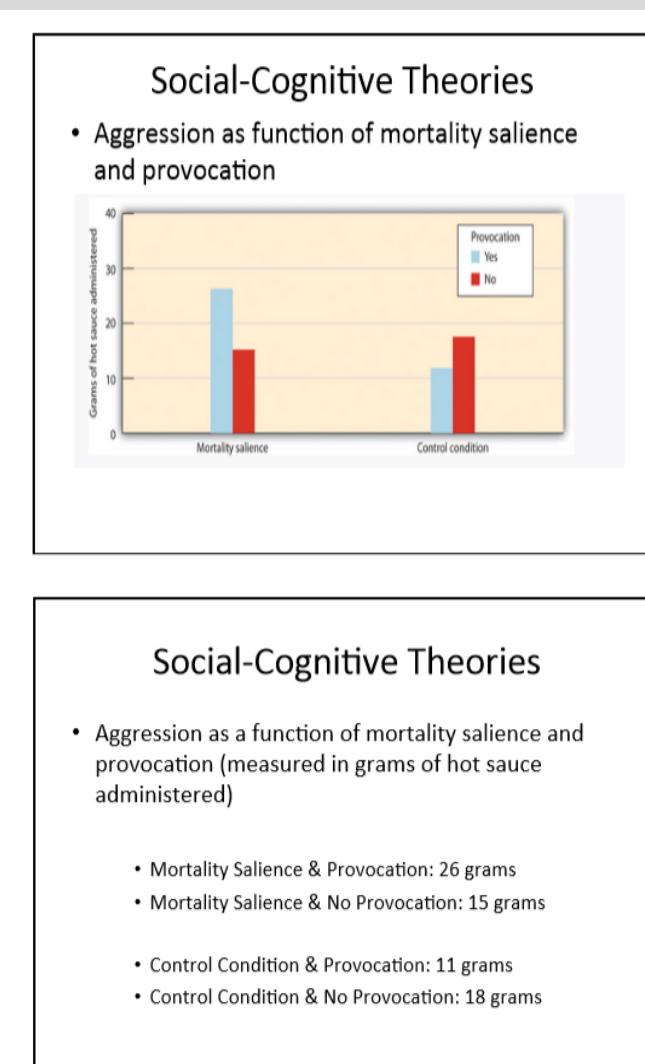


Figure 3

Figure 4

Procedure

One target research study selected for each chapter

Each section of the class saw results of the target study presented either as a graph or as text (Table 1)

Both sections of the class given the same multiple-choice questions about the target studies on their exams.

	Section 10	Section 11
Ch. 1: Thinking Critically About Psychological Science	None	None
Ch. 2: Biology of the Mind	Graph	Text
Ch. 3: Consciousness	Text	Graph
Ch. 5: Development	Graph	Text
Exam 1		
Ch. 6: Sensation & Perception	Text	Graph
Ch. 7: Learning	Graph	Text
Ch. 8: Memory	Text	Graph
Ch. 9: Language	Graph	Text
Exam 2		
Ch. 13: Social Psychology	Text	Graph
Ch. 14: Personality	Graph	Text
Ch. 15: Psychological Disorders	Text	Graph
Final Exam		

Table 1

Study 1

RESULTS

A 2 (material type) x 3 (exam number) repeated measures ANOVA was used to evaluate students' performance (Figure 5)

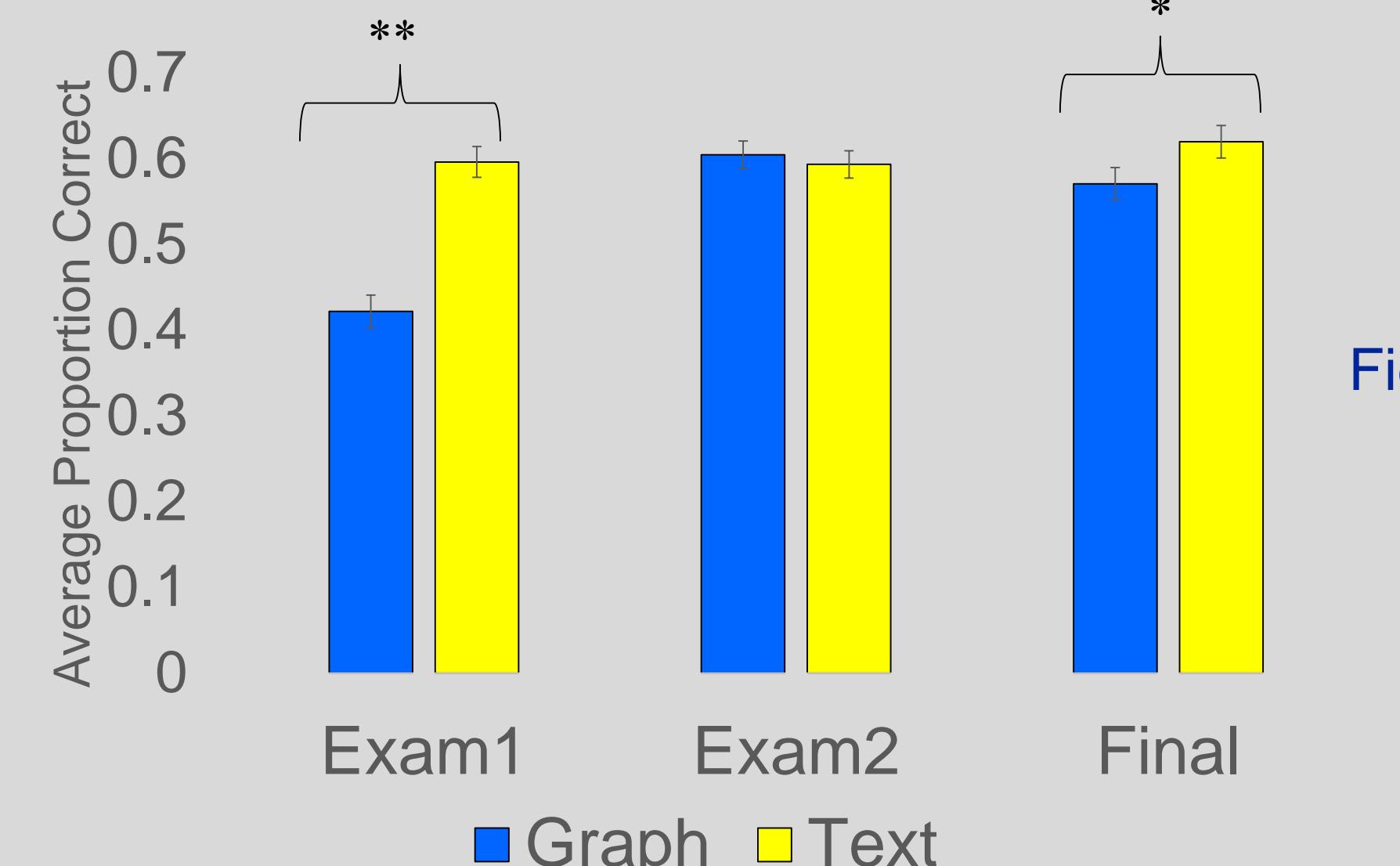


Figure 5

Significant main effect of material type: $F(1, 530) = 28.171, p < .001, \eta_p^2 = .050$
 Significant main effect of exam number: $F(2, 1060) = 16.974, p < .001, \eta_p^2 = .031$
 Significant material type x exam number interaction: $F(2, 1060) = 16.453, p < .001, \eta_p^2 = .030$

DISCUSSION

Scores were consistent when lecture material was presented as text.
 Scores improved between exams 1 and 2 for information that was presented as a graph in lecture.

Got better at understanding or remembering the graphs (Acquired a new skill)
 Realized they should study them (Implemented a skill they already had)

Study 2

Hypothesis: Students would become better able to read and interpret novel graphs over the course of the semester.

METHOD

Participants

Approximately 2300 students enrolled in 9 sections of General Psychology over 4 semesters from Fall 2014 to Spring 2016

Materials & Procedure

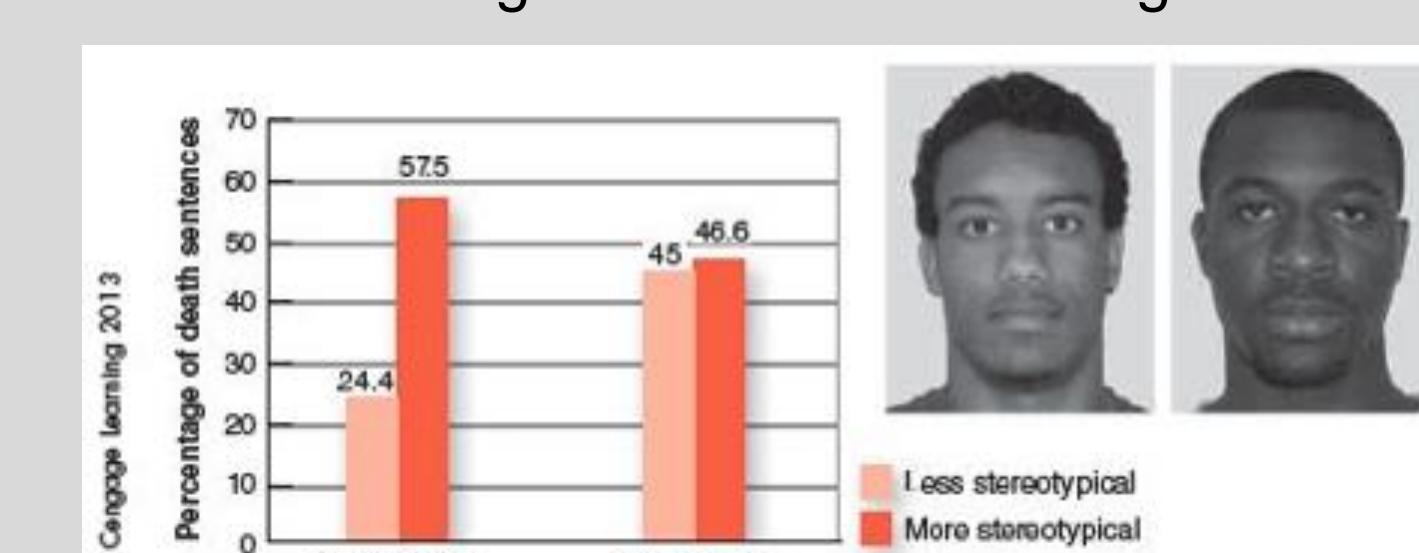
Novel research studies, to which students were never exposed, but related to the material from each chapter were selected.

On the exams, students were given brief description of study's purpose and graph depicting the results. (Figure 6)

Students responded to multiple choice question about the meaning of the findings.

Figure 6: Question used on Final Exam

Researchers conducted a study in which participants heard about a crime that was committed and had to decide whether the defendant should be sentenced to death or not. First, the researchers manipulated whether the victim was described as white or black. Second, they manipulated the degree to which the physical appearance of the defendant was stereotypically black or not. The results of this study are shown in the graph below. Which of the following was one of the findings from this study?



Study 2

RESULTS

Single Factor Repeated Measures ANOVA (Figure 7)

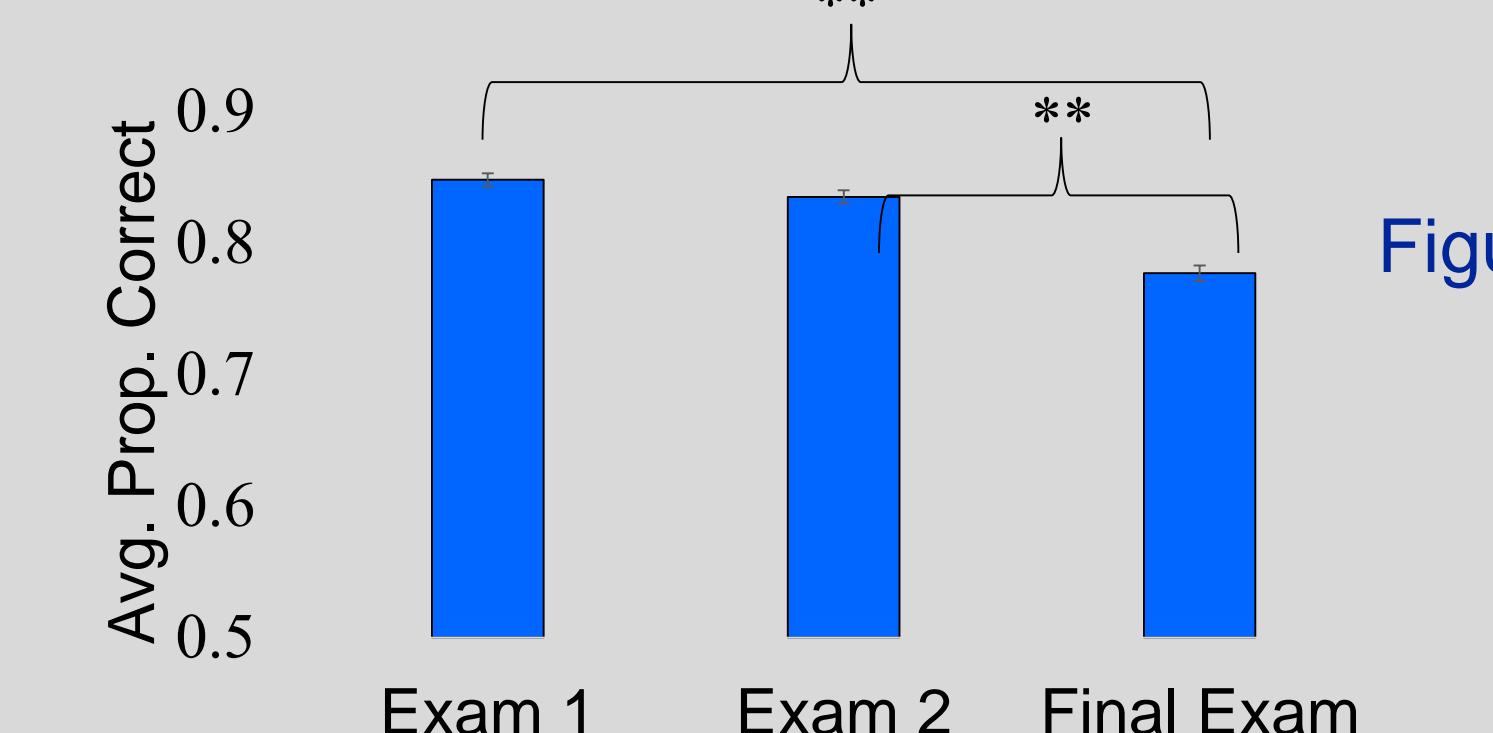


Figure 7

Significant effect of exam number: $F(2, 4746) = 58.54, p < .001, \eta_p^2 = .024$

Items Analysis to evaluate reason for low performance on final exam (Figure 8)

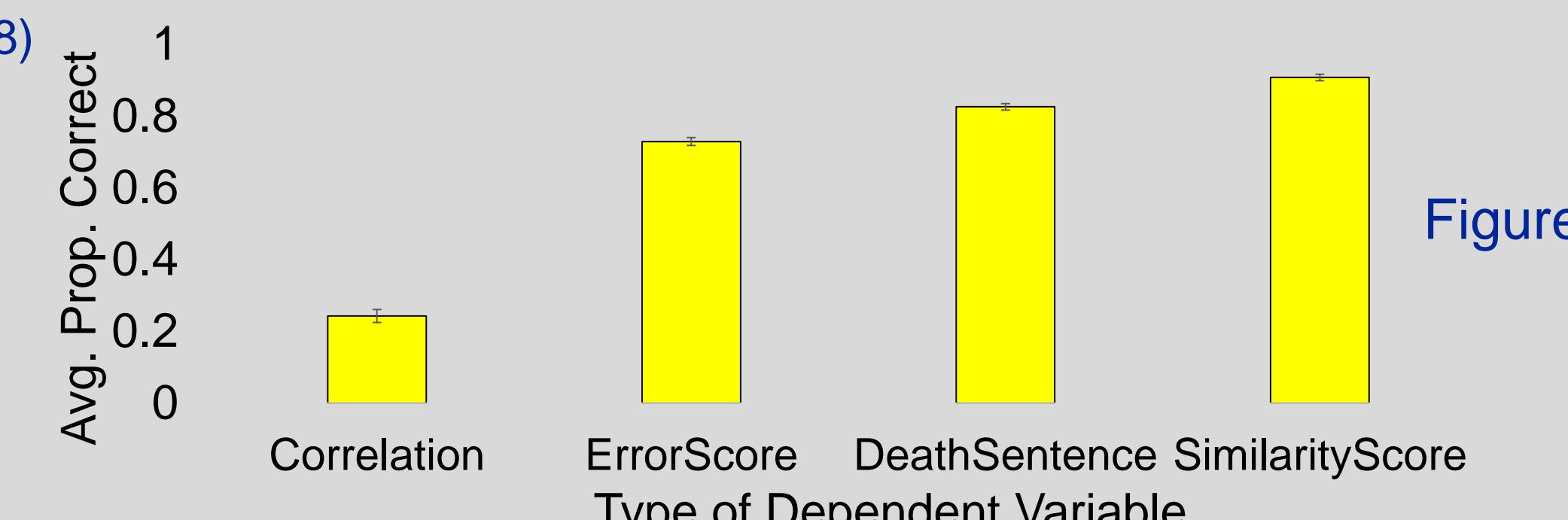


Figure 8

Significant effect of item $F(3, 5054) = 396.0, p < .001, \eta_p^2 = .190$

All items significantly different from each other at $p < .001$

DISCUSSION

Students do generally well reading & interpreting novel graphs.
 Have more difficulty interpreting some kinds of graphs:

Correlations – less familiar

y-axis indicates negative trait (e.g. error score) - Value-thinking vs. location thinking (David, Roh, & Sellers, 2018; Okan, Garcia-Retamero, Galesic & Cokely, 2012)

General Discussion

Requiring students to both remember what a graph looked like and its meaning may be too much cognitive load.

When students know that they will be tested on information that had been presented as graphs, their performance on those questions improves.

Even with practice, students' ability to interpret certain types of novel graphs is relatively poor.

Future Directions

Compare performance based on students' academic major

Evaluate graph interpretation in upper level courses

Examine effects of explicit graph-reading instruction

References

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