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July 12, 2020

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The authors declare that there no conflicts of interest with respect to this preprint.

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Abstract

Seductive details are highly interesting, but irrelevant, elements added to learning materials. The current study examined how the inclusion of these details influences learners' ability to form inferences between texts. Participants were asked to read two texts about El Niño and to judge the validity of inferences from across texts. Results show that seductive details led to decreased performance, though learner characteristics provided some general benefits on this task.

Keywords: text processing, comprehension, inferences, seductive details

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As educators attempt to reach an increasing number of students, with increasingly diverse backgrounds, the ability to maintain student interest and engagement is essential. A variety of effective methods have been identified, such as using more vivid and coherent materials. One method of increasing interest, however, has been shown to produce paradoxically detrimental effects. The inclusion of highly interesting details that are irrelevant or tangential to learning goals, referred to as *seductive details*, leads to a variety of deleterious consequences for learning, as reflected in meta-analyses (e.g., Rey, 2012). At the same time, individual differences may reduce these consequences, with some findings suggesting that seductive details may benefit those with higher interest or prior knowledge (Korbach et al., 2016). The present study sought to extend these effects to multiple-text comprehension and to examine potential protective effects of several learner characteristics.

This study also examined the three potential explanations for these detriments, as described by Lehman et al. (2007). These explanations were modified from Harp and Mayer's (1998) original descriptions. The *reduced attention hypothesis* suggests that seductive details draw readers' attention away from the main text, resulting in a misallocation of their limited cognitive resources. The *coherence break hypothesis* asserts that seductive details disrupt the coherence of a text and, accordingly, is detrimental to individuals' formation of a coherent representation, particularly when this disrupts causal chains of events. Finally, the *inappropriate schema hypothesis* suggests that seductive details cause readers to form their representation of the text around these seductive details, rather than the main text.

The current study sought to build upon past research by extending the SDE to multiple text comprehension, examining detrimental effects on inferences using the inter-textual inference

verification task (IIVT), exploring effects of several learner characteristics (i.e., prior knowledge, interest, need for cognition, and vocabulary knowledge), and testing reading time predictions from prior research (e.g., Lehman et al., 2007).

Method

Participants

A total of 139 participants were recruited from a large university in the south-central United States. A total of 127 participants were retained after removing participants with suspicious survey times ($n = 4$), or that performed below chance on prior knowledge ($n = 8$), as this indicated inattentive participation during prescreening. The sample was primarily female (70.9%) and represented varied ethnicity: White (37.8%), African American (35.4%), and others (26.8%).

Materials

Weather texts. Participants read two texts, adapted from Braasch and Goldman (2010), regarding typical weather patterns across the Pacific Ocean (Text 1) and changes in these patterns during El Niño cycles (Text 2). These were presented one sentence at a time to test several hypotheses based on sentence-level reading times. Within each text were sentences necessary to correctly answer the IIVT questions, referred to as *critical sentences*, used to determine placement of the seductive detail sentences. Seven critical sentences were targeted by placing seductive details immediately before or after, to evaluate their impact on IIVT performance. Approximately half of the participants ($n = 63$) received texts containing seductive details, while the other half read texts with no seductive details.

Seductive details were selected based on a pilot study conducted on Amazon Mechanical Turk (mTurk). The mTurk workers read these texts and rated each sentence for interest and importance. At each of the seven critical locations (i.e., where seductive details would be inserted), they received one of three potential details. The most interesting and least important sentence at each location was selected (Table 1).

Table 1
Mean Pilot Ratings of Seductive Details for Current Study

Location		*n*	Importance	Interest
Text 1				
	SD1	33	3.30	5.73
	SD2	32	3.84	6.00
	SD3	33	3.21	5.48
	SD4	33	1.91	5.45
Text 2				
	SD1	33	2.45	6.12
	SD2	33	2.21	6.00
	SD3	33	2.70	5.64

Intertextual Inference Verification Task. The intertextual inference verification task (IIVT) requires participants to combine information from two or more texts to determine whether a provided inference could be inferred by combining information across the texts. For example, one item asks whether trade winds flow more slowly from east to west during an El Niño event. To answer this, participants needed to combine information that the trade winds generally blow westward (Text 1), but slow or even reverse in direction during El Niño (Text 2). A total of 18 IIVT questions (7 true, 11 false) were presented. For each, participants had to indicate whether a provided inference could be made by combining information across texts.

Learner Characteristics. To measure participants' interest in weather, both the well-developed individual interest (WDII) and emerging individual interest (EII) measures from

Wang and Adesope (2016) were administered. The WDII measure included five 7-point Likert ratings regarding a more developed interest in weather and the EII measure contained six 7-point Likert ratings regarding a more nascent interest in weather and a desire to learn more about this topic. These measures were collapsed into one combined item for analysis.

Prior knowledge about weather phenomenon was measured through a 15-question multiple-choice measure regarding a variety of weather topics (e.g., "As altitude decreases, air pressure _____." [*decreases*]) presented early in the semester through a SONA prescreening survey. Participants were also given a measure of their vocabulary knowledge. For each item, participants saw a word and were asked to choose the best definition from five alternatives in a multiple-choice format. Finally, the 18-item version of the need for cognition (NFC) scale was included to measure individuals' propensity toward, and enjoyment of, cognitively demanding tasks (Cacioppo, Petty, & Kao, 1984).

Procedure

Participants were given the WDII measure and prior knowledge measure through a SONA prescreening survey. On the primary study day, participants completed a series of tasks through Qualtrics. First, they read both texts, presented one sentence at a time, to measure reading times. After reading the texts, participants were given the 15-item vocabulary quiz for college students. This measured their vocabulary knowledge and served as a distractor task between reading and the IIVT.

Participants then answered 18 IIVT questions from Braasch et al. (2014). For each question, they indicated whether a provided inference could be made by combining information across the two texts they read. They were also asked to indicate their confidence on a 7-point Likert scale, though these data were exploratory and are not described further. Afterwards, they

completed a measure of their emerging individual interest (Wang & Adesope, 2016) and the 18-item NFC scale (Cacioppo et al., 1984).

Results

As predicted, participants reading a text with seductive details ($M = 8.71$, $SD = 2.61$) did significantly worse than those reading the standard text ($M = 9.84$, $SD = 2.66$) on the IIVT, $t(125) = 2.42$, $p = .017$, $d = .43$. To examine how individual differences affect these results, a multiple regression model was fit (Table 2).

Table 2

Summary of Multiple Regression Predicting IIVT Performance

Variable	B	SE_B	t	p
Condition	-1.43	0.47	-3.04	0.003[*]
Prior Knowledge	0.01	0.09	0.11	0.911
Combined Interest	-0.01	0.03	-0.41	0.682
Vocabulary	0.19	0.09	2.10	0.038[*]
Need for Cognition	0.04	0.02	2.11	0.037[*]

Overall, there was a significant model, $F(5, 121) = 3.84$, $p = .003$, explaining approximately 14% of the variance ($R^2 = .14$). Condition remained a significant predictor, reflecting worse performance among participants receiving the text with seductive details. Additionally, both vocabulary knowledge and NFC were significant predictors. Contrary to expectations and previous work, however, neither interest nor prior knowledge were significant predictors of IIVT performance ($p = .68$ and $p = .91$, respectively), nor were there any significant interactions.

Prior to testing sentence-level reading time predictions, data were cleaned to replace outlying values. While log-transformation improved the skewness of these data, the presence of extreme positive and negative times strongly affected the mean and standard deviation. To address this concern, median absolute deviation (MAD) was used, as suggested by Leys et al. (2013), as it is more robust against outliers. This method is based on absolute deviation around the median, rather than the mean. For each sentence, times three MAD units above or below the median were replaced with the cut-off value (e.g., a value over three MAD units from the median was replaced with the median plus three MAD). Additionally, these sentence level reading times were converted into average word reading times for comparing reading time predictions derived from Lehman et al. (2007).

First, average word reading time for the base text was compared to average word reading time for seductive details to determine if participants in the seductive details condition spent significantly longer reading the seductive details sentences. A Wilcoxon Signed-Ranks Test was conducted and revealed a non-significant difference ($S = -103$, $p = .49$). Next, base text reading times were compared between the seductive details and control conditions to test whether participants in the seductive details condition spent significantly less time reading the base text, as suggested by Lehman et al. (2007). Results of a Wilcoxon Rank Sum test revealed no significant differences ($z = 0.88$, $p = .19$).

Finally, *critical sentence* reading times were compared. These were sentences that immediately followed seductive details for participants in the seductive details condition. Lehman et al. (2007) predicted that, if seductive details disrupt coherence, participants should spend longer reading these sentences as they attempt to repair the coherence break caused by seductive details. A Wilcoxon Rank Sums test revealed a non-significant difference, $z = 1.06$, $p =$

.14, though this difference was in the correct direction. Summary statistics for individual

sentences are shown in Table 3.

Table 3

Average Word Reading Times on Sentences Immediately Following Seductive Details

Sentence	Control ($n = 64$)		Seductive Details ($n = 63$)		Wilcoxon Rank Sum[a]	
	M	*SD*	*M*	*SD*	*z*	*p*
T1S8	0.46	0.27	0.47	0.31	0.40	0.34
T1S17	0.35	0.25	0.37	0.30	0.12	0.45
T1S27	0.26	0.18	0.28	0.19	0.76	0.22
T2S1	0.39	0.25	0.40	0.22	1.09	0.14
T2S7	0.37	0.25	0.43	0.40	1.01	0.16
T2S12	0.32	0.22	0.36	0.24	1.47	0.07
Average	0.28	0.10	0.30	0.10	1.06	0.14

Note. Values shown are mean word reading times, though log-transformed values were used for the Wilcoxon Rank Sum values reported. [a]Values reflect one-sided p-value for a priori predicted increased times in the seductive details condition.

Discussion

The current study extended the seductive details effect to a multiple text inference task

and supported the assertion that seductive details lead to worse learning outcomes in these

settings. Consistent with the previous research showing detrimental effects on conceptually

similar inference tasks, the ability to form inferences across texts was reduced when participants

read a text with seductive details. Vocabulary knowledge was related to performance, though it

did not interact with condition, similar to McCrudden and Corkill's (2010) findings. NFC was

also related to performance but, again, did not interact with condition. Reading time predictions

were not supported, though the precision of timing data collected through Qualtrics, where

participants had to use the mouse to advance, may have prevented the detection of such

differences. While results were not significant, the reading time predictions posited by the

coherence break hypothesis were all in the correct direction (i.e., increased reading times for

those in the seductive details condition). As such, a larger sample may support these predictions.

Unexpectedly, neither interest nor prior knowledge were related to IIVT performance.

Prior knowledge has been shown to protect against the seductive details effect in past research

(Korbach et al., 2016), so this was unexpected. One possibility is that the IIVT was too

challenging to be meaningfully related to the simpler multiple-choice questions used for this

study. Regarding interest, prior research has also supported its protective effects when seductive

details are present (Wang & Adesope, 2016). As our interest questions asked about interest in

weather, this may have brought more salient topics to mind (e.g., tornadoes, hurricanes).

Consequently, reported interest may not have aligned with the learning materials, describing

changes in weather systems across the Pacific.

Seductive details negatively affected IIVT performance, regardless of individual

differences, which further supports the detrimental properties of these textual elements. This

effect was found even when multiple texts were used, along with a more challenging, inference-

based, measure of comprehension. While vocabulary and NFC were associated with increased

IIVT performance, generally, they were inadequate to protect against these detrimental details.

Together, these findings contribute to the growing literature suggesting that the inclusion of

seductive details is a problematic method of securing student interest.

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