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Decorative Disadvantages in a Leading Educational Psychology Textbook: The Seductive Cartoons Effect

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Abstract: *Seductive details are interesting but irrelevant details that impede text comprehension (Mayer, 2005). Whether visual images can act as seductive details remains unclear (Rey, 2012). In two experiments, 125 undergraduates read 10 pages from a leading educational psychology textbook that either included illustrated cartoons or not, followed by a comprehension test. Experiment 1 revealed no seductive cartoons effect. Experiment 2, after increasing reading time and question difficulty, revealed a seductive cartoons effect where students who saw cartoons performed worse than those who did not see cartoons. Results are consistent with the cognitive theory of multimedia learning (Mayer, 2005) and cognitive load theory (Sweller, 2005), where seductive information draws cognitive resources away from what is needed to process relevant information. Thus, seductive cartoons are similar to other types of visual seductive details that serve only a decorative purpose to increase interest, but also decrease comprehension.*

Key Words: seductive details, visual images, textbooks, illustrations, interest

A continuous challenge for educators is producing curriculum that learners will find interesting. After all, there is conclusive evidence that students learn better when material is interesting than they do when material is uninteresting (e.g., Hidi & Renninger, 2006; Renninger et al., 1992). Unfortunately, oftentimes academic material is not inherently interesting to students. Thus, instructors and textbook authors may attempt to take the existing materials and simply make them more interesting. Sometimes these efforts are successful and student learning is improved (e.g., Alexander et al., 1994; Schraw & Lehman, 2001).

Unfortunately, sometimes these innocent attempts to increase learner engagement backfire. Adding potentially interesting information may result in actually reducing student performance. An example of such negative effects is when authors include interesting, but not always relevant, details (Dewey, 1913; Harp & Maslich, 2005; Harp & Mayer, 1998; Mayer et al., 2001; Mayer & Jackson, 2005). Certain topics, such as danger, power, and sex, are almost universally interesting but rarely relevant in academic curricula (Hidi & Baird, 1988). Such details are sometimes referred

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to as *seductive details* as they seduce the reader into paying attention to them more than relevant content (Garner et al., 1992; Garner et al., 1989; Harp & Maslich; Harp & Mayer, 1997; Schraw, 1998; Wade et al., 1993).

In most studies of seductive details, students are provided with materials that either contain such details or not and then given tests that measure retention and comprehension later. For example, Garner et al. (1989) had students read expository passages with and without seductive details. Seductive details decreased student learning of target content, even with skilled readers. Garner et al. (1992) replicated these results and suggested that including seductive details in text almost always interferes with learning of target material. Yet, there are circumstances where seductive details seem to be more troublesome than others.

For example, seductive details appear to negatively affect higher levels of cognitive processing more than simple retention. Mayer et al. (2008) had students view materials with either several high or low interest details. Students who viewed the low interest materials performed better on problem-solving transfer tests than those who viewed high interest materials but did not differ on measures of retention.

The placement of seductive details can also affect the severity of the effect. Seductive details appear to do the most damage when they appear prior to target material. Rowland et al. (2008) found that students performed worse when the details were placed prior to text than when they appeared after text. The strength of this "prior" seductive details effect apparently cannot be overcome even when a graphic organizer that ties the seductive details to the content appears before the details (Rowland et al., 2009). This is consistent with the diversion hypothesis offered by Harp and Mayer (1998) where seductive details that appear early cause the reader to activate inappropriate schemas to incorporate later relevant information.

THEORETICAL RATIONALE FOR THE SEDUCTIVE DETAILS EFFECT

Harp and Mayer (1998) first offered three possible explanations for the seductive details effect. The *distraction* hypothesis posits that seductive details simply draw selective attention away from target material, resulting in poorer learning. As previously mentioned, Harp and Mayer also suggested that seductive details may activate inappropriate schemas to use when processing new information instead of appropriate ones that match the target material. Note that the *diversion* hypothesis only makes sense when the details precede the target material. Finally, Harp and Mayer offered that the seductive details effect could possibly be explained by disrupting the learner from building a coherent understanding of the main ideas. Mayer (2005) later combined the distraction and diversion hypotheses and concluded that the seductive details effect may be best explained by the *cognitive diversion* hypothesis which posits that attending to seductive details simply requires precious cognitive resources that then cannot be used to process target material (e.g., Sweller & Chandler, 1991). Both cognitive load theory (e.g., Sweller, 2005) and the cognitive theory of multimedia learning (e.g., Mayer, 2005) propose limited processing capacities during learning. It is the cognitive diversion hypothesis, that seductive details simply increase extraneous cognitive load, that provides the theoretical foundation for the present study.

VISUAL SEDUCTION

Seductive details effects are not limited to the written text modality in which the details appear in most studies. In addition to written text, seductive details can also take the form of spoken words in lectures (Harp & Maslich, 2005), videos (Mayer et al., 2001), and music (Moreno & Mayer, 2000). The literature on the role of visual images as adjuncts to text suggests five possible functions: decorative (i.e., simply to appeal to the reader with no intent to enhance learning), representational, organizational, interpretational, and transformational (Levin, 1981). An early meta-analysis revealed that studies where images were used for purely decorative reasons resulted in no beneficial learning effects, whereas illustrations used for representational, organizational, interpretational, and transformational reasons resulted in positive effects (Levin et al., 1987). It is important to note that no negative learning effects were associated with decorative images, indicating no visual seductive details effects prior to 1987.

If there are no learning benefits associated with decorative images, then why would educators still include them? Beyond the obvious possibility that such decorations may improve the "curb appeal" of dry curricula, they may also increase student motivation (Park et al., 2015) and improve alertness, mood, and calmness (Lenzer et al., 2013). Finally, Schneider et al. (2020) found that when decorative pictures were used as a retrieval cue, in addition to appearing during the learning phase, student learning was superior to having no decorative pictures during the learning phase. Given the possible motivational, affective, and even cognitive advantages, it should be no surprise that instructional designers continue to use decorative images with expository text.

Despite the appeal of decorative images, do they really have no negative effects on learning? Since the Levin et al. (1987) meta-analysis, several studies have searched for possible visual seductive details effects to determine if decorative images can be harmful. For example, Harp and Mayer (1998) added seductive illustrations to multimedia messages. In a text about how lightning forms, they included a photo of a football player who had been struck by lightning. The photo was not relevant to understanding how lightning forms, but seductively interesting. The inclusion of the photo and text that described it resulted in poorer comprehension than when they were excluded, suggesting a possible visual seductive details effect.

This possible visual seductive details effect was not always found in other similar studies. Rey (2012) reviewed 13 visual seductive details studies since 1998 and found that only four clearly found a negative impact of visual images, six had mixed results, and three had no visual seductive detail effect. Thus, it remains uncertain under which conditions a visual seductive details effect occurs. Unlike previous visual seductive details studies that used researcher-constructed materials, the present study used learning materials that appeared in a leading educational psychology textbook that described numerous best practices for instruction.

CARTOONS

Illustrated cartoons are another example of visual images often included as adjuncts to text. Figure 1 is a cartoon that is presented alongside material on mnemonic strategies. Readers may find it interesting (simply due to the illustration) and humorous (due to the incongruity), and the content of the cartoon is actually relevant to the topic of mnemonics. Unfortunately, it likely does not help the reader better understand the content. According to the instructional humor processing theory (Wanzer et al., 2010), for this cartoon to facilitate learning, a student would need

to both perceive and resolve the incongruity (e.g., cat before slave instead of the "i" before "e" mnemonic) to "get" the humor and better understand the content. If the incongruity is not resolved, the student will experience confusion instead of humor. Of course, there is another possible reason why the cartoon may due damage to comprehension. It could simply draw precious attentional resources away from reading the text which explains the material better than does the cartoon. This latter reason is likely if the cartoon in Figure 1 was simply considered a decoration that enhances the likelihood that instructors will adopt the textbook and/or that students will perceive the textbook as less boring. Ironically, the cartoon appeared in a best-selling educational psychology textbook (Woolfolk, 2006) that should showcase best practices in instruction and not include material that would inhibit learning.

Ozdogru and McMorris (2013) examined the effects of humorous cartoons on student learning by either including them with learning passages or not. Although students rated passages with cartoons as more favorable than those without, the cartoons did not facilitate learning. More recently, Celik and Gundogdu (2016), using a quasi-experimental design, gave high school students a seven-week lesson either with or without cartoons. In addition to improving attitudes towards the material, cartoons increased retention of content. These cartoons were referred to as "concept cartoons" as they addressed conceptual information. Thus, the question of whether all cartoons increase or decrease student learning of text remains unclear.

The main research question in the present study was whether a visual image humor advantage or a visual seductive details effect would be found using real cartoons that appeared on pages from a textbook that, of all textbooks, should model best practices for student learning. It was predicted that because the cartoons appeared to be interesting but not particularly helpful in understanding the relevant content, they would draw precious cognitive resources away from processing the relevant content, causing an increase in extraneous cognitive load, and resulting in lower comprehension performance. Given that seductive information does the most damage when it is placed before target material and when students are assessed for higher cognitive processing, we placed the cartoons before related written material and also assessed students at the application, rather than knowledge, level.

Figure 1. Example of a seductive cartoon.

EXPERIMENT 1

Based on an a priori power analysis using G-Power software (Faul et al., 2007), a total of 36 students (18 per group) would yield 0.80 power to detect a large effect size (.87) using the following parameters: alpha = .05, one between-subjects condition, and a one-tailed test (Cohen,

1992). A large effect size was expected based on the recent meta-analysis by Sundararajan and Adesope (2020) where they found large (d = .87) effects when seductive details are presented in both text and image formats. A larger sample size was used in Experiment 1 due to availability.

METHOD

PARTICIPANTS

Ninety-one undergraduates (59% female; 8% Freshmen, 11% Sophomores, 20% Juniors, and 61% Seniors) were recruited from an educational psychology subject pool at a large public university in the southwest United States.

INSTRUMENTS AND MEASURES

Ten pages (pp. 138-139, 210-211, 262-263, 276-277, and 402-403) were selected from Woolfolk (2006) as the instructional text where five of the pages (pp. 138, 211, 263, 277, and 402) included illustrated cartoons. To create a version without cartoons, the cartoons were overlaid with white paper and photocopied the pages. Fourteen multiple-choice questions were selected from the publisher's test bank that referred to information presented in the 10 pages. All questions presented a novel scenario and asked students to determine which concept from the text applied. An example item appears below:

> To remember that the capital of Maine is Augusta, Bart pictures a lion with *a gust of* wind blowing through its *mane*. Bart's technique illustrates:
>
> a. the keyword method*
> b. verbal mediation
> c. the method of loci
> d. an external retrieval cue

PROCEDURE

Students were randomly assigned to conditions (47 in the cartoons group vs. 44 in the no-cartoons group) in the following manner. Materials were collated and pages with cartoons were assigned an even identification number whereas materials without cartoons were assigned an odd number. The collated materials were then shuffled randomly. When students arrived in the classroom, the materials were distributed to them. Students were told they would have 30 minutes to read and study the materials. Immediately following the acquisition period, students had 10 minutes to complete the 14 test items.

RESULTS AND DISCUSSION

Cronbach's alpha was computed to determine the internal consistency reliability of the comprehension test, and resulted in a score of 0.67, indicating fair to good reliability. A one-tailed, independent t-test was used to compare the two groups. There was no seductive cartoons effect, $t(89) = 1.02$, $p = .08$. Students who saw no cartoons ($M = 9.98$, $SD = 2.04$) did not score statistically higher than those who saw cartoons ($M = 9.34$, $SD = 2.12$), $d = .31$ (small). This effect size was much smaller than the expected large effect size of .87. Thus, although the direction of the difference was consistent with a seductive cartoons effect, it failed to reach statistical significance. Two potential reasons were identified for the small effect. First, several students reported after the experiment that 30 minutes was not enough time to read all of the pages. This potential limitation is consistent with one of the weaknesses in seductive details studies noted by Rey (2012). He found that most studies provided very limited time for reading. Thus, it is possible that those students

who received cartoons did not have sufficient time to even look at the cartoons. Second, the items in the comprehension test came straight from the publisher's test bank. The items each had four distractors and several were not selected. Although there was no evidence of a ceiling effect, both groups averaged over nine out of the 14 items correct, with standard deviations of around two. Thus, Experiment 2 was designed to replicate Experiment 1, while incorporating two changes designed to overcome two potential methodological weaknesses.

EXPERIMENT 2

In Experiment 2, students were given more time to read (40 min. vs. 30 min.) to allow them to read the entire text (and cartoons). An attempt was also made to increase the difficulty of the comprehension test by increasing (from four to five) and improving the item distractors. Below is the example item shown previously from Experiment 1, with improved and additional distractors added.

> To remember that the capital of Maine is Augusta, Bart pictures a lion with *a gust of* wind blowing through its *mane*. Bart's technique illustrates the:
>
> a. keyword method*
> b. first-letter mnemonic
> c. method of loci
> d. pegword method
> e. acronym method

These changes were made while still realizing that the length of the materials and learning session were still brief compared to most classroom learning conditions. Expecting to obtain a large effect size (d = .87), the recommended minimum sample size as computed for Experiment 1 was followed.

METHOD

PARTICIPANTS

Thirty-six different undergraduates (54% female; 10% Freshmen, 12% Sophomores, 16% Juniors, and 62% Seniors) were recruited from an educational psychology subject pool at the same university. There were 18 undergraduates in each experimental condition.

INSTRUMENTS AND MEASURES

The same instructional materials were used as those in Experiment 1. The 14 test items were revised by rewriting several distractors to make them more appealing to students who did not know the correct answer.

PROCEDURE

Participants were given 40 minutes to read and study the materials and 10 minutes to complete the test.

RESULTS AND DISCUSSION

A Cronbach's alpha reliability score of 0.71 was computed for the revised comprehension test, indicating acceptable reliability. This time there was a seductive cartoons effect, $t(34) = 2.93$, $p = .003$, $d = 0.97$ (large). Students who viewed cartoons ($M = 7.61$, $SD = 1.69$) scored worse than those who did not view cartoons ($M = 8.94$, $SD = 0.94$). Because the homogeneity of variances assumption was not supported by a Levene's test ($F = 10.43$, $p = .01$.), a second t-test was conducted with equal variances not assumed with a degrees of freedom adjustment and also found

a similar statistical effect, $t(26.6) = 2.93$, $p = .004$. The revision of the comprehension test was successful in making the test more difficult as this time the groups averaged less than nine out of 14 correct.

General Discussion

Research on the visual seductive details effect has been inconclusive (Rey, 2012). More specifically, there have been few studies that have examined the effect of cartoons on learning. The present study was unique in that it used real learning materials from a leading educational psychology textbook that should model best instructional practices.

In the present study, ten pages from a textbook were read by undergraduates. Five of the pages contained illustrated cartoons that were relevant to text content. Two conditions were created by simply hiding the cartoons for half of the undergraduates. In Experiment 1, there was no difference in performance on 14 multiple choice comprehension items. After determining that several students were unable to complete the reading material, acquisition time was increased in Experiment 2. Item difficulty was also increased by improving the distractors. These two methodological changes allowed a seductive cartoons effect to emerge in Experiment 2. The effect size ($d = 0.97$) was similar to those found in previous visual seductive details studies (e.g., Harp & Mayer, 1997; 1998).

Limitations

As with any study, the results must be interpreted in light of their limitations. First, as with most seductive details studies, this was laboratory based with student volunteers. Even though actual materials students may be required to read in a course were used, there was no incentive for performance. Thus, not all students may have been motivated to try their best. Second, the acquisition materials and test were relatively brief due to the one-hour time limit for the laboratory experiment. Third, affective variables such as interest and motivation were not measured. It was simply assumed that cartoons might increase interest. In their meta-analysis, Sundararajan and Adesope (2020) did not find seductive details effects varied by such manipulation checks. Fourth, the sample size in Experiment 2 was admittedly small (18 in each condition). Although we found a large effect, this effect did not appear in the first experiment. Thus, any conclusions should be interpreted cautiously. Finally, the quality of the cartoons in terms of helping readers better understand target content was not manipulated. It is possible that a cartoon could be created that would be successful in helping readers to connect concepts and build better conceptual models (i.e., concept cartoons).

Implications

These findings have both theoretical and practical implications, while also acknowledging caution due to only one statistically significant finding. Theoretically, a certain type of decorative illustration, cartoons, may not only have zero positive effects on learning, but may actually be detrimental to learning. It is likely that this seductive cartoons effect operates similarly to the seductive illustrations effect found by Harp and Mayer (1998). These decorative, interesting, relevant, but ineffective snippets distract learners from more important content by seducing them into devoting attention and cognitive resources to their details. The seductive cartoons in the

present study are similar to the ones used by Harp and Mayer and may be emotionally, rather than cognitively, interesting. Whether any type of cartoon that relies on humor to convey its message could be made to be cognitively interesting, and thus, potentially not harmful, (e.g., concept cartoons) remains to be seen.

Practically, it is somewhat ironic that a leading educational psychology textbook, that is filled with prescriptions on how to improve learning, included cartoon illustrations that are detrimental to learning. Of course, most prescriptions (recommendations for practice) found in such textbooks are not based on experimental evidence (Dacy et al., 2011). Why are the cartoons included? One possibility is that publishers are simply more interested in selling books than following best practices. Thus, the author may not be the one to blame here. Most other textbooks likely include such seductive cartoons to simply boost the "curb appeal" of the book to the skimming, potential consumer who is basing an adoption decision partly on the level of disgust students will experience when first glancing at the book.

CONCLUSION

The results of this study indicate that inserting such visual images as cartoons does not aid in comprehension of target material, but rather detracts from it. It is likely that both students and instructors prefer the appearance of textbooks that contain visual images occasionally rather than ones with no images and all text. However, attempts to make textbooks more attractive, readable, and sellable may very well result in poorer student learning. Further research is needed to determine the types of cartoons, if any, that may not detract from learning.

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