WORK-LEARNING RESEARCH

Bells, whistles, neon, and purple prose: When interesting words, sounds, and visuals hurt learning and performance—a review of the seductive-augmentation research.

Will Thalheimer, Ph.D.

Cost Per Person: $15.00

Pages: 30
Originally Published April 2004
Updated November 2004

How to cite this report using APA style:

Thalheimer, W. (2004, November). *Bells, whistles, neon, and purple prose: When interesting words, sounds, and visuals hurt learning and performance—a review of the seductive-augmentation research.* Retrieved November 31, 2004, from http://www.work-learning.com/seductive_augmentations.htm

Obviously, you should substitute the date on which the document was downloaded for the fictitious November 31 date.

Published April 2004
Formatting Improvements November 2004

The Author: Will Thalheimer is a research psychologist specializing in learning, cognition, memory, and performance. Dr. Thalheimer has worked in the learning-and-performance field, beginning in 1985, as an instructional designer, project manager, product leader, instructor, consultant, and researcher. He has a PhD from Columbia University and an MBA from Drexel University. He founded Work-Learning Research in 1998 with the purpose of helping instructional designers, e-learning developers, trainers, and performance consultants utilize research-based knowledge to build effective learning-and-performance solutions.

Work-Learning Research
Somerville, Massachusetts, USA
(617) 718-0067, info@work-learning.com

www.work-learning.com

Summary of the Article

One of the most important and most common decisions that designers of instruction have to make is whether to add interesting words, sounds, and visuals to learning material. While earlier research (Levie & Lentz, 1982; Carney & Levin, 2002), popular instructional-design texts (Gagne, Briggs, Wager, 1988), and common practice have recommended that interesting items be utilized to gain learner attention, a recent thread of research has warned that "seductive details" and interesting instructional items can hurt learning outcomes by taking attention away from the most important learning material (Garner, Gillingham, & White, 1989; Moreno & Mayer, 2000).

In the article that initiated the interest in this area, Garner, Gillingham, and White (1989) found that when they added interesting yet unimportant text segments (i.e., seductive details) to expository texts, learning for the main points in the text declined. Mayer and his colleagues (e.g., Moreno & Mayer, 2000; Mayer, Heiser, and Lonn, 2001) have made similar comparisons by adding photos, sounds, and video. These seductive augmentations have also prompted learning decrements for the main points presented in the instructional material.

In the seductive-augmentation research—including the seductive-details research—a comparison is made between the learning outcomes for a set of base materials to the learning outcomes for the same base materials augmented with interesting yet unimportant words, sounds, graphics, photos, or video. The comparison usually, but not always, shows that adding interesting items hurts learning. However, criticism of this research has cast doubt on its conclusions.

This paper provides a review of the seductive-augmentation research to determine its practical viability and to make recommendations to designers of instruction. A review of the research literature was undertaken, beginning with the article that got this all started, Garner, Gillingham, and White's (1989) article on "seductive details." Research articles were chosen based on their relevance and their methodological rigor. Articles were considered relevant if they compared a base set of learning materials to the same set with additional "interesting yet unimportant" items.

Twenty-four research comparisons were found. Of these, 16 showed that adding interesting items hurt learning, 7 showed no benefit and no harm, and 1 showed that interesting items actually helped learning. For the 24 comparisons, the average recall result was a decrement of 19.4% (ES = .70). Median recall showed a decrement of 18.5% (ES = .57). Different modes of interesting items (e.g., illustrations, text, and sounds) produced different results.

Weaknesses of the research that was reviewed include the following: (1) average learning session was 3 minutes, 54 seconds; (2) average retention interval was 4 minutes, 14 seconds; and (3) many studies used same materials.

More research is needed to clarify the situations in which adding interesting instructional items hurts learning. However, the research does provide us with a warning against willy-nilly adding "decorative" (Levie & Lentz, 1982) bells, whistles, neon, or purple prose to our learning material. Specifically, we should add only elements that (1) directly help our learners understand the content and (2) avoid overtaxing learners' limited capacity to process visual and auditory information. In adding interesting elements to our learning material, we ought to create job-relevant content and challenge learners with realistic exercises that prompt them to make decisions just as the might do so on the job.

Overview of the Findings

1. A seductive-augmentation effect was found when:

   a. Printed seductive details were added to expository text.
   b. Photos were added to expository text.
   c. Photos and printed seductive details were added to expository text.
   d. Visuals or printed or narrated seductive details were added to multimedia narrated animations.
   e. Music was added to multimedia narrated animations and computer-based instruction.

2. A seductive-augmentation effect was NOT found when:

   a. Printed seductive details were added to narrated biography text.
   b. Context-appropriate sounds were added to multimedia narrated animation and computer-based instruction.

3. Because the average learning session and the average retention interval were only about four minutes in length, we must recognize that these findings may not be relevant to realistic learning situations.

4. Despite this caveat, it appears that the addition of seductive augmentations creates a reliable disturbance at the micro level for many of the learning situations studied; making it less likely that learners will learn the main points presented in the instructional material.

5. Although the seductive-augmentation research shows that augmentations can hurt the learning of main ideas, there are other research threads that show that augmentations can help learning. Augmentations to base instructional materials can create benefits if they guide learner attention and processing to relevant learning material, but they can also create decrements if they distract or disturb the learners from focusing and processing the critical information in that material.

The Research Question

This review of the research on seductive augmentations is intended to answer the following questions:

1. Does adding interesting yet unimportant instructional elements (i.e., words, sounds, or visuals) hurt the learning of the main points included in instructional material?

2. If interesting yet unimportant augmentations hurt learning in some situations, (1) what do these situations look like, (2) what type of added elements hurt learning, (3) how can we distinguish between learning situations that would benefit from added elements and learning situations that would not, and (4) how can we determine which types of added elements are beneficial and which are harmful?

These research questions arise from a basic practical concern. Instructional designers routinely design learning materials with an overriding intention to ensure that learners find those materials engaging. Where earlier research and common practice have encouraged instructional designers to add clip art, graphics, sound, video, stories, and provocative examples to their learning interventions to garner such engagement, experiments in the late 1980's and 1990's on the "seductive-details effect" called this practice into question when it was found that the addition of interesting yet unimportant augmentations can divert learners from learning the main points that are being made.

The Literature Review

Introduction

Robert Gagne once suggested the "first event" of instruction should be focused on gaining the attention of the learner (Gagne, Briggs, Wager, 1988, p. 182). Such advice makes intuitive sense and is consistent with common practice in the instructional-design field where instructional professionals have become quite proficient at engaging learners—at least enough to score highly on learner ratings at the end of instruction. Many methods to engage learners have been used, including telling stories, using case studies, walking around the classroom, using flipcharts, prompting group discussions, and asking questions. Similarly, instructional professionals have augmented text-based learning materials by adding interesting elements such as provocative stories, biographical details, clip art, photographs, sounds, and video. Research reviews have sometimes buttressed these practices, for example concluding that adding pictures to text passages improves learning (Levie & Lentz, 1982; Carney & Levin, 2002).

Although the weight of both research and practice seem to recommend that designers of instruction continue to add interesting augmentations to their learning materials, a study by Garner, Gillingham, and White in 1989 may call this practice into question. They found that adding "unimportant but interesting" sentences to expository texts hurt the learning of the main points in the text. They labeled this the "seductive-details" effect to describe how these added details seduced the readers away from the main ideas in the text.

Garner, Gillingham, and White (1989) provided learners with a short text on insects in which three interesting sentences about specific insect behavior were either included in the text or were not. For example, the following sentence was considered a seductive detail. "When a Click Beetle is on its back, it flips itself into the air and lands right side up while it makes a clicking noise." This unimportant but interesting information can be contrasted with "main-idea" information, for example, "Some insects protect themselves by looking like other animals, and others protect themselves by looking like plants." After reading the text, the learners were asked to recall "just the really important information you read about the insects, not all the information, just the really important information." Learners who had the seductive details in their text passages recalled less than half of the main points as did those without the seductive details.

Several studies followed that were viewed by the authors as being consistent with these results (e.g., Wade & Adams, 1990; Garner & Gillingham, 1991). Moreover, it was found that seductive details are better remembered than main ideas (Wade & Adams, 1990; Wade, Schraw, Buxton, & Hayes, 1993; Garner & Gillingham, 1991; Schraw, 1998). For example, Wade, Schraw, Buxton and Hayes (1993) found that seductive details were remembered better than main ideas by 50% and were paid more attention to by 57%.

6

Wade and Adams (1990) found interesting segments were recalled 154% better one week later than less interesting segments.

The momentum of the seductive-details research was halted in the mid 1990's when Goetz and Sadoski (1995) provided a strong criticism of the conclusions that had been drawn from previous research. They pointed out that just because seductive details are better remembered than main ideas, doesn't mean that they hurt the learning of those main ideas. They codified the necessary research-design requirements for a test of the seductive-details effect:

> "[Seductive-details experiments must contrast] the recall of text with and without seductive details. This contrast is essential to establishing that the presence of seductive details interferes with the recall of the main ideas, as their name implies." (p. 503).

They went on to criticize many methodological problems in the research that did meet the above criteria. For example, they showed that the addition of seductive details actually made the passages significantly longer than the original passages, potentially obscuring or minimizing the potency of the main ideas. Goetz and Sadoski concluded that the studies of the seductive-details effect, up to that point in time, had failed to "empirically establish the existence of a seductive detail effect." (p. 509). In the same volume of the journal, Wade, Alexander, Schraw, and Kulikowich (1995) raise objections to Goetz and Sadoski's criticisms, but their defense did not fully answer the questions raised.

In 1997, Harp and Mayer (1997) published a study that met Goetz and Sadoski's (1995) criteria and showed a seductive-detail effect for both the recall of main ideas and problem-solving transfer. In addition to adding seductive details as printed words, Harp and Mayer innovatively added interesting yet unimportant photos to determine whether these too would create a seduction effect. They did. Harp and Mayer found that emotionally interesting photos decreased learning by 42% for recall of the main points and 34% when learners were asked to apply what they learned to a problem-solving task. Moreover, they found that adding both seductive illustrations and seductive text segments decreased recall for the main points a whopping 76% and problem-solving 63%. Harp and Mayer (1998) followed up with another series of experiments that showed that seductive words and pictures together created a seductive-detail effect.

That same year Schraw (1998) published research that did not find a seductive-details effect. Sadoski (2001) criticized Harp and Mayer's (1997, 1998) experiments because they failed to tease apart the effects of the seductive text segments from the effects of a change in the text's structure. This criticism is weaker than Goetz and Sadoski's (1995) criticism that adding seductive details to text increases the overall amount of text to be processed. The criticism also pertains only to the seductive material that is text-based. In both articles, Harp and Mayer (1997, 1998) found seductive-augmentation effects for seductive photos as well as seductive text.

Literature Review Summary

These positive and null results have left the seductive-details effect in some question. Additional research has been undertaken to learn more about these seduction effects (e.g, Mayer, Heiser, and Lonn, 2001; Moreno and Mayer, 2000, 2002) but a definitive analysis as to the reliability and boundary conditions of the phenomenon has not been forthcoming. This state of confusion makes it difficult to make recommendations to practitioners who have to decide whether to add interesting examples, stories, photos, graphics, illustrations, audio, sounds, or video to their learning designs.

It should be noted that the original focus of the research—adding sentences to printed text passages—has morphed into broader concerns. Harp and Mayer (1997) added to the research by utilizing seductive photos ("illustrations" in their words), not just seductive phrases and sentences. This innovation sparked the use of a number of additional types of seductive augmentations, including context-relevant sounds, music, and video (Moreno and Mayer, 2000, 2002). Similarly, the base instructional material has been expanded beyond simple printed texts to multimedia animations and narrated audio (Mayer, Heiser, & Lonn, 2001).

Because the term "seductive details" is not descriptive beyond its use as the addition of words and sentences, the rest of this document will use the more inclusive term, "seductive augmentations."

Methodology

The literature review was aimed at articles from preeminent refereed journals. The search for relevant articles was initiated by searching the PsycINFO database for "seductive details" and "text and interest" from 1989 until the present. Citations from these articles were perused to find additional relevant articles. Researchers known to be interested in this thread of research were contacted through email and asked whether additional articles were forthcoming or known.

Relevant articles were selected and read to determine their methodological rigor and relevance to this review. Articles were selected if and only if they compared the learning outcomes for a base set of learning materials (i.e., a text passage) to the outcomes for the same base set of materials augmented with additional words, sounds, or visuals. This criterion is consistent with the recommendation by Goetz and Sadoski (1995), but is expanded beyond the text-only boundaries relevant to their more narrow concerns.

Each relevant experiment was examined for (1) percent decrements from the addition of the distracting augmentations—determined by subtracting the mean of the base material by the mean of the augmented material and dividing by the mean of the base material, (2) Cohen's *d* effect size for the difference in means (Cohen, 1992), (3) the duration of the learning session, (4) the duration of the retention interval—how long after learning were the learners required to recall what they learned, and (5) other explanatory factors, including the type of text used, the mode of the augmenting material, the types of learners, etc. Effect sizes were calculated using the prescriptions and spreadsheet developed by Thalheimer and Cook (2002).

Results

The research on seductive augmentation begun by the publication of Garner, Gillingham, and White's (1989) article has generated a limited number of experimental comparisons. I found only 24 comparisons drawn from only 9 published articles. In chronological order, these include the following (Garner, Gillingham, & White, 1989; Garner & Gillingham, 1991; Garner, Alexander, Gillingham, Kulikowich, & Brown, 1991; Harp & Mayer, 1997; Harp & Mayer, 1998; Schraw, 1998; Moreno & Mayer, 2000; Mayer, Heiser, & Lonn, 2001; Moreno & Mayer, 2002). Clearly, this limited literature is not enough to be definitive. Compounding this problem is the fact that the instructional materials used in these experiments were often used in multiple experiments, minimizing the generalizability of the results.

To help determine the boundary conditions of the seductive-augmentation effect, I made some distinctions between the types of augmentations used in the experiments. It is not unreasonable to expect that some augmentations may be more "seductive" than others.

Types of Augmentation	
Type	Description
Seductive details	Sentences added to text passages (where the sentence content is unimportant but interesting).
Photos/Illustrations	Photos/illustrations that are designed to promote interest.
Sounds	Sounds that were contextually appropriate to the visuals being displayed (e.g., wind for visual depicting downdraft).
Music	Music not necessarily relevant or associated to the visuals being displayed (e.g., bland synthesized music for a visual depicting downdraft).
Video	Short video clips that were intended to be interesting, and relevant, but not explanatory.

Similarly, the reviewed research used different instructional materials as a base for comparison. Again, it seems reasonable that some base instructional materials may more easily produce a seductive-augmentation effect than others.

Types of Base Instructional Materials	
Type	Description
Text Passages in the form of Narrative Biographies.	Text passages focused on a single person (often a historical figure).
Text Passages in the form of Expository Texts	Text passages focused on explaining a topic, principle, or describing how something works.
Expository Multimedia	Expository text passages presented on a computer.
Multimedia Narrated Animation	Expository narrated animations presented on a computer.

Combining these two typologies, the following pages presents a series of tables that describes the 24 experimental comparisons. After these tables, the results of the analysis are summarized.

Reading the Tables Below

Each of the columns in the tables below provides unique information. The first column includes the title of the article and the experiment that is analyzed. Articles and experiments may be referenced more than once. The primary indexing factor is the type of augmentation that is made. The type of augmentation and the type of base material each have separate columns. Another column indicates whether the seductive-augmentation effect was found or not.

A column is provided for the percent change in comparing the results for base material to the augmented material. Percent change is calculated by subtracting the mean for the base material minus the mean for the augmented material and dividing the result by the mean for the base material. When the outcome from this calculation is positive the base material outperformed the augmented material. When the outcome is negative, the augmented material produced more learning than the base material. Another column is provided for Cohen's d effect size estimate of the difference between means. Due to lack of information in some of the articles, effect sizes were not calculable for all comparisons

The final two columns include the duration of the learning session and the duration of the retention interval. The retention interval is defined as the amount of time between the end of the learning session and the beginning of the final testing session.

There are seven tables in the analysis, broken down by the type of augmentation and the type of base material. These categories were derived from post-hoc analyses of the data and enable clarifying representations of key findings. The following table shows the categories used in the analysis.

Categories Used in the Tables
1.   Adding Printed Seductive Details to Narrative Biography Text
2.   Adding Printed Seductive Details to Expository Text
3.   Adding Photos/Illustrations Alone to Expository Text
4.   Adding Photos/Illustrations AND Printed Seductive Details to Expository Text
5.   Adding Visuals or Printed or Narrated Seductive Details to Multimedia Narrated Animations
6.   Adding Context-Appropriate Sounds to Multimedia Narrated Animation & CBI
7.   Adding Music to Multimedia Narrated Animation & CBI

The seven tables begin on the following page.

1. Adding Printed Seductive Details to Narrative Biography Text							
Experiment	Type of Base Instructional Material	Type of Augmentation	Seductive-Augmentation Effect Found?	Percent Change	Cohen's d Effect Size	Duration of Learning	Duration of Retention Interval
Garner, Alexander, Gillingham, Kulikowich, & Brown (1991). Experiment 1 For Recall of Main Ideas based on introductory paragraph	Narrative Biography Text	Sentences as Seductive Details (Printed as opposed to narrated.) (Seductive details are interesting, unimportant sentences)	NO	+54 RECALL (For Recall of Main Ideas)	.63 (ns) RECALL (For Recall of Main Ideas)	3 minutes	0 minutes
Experiment 1 For Recall of Main Ideas based on wager paragraph.	Narrative Biography Text	Sentences as Seductive Details	NO	Not reported (ns)	Not reported (ns)	3 minutes	0 minutes
Experiment 2 For Recall of Main Ideas based on introductory paragraph	Narrative Biography Text	Sentences as Seductive Details	NO	+16% (ns) (0 for high-knowledge learners (ns) 41% for low-knowledge)	.22 (ns) (0 for high knowledge learners (ns) .47 for low-knowledge)	3 minutes	0 minutes
Experiment 2 For Recall of Main Ideas based on wager paragraph.	Narrative Biography Text	Sentences as Seductive Details	NO	Not reported (ns)	Not reported (ns)	3 minutes	0 minutes
Schraw (1998). Experiment 3	Narrative Biography Text	Sentences as Seductive Details	NO	+12 (ns)	.19 (ns)	12.5 minutes	5 minutes
Garner & Gillingham. (1991). Experiment 3	Narrative Biography Text	Sentences as Seductive Details	NO	+7 (ns)	Not available (ns)	3 minutes	0 minutes
Summary Information	Of the 6 comparisons, none showed the seductive-augmentation effect. In fact, all but one comparison were non-significant and leaned in the other direction. The significant comparison showed that seductive augmentations helped learning of main ideas.			MEDIAN 14% (based on 4) AVERAGE 22.3% (based on 4)	MEDIAN ES= .22 (based on 3) AVERAGE ES= .35 (based on 3)	Median 3 minutes Average 4.6 minutes	Median 0 minutes Average 0.8 minutes

2. Adding Printed Seductive Details to Expository Text							
Experiment	Type of Base Instructional Material	Type of Augmentation	Seductive-Augmentation Effect Found?	Percent Change	Cohen's d Effect Size	Duration of Learning	Duration of Retention Interval
Harp & Mayer (1997). Experiment 1 For Recall of Main Ideas based on introductory paragraph	Expository Text	Sentences as Seductive Details	YES	RECALL SD text –39% SD text & illustrations –76% TRANSFER SD text –50% SD text & illustrations –63%	RECALL SD text ES=1.05 SD text & instructions ES=2.37 TRANSFER SD text ES=1.06 SD text & illustrations ES=1.35	7 minutes	8 minutes
Garner, Gillingham, & White (1989) Experiment 1 -- Adults	Expository Text	Sentences as Seductive Details	YES	–54% (For main ideas, not details related to main ideas, which were not significant.)	2.41	2 minutes	0 minutes
Summary Information	Both comparisons showed a seductive-augmentation effect.			AVERAGES RECALL –47%	AVERAGES RECALL ES = 1.73	Average 4.5 minutes	Average 4 minutes

3. Adding Photos/Illustrations Alone to Expository Text							
Experiment	Type of Base Instructional Material	Type of Augmentation	Seductive-Augmentation Effect Found?	Percent Change	Cohen's d Effect Size	Duration of Learning	Duration of Retention Interval
Harp & Mayer (1997). Experiment 1	Expository Text	Photos/ Illustrations	YES	RECALL –42% TRANSFER –34%	RECALL ES=1.00 TRANSFER ES= .74	7 minutes	8 minutes
Summary Information	The 1 experimental comparison showed a seductive-augmentation effect that hurt both recall of main ideas and problem-solving transfer.			AVERAGES RECALL –42% TRANSFER –34%	AVERAGES RECALL ES=1.00 TRANSFER ES= .74	7 minutes	8 minutes

4. Adding Photos/Illustrations AND Printed Seductive Details to Expository Text							
Experiment	Type of Base Instructional Material	Type of Augmentation	Seductive-Augmentation Effect Found?	Percent Change	Cohen's d Effect Size	Duration of Learning	Duration of Retention Interval
Harp & Mayer (1997). Experiment 1	Expository Text	Photos/ Illustrations AND Sentences as Seductive Details	YES	RECALL SD text & illustrations –76% TRANSFER SD text & illustrations –63%	RECALL SD text & illustrations ES=2.37 TRANSFER SD text & illustrations ES=1.35	7 minutes	8 minutes
Harp & Mayer (1998). Experiment 1	Expository Text	Photos/ Illustrations AND Sentences as Seductive Details	YES	RECALL –59% TRANSFER –61%	RECALL ES = 1.67 TRANSFER ES = 1.61	6.5 minutes	6 minutes
Harp & Mayer (1998). Experiment 2	Expository Text	Photos/ Illustrations AND Sentences as Seductive Details	YES	RECALL –59% TRANSFER –49%	RECALL ES = 1.87 TRANSFER ES = 1.45	6.5 minutes	6 minutes
Harp & Mayer (1998). Experiment 3	Expository Text	Photos/ Illustrations AND Sentences as Seductive Details	YES	RECALL –64% TRANSFER –49%	RECALL ES = 1.95 TRANSFER ES = 1.27	6.5 minutes	6 minutes
Summary Information	Of the 4 experimental comparisons, 4 showed the seductive-augmentation effect, hurting both recall of main ideas and problem-solving transfer of critical information.			AVERAGES RECALL –65% TRANSFER –56%	AVERAGES RECALL ES= 1.62 TRANSFER ES= 1.42	Median 6.5 minutes Average 6.63 minutes	Median 6.0 minutes Average 6.5 minutes

5. Adding Visuals or Printed or Narrated Seductive Details to Multimedia Narrated Animations							
Experiment	Type of Base Instructional Material	Type of Augmentation	Seductive-Augmentation Effect Found?	Percent Change	Cohen's d Effect Size	Duration of Learning	Duration of Retention Interval
Mayer, R. E., Heiser, J., & Lonn, S. (2001). Experiment 1, text summaries added	Multimedia Narrated Animation	Sentences as Seductive Details	YES	RECALL –13% TRANSFER –30%	RECALL ES= .55 TRANSFER ES= .88	2.33 minutes	6 minutes
Mayer, R. E., Heiser, J., & Lonn, S. (2001). Experiment 1, seductive narration sentences added	Multimedia Narrated Animation	1. Narrated Sentences as Seductive Details 2. Both Narrated Sentences and Text Summaries	YES	RECALL –25% TRANSFER –25% BOTH RECALL –38% TRANSFER –44%	RECALL ES= .76 TRANSFER ES= .68 BOTH RECALL ES= 1.53 TRANSFER ES= 1.39	2.33 minutes	6 minutes
Mayer, R. E., Heiser, J., & Lonn, S. (2001). Experiment 2	Multimedia Narrated Animation	Sentences as Seductive Details	YES	RECALL –14% TRANSFER –40%	RECALL ES= .42 TRANSFER ES= 1.33	2.33 minutes	6 minutes
Mayer, R. E., Heiser, J., & Lonn, S. (2001). Experiment 2	Multimedia Narrated Animation	Narrated Sentences Seductive Details	YES (But not significant on recall)	RECALL –25% (ns) TRANSFER –41%	RECALL ES= .82 TRANSFER ES= 1.23	2.33 minutes	6 minutes
Mayer, R. E., Heiser, J., & Lonn, S. (2001). Experiment 3	Multimedia Narrated Animation	Video Segments	YES (But not significant on recall)	RECALL –14% (ns) TRANSFER –23%	RECALL ES= .26 TRANSFER ES= .70	2.33 minutes	6 minutes
Moreno, R., & Mayer, R. E. (2002). Experiment 2	Multimedia Narrated Animation	Sentences as Seductive Details	YES	RECALL –25% TRANSFER –38%	RECALL ES= 1.22 TRANSFER ES= .73	0.75 minutes	5 minutes
Summary Information	Of the 6 comparisons, 4 showed the seductive-augmentation effect for recall, while 6 showed the effect for problem-solving transfer.			AVERAGES RECALL –19% TRANSFER –33%	AVERAGES RECALL ES= .67 TRANSFER ES= .93	Median 2.33 minutes Average 2.07 minutes	Median 6 minutes Average 5.83 minutes

17

6. Adding Context-Appropriate Sounds to Multimedia Narrated Animation & CBI							
Experiment	Type of Base Instructional Material	Type of Augmentation	Seductive-Augmentation Effect Found?	Percent Change	Cohen's d Effect Size	Duration of Learning	Duration of Retention Interval
Moreno & Mayer (2000) Experiment 1	Expository Multimedia Animation	Context-appropriate Sounds	NO	RECALL 5% (ns) TRANSFER 12% (ns)	RECALL ES= .17 (ns) TRANSFER ES= .22 (ns)	0.75 minutes	5 minutes
Moreno & Mayer (2000) Experiment 2 A replication of Experiment 1 with different materials.	Expository Multimedia Animation	Context-appropriate Sounds	YES	RECALL –21% TRANSFER –45%	RECALL ES= .52 TRANSFER ES= 1.35	0.75 minutes	5 minutes
Moreno & Mayer (2002) Experiment 3	Expository Online Text (no animation)	Context-appropriate Sounds	NO	RECALL 7% (ns) TRANSFER 0% (ns)	ON RECALL ES=.13 (ns) TRANSFER ES= ~0	5 minutes	5 minutes
Summary Information	Of the 3 comparisons, 1 showed the seductive-augmentation effect. For the other two comparisons, sounds did not hurt recall or transfer. CBI is Computer-Based Instruction.			AVERAGES RECALL –3% TRANSFER –11%	AVERAGES RECALL ES= –.07 TRANSFER –.37	Median 0.75 minutes Average 2.17 minutes	Median 5 minutes Average 5 minutes

7. Adding Music to Multimedia Narrated Animation & CBI							
Experiment	Type of Base Instructional Material	Type of Augmentation	Seductive-Augmentation Effect Found?	Percent Change	Cohen's d Effect Size	Duration of Learning	Duration of Retention Interval
Moreno & Mayer (2000) Experiment 1	Expository Multimedia Animation	1. Music 2. Music and Context-Appropriate Sounds	YES	RECALL Music –16% Both –43% TRANSFER Music –29% Both –60%	RECALL Music ES= .59 Both ES= 1.49 TRANSFER Music ES= .70 Both ES= 1.53	0.75 minutes	5 minutes
Moreno & Mayer (2000) Experiment 2 A replication of Experiment 1 with different materials.	Expository Multimedia Animation	1. Music 2. Music and Context-Appropriate Sounds	YES	RECALL Music –21% Both –38% TRANSFER Music –40% Both –39%	RECALL Music ES= .59 Both ES= .98 TRANSFER Music ES= 1.26 Both ES= 1.03	0.75 minutes	5 minutes
Summary Information	Of the 2 comparisons, 2 showed the seductive-augmentation effect, showing that adding music hurt both recall of main ideas and problem-solving transfer. CBI is Computer-Based Instruction.			AVERAGES RECALL Music –19% Both – 41% TRANSFER Music –35% Both – 50%	AVERAGES RECALL Music ES= .59 Both ES= 1.24% TRANSFER Music ES= .98 Both ES= 1.28	Average 0.75 minutes	Average 5 minutes

19

Summary of Results

Of the 24 comparisons, 14 showed a seductive-augmentation effect for both recall of main ideas or problem-solving transfer (if tested), 2 showed a seductive-augmentation effect for transfer but not for recall, and 8 showed no seductive-augmentation effect. Of these 8 null results, only 1 showed a reverse effect, in which seductive details actually helped recall of main ideas. For the 24 comparisons, the average recall result was a decrement of 19.4% (ES = .70). Median recall showed a decrement of 18.5% (ES = .57).

By indexing the results to the type of base instructional material and the type of augmentation provided, some interesting results emerged, as shown in the table on the following page.

Results Indexed by Type of Base Instructional Material and Types of Augmentation		
Category	Effect?	Results
1. Adding Printed Seductive Details to Narrative Biography Text	NO	6 of 6 comparisons showed NO seductive-augmentation effect. Average improvement is 22.3% (ES = 0.35).
2. Adding Printed Seductive Details to Expository Text	YES	2 of 2 comparisons showed a seductive-augmentation effect. Average decrement is 47% for recall (ES = 1.73).
3. Adding Photos/Illustrations Alone to Expository Text	YES	1 of 1 comparison showed a seductive-augmentation effect. Average decrement is 42% for recall, 34% for transfer (ES = 1.00 and 0.74, respectively).
4. Adding Photos/Illustrations AND Printed Seductive Details to Expository Text	YES	4 of 4 comparisons showed a seductive-augmentation effect. Average decrement is 65% for recall, 56% for transfer (ES = 1.62 and 1.42, respectively).
5. Adding Visuals or Printed or Narrated Seductive Details to Multimedia Narrated Animations	YES	4 of 6 comparisons showed a seductive augmentation effect for recall of main ideas. 6 of 6 showed an effect for problem-solving transfer. Average decrement is 19% for recall, 33% for transfer (ES = 0.67 and 0.93, respectively).
6. Adding Context-Appropriate Sounds to Multimedia Narrated Animation & CBI	NO	1 of 3 comparisons showed a seductive-augmentation effect. Average decrement is 3% for recall, 11% for transfer (ES = 0.07 and 0.37, respectively).
7. Adding Music to Multimedia Narrated Animation & CBI	YES	2 of 2 comparisons showed a seductive-augmentation effect. Average decrement is 19% for recall, 35% for transfer (ES = 0.59 and 0.98, respectively).

Five of the seven categories showed very strong effects with almost all the comparisons in those categories showing the seductive-augmentation effect. The two categories that did not support the effect were (1) when printed seductive details were added to biographical narrative texts, and (2) when sounds were added to computer-mediated instruction.

In the six studies reviewed, narrative biographical texts were not subject to the seductive-augmentation effect. None of the six published studies using biographical texts produced an effect, and one produced the opposite effect.

Content-appropriate sounds did not reliably interfere with recall of the main ideas or problem-solving transfer. Only one of the three reviewed studies showed the seductive-augmentation effect.

When these two categories—the ones that produced null results—were removed from the list, 15 comparisons remained, producing average seductive-augmentation recall decrements of 36.4% (ES=1.17) and median decrements of 25% (ES=.91).

The average learning session took 3 minutes and 54 seconds. The average retention interval was 4 minutes and 14 seconds.

Discussion

Given that only 24 comparisons were found comprising 9 research articles—and that the same learning materials were used across multiple comparisons—any conclusions must remain tentative. Some initial observations can be noted however.

Does some sort of seductive-augmentation effect occur reliably? In other words, is the learning of main ideas hurt when interesting yet unimportant augmentations are added to instructional materials? With 16 of 24 comparisons showing some sort of effect—16 of 18 if we discount those comparisons that utilize biographical narrative texts, and 15 of 15 if we further discount those that used context-appropriate sounds as the augmentation—then it does appear that seductive augmentations can disrupt learning of the main ideas.

Augmentations that have a demonstrated potency for seduction are printed words, narrated words, visuals, and music. Context-appropriate sounds do not appear to create a seductive-augmentation effect.

It should be noted that many of the seductive-augmentation effects were found when the augmentation was presented in the same perceptual modality as the base instructional message. Visual stimuli were added when the primary learning message was displayed in a visual format. Auditory stimuli were presented when the learning message was conveyed in a narration. For example, printed words, photos, and video disrupted learning from printed words and visual animations (Garner, Gillingham, & White, 1989; Harp & Mayer, 1997, Exp. 1; Harp & Mayer, 1998, Exp. 2 and 3). Narrated words disrupted learning from narrated multimedia animations (Mayer, Heiser, & Lonn, 2001). This observation should be noted with skepticism given the small number of comparisons and the many modalities that were available to be confounded. However, it is consistent with the dual-processing theory of multimedia learning (Mayer, 1997; Mayer & Moreno, 1998).

Augmenting Learning Materials Isn't Always Bad

It should be pointed out that augmenting text or other learning materials isn't always bad. Levie and Lentz (1982), Carney and Levin (2002), and Gyselinck and Tardieu (1999) have reviewed the literature on adding pictures and illustrations to text and have found many examples when these adjuncts do aid learning. For example, Mayer (1989) showed that labeled illustrations added to a text helped learners with both recall and problem-solving transfer tasks. Adding adjunct questions and learning objectives to text have been shown to aid learning (Rothkopf 1966, 1982; Hamaker, 1984). It's not any augmentation that will hurt learning. It is only those augmentations that divert the learners' cognitive processing away from the information that should be learned.

This point is well illustrated by the research on learning objectives provided to learners before they read. Rothkopf & Billington (1979) found that when learning objectives were provided to learners, performance on material related to the objectives improved by 49% and 47% over situations when learning objectives were not used. However, the material not related to the learning objectives was learned 39% and 33% WORSE than it would have been if no learning objectives were used! Augmentations can be helpful or harmful, depending on what cognitive processes they facilitate.

The Problem with Short Learning Sessions

From a practical standpoint, one of the most telling results from this analysis was the very short learning sessions and retention intervals, averaging about four minutes each. Typically, the learning-into-performance process consists of the following steps: (1) a learning session, (2) a retention interval, and (3) retrieval from memory of the learned information.

If a seductive-augmentation effect exists, it suggests that instructional designers ought to avoid adding interesting but unimportant information to learning materials. As Harp and Mayer (1998) have written, seductive augmentations seem to divert the learners' attention from the most important ideas within the learning material, making it less likely that they'll form memory structures for the targeted learning messages. This line of thinking makes sense for a four-minute learning session. We wouldn't want to add augmentations that divert learner attention when that attention is strong—but what about for an hour-long e-learning program or a six-hour classroom workshop? Wouldn't learners' attention be more likely to waver during these longer time spans? Wouldn't the costs of seduction be worth the benefits of keeping the learners engaged at some minimal threshold of attention? The results from the studies reviewed showed about a 20% decrement in learning from seductive augmentations. What if this 20% is the price to pay to keep the learners engaged with the learning material at all? These are questions that cannot be answered with learning sessions of four minutes in length.

The Problem with Short Retention Intervals

The average four-minute retention interval—the time between the end of the learning sessions and the beginning of memory retrieval—raises its own set of questions. Such a short retention interval is not typical in the real world where learners have to remember what they've learned for days, weeks, and sometimes even months. In the reviewed experiments, the four-minute retention interval enables the experimenters to test the learning material's ability to create learning but not its ability to minimize forgetting. Given that learning methods can be dichotomous in the regard (Ghodsian, Bjork, & Benjamin, 1997)—in other words, a learning method can be good at creating learning but bad a minimizing forgetting—by only testing the learners immediately, these experiments leave open the possibility that more realistic long-term effects may be overlooked.

To relate that to the issues at hand, it could be that seductive augmentations hurt short-term retention, but actually help the learners minimize forgetting. Is there a plausible causal process that might create such an effect? Let me offer two possibilities. First, perhaps over time, the seductive details will help trigger memories for the main points that were learned, just as reentry into learning contexts trigger previously learned memories (Smith, Glenberg, and Bjork, 1979). We know that seductive details are recalled more easily than main ideas (e.g., Wade, Schraw, Buxton, & Hayes, 1993), and that this holds true for both delayed and immediate tests (Wade & Adams, 1990). Perhaps over time as memories fade, the only accessible memories are the seductive details. Perhaps remembering these will, in turn, trigger the memories for the main ideas stored in memory. A second possibility is that the seductive augmentations may hurt retrieval in the short term because they create interference, but equalize to the level of the base text over the long term as the interference fades.

Both of the previous possibilities are wild conjectures more than definitive hypotheses, but they highlight the need to test seductive augmentations with longer, more realistic retention intervals. Because the reviewed experiments have unrealistically short learning sessions and short retention intervals, they leave open the possibility that the seductive-augmentation effect is not relevant in real-world learning situations. In the micro situation, the seductive-augmentation effect seems reliable—but we can only speculate what might occur in more-realistic macro situations where there is a need to maintain some minimum level of learner engagement.

Still, the problems that occur in the micro situation are real problems. When learners are faced with seductive augmentations, they seem to have difficulty creating the memory structures they would need for longer retention. It seems reasonable therefore to worry that the effect of these seductions may hurt the long-term viability of the learning. More research is needed before we can be certain whether there is a predictable relationship between the effects in the micro situation and those that may occur in the real world.

Why aren't Narrative Biographical Texts subject to Seduction Effects?

It's interesting that seductive details did not produce an effect in narrative biographical texts, but did have an effect in expository texts and expository multimedia. Given that only six comparisons utilized narrative biographies—at least some of which used the same learning materials—it would be premature to draw definitive conclusions. Nevertheless, it seems appropriate to attempt a conjecture or two. When learners are reading expository texts, they are attempting to create knowledge structures of the information in that text. Given the nature of expository texts, they either have to create many separate knowledge structures of various facts or create a few rather complicated knowledge structures of complex phenomenon. Conversely, for biographical narratives learners are likely to create integrated knowledge structures of the person they are reading about based on the often-utilized schemas they have for people (or perhaps for

25

historical figures). These overarching schemas may enable the learners to more easily comprehend and integrate the new learning despite threats from the instantiated seductive details.

Alternatively, perhaps we have a slot in our person schemas for interesting personal anecdotes. Given the social benefits we can obtain from gossip, having a schematic hook for juicy anecdotes seems to be a likely possibility. If we do have such a slot, perhaps it lets us deal with seductive details without utilizing too much working-memory capacity, freeing up such capacity to concentrate on the main ideas.

Although the above suggestions point to the possibility that seductive augmentations have different effects on different types of texts because of the type of processing that these texts engender, and evidence exists generally that different types of texts are processed differently (e.g., Sadoski, Goetz, and Rodriguez, 2000), definitive conclusions cannot be made unless research is conducted specifically to test this hypothesis.

Why Don't Context-Appropriate Sounds Produce Seduction Effects?

There are only three comparisons reported that utilize context-appropriate sounds alone as the seductive augmentation. Of these, one showed a seductive-augmentation effect, while the other two did not. Moreno and Mayer (2002, Experiment 3) argued that their null result was consistent with their dual-processing theory of multimedia learning, which states that working memory has separate visual and auditory components and that when information from both channels can be combined to create a coherent memory representation, then learning can be improved. In other words, the context-appropriate sounds could have been easily processed together with the visual information garnered by reading the onscreen text, thus producing no seductive-augmentation effect. This explanation seems reasonable, but given the lack of experimental comparisons, more research is recommended.

Practical Recommendations

These recommendations are based on relatively few studies, all of which fail the ecological-validity test because the learning sessions and the retention intervals are too short. Despite these problems, it does appear to this reviewer that some sort of seductive-augmentation effect causes problems for learners at the micro level. The following recommendations come from this conclusion:

1. In designing instruction, we should avoid the tendency to willy-nilly add "decorative" (Levie & Lentz, 1982) bells, whistles, neon, or purple prose to our learning material.

2. Specifically, we should add only elements (1) that directly help our learners understand the content, and (2) avoid overtaxing learners' limited capacity to process visual and auditory information.

3. In adding interesting elements to our learning materials, we ought to create job-relevant (or, more broadly, performance-relevant) content that challenges learners with realistic exercises that prompt them to make decisions similar to those they'll have to make on the job (or in future performance situations).

An additional final recommendation comes not from a review of this research per se, but from the large number of tangential studies that showed that seductive augmentations are better remembered than main ideas. Given this reality, it would behoove test makers to avoid asking learners questions about seductive augmentations. Such a practice is likely to give a false impression that learners are learning more than they actually are. In other words, asking about Benjamin Franklin and his kite might give us a false impression that the learners are learning something important—and learning at a relatively high level. It is probably better to ask about how Franklin's renowned as a scientist enabled him to lobby the French government for financing and military supplies to enable the struggling American colonies to overcome the superpower of the 1770's, the British empire.

References

Reviewed Articles Meeting the Selection Criterion

Garner, R., & Gillingham, M. G. (1991). Topic knowledge, cognitive interest, and text recall: A microanalysis. *Journal of Experimental Education, 59*, 310-319.

Garner, R., Alexander, P. A, Gillingham, M. G., Kulikowich, J. M., & Brown, R. (1991). Interest and learning from text. *American Educational Research Journal, 28*, 643-659.

Garner, R., Gillingham, M. G., & White, C. S. (1989). Effects of "seductive details" on macroprocessing and microprocessing in adults and children. *Cognition and Instruction, 6*, 41-57.

Harp, S. F., & Mayer, R. E. (1997). The role of interest in learning from scientific text and illustrations: On the distinction between emotional interest and cognitive interest. *Journal of Educational Psychology, 89*, 92-102.

Harp, S. F., & Mayer, R. E. (1998). How seductive details do their damage: A theory of cognitive interest in science learning. *Journal of Educational Psychology, 90*, 414-434.

Mayer, R. E., Heiser, J., & Lonn, S. (2001). Cognitive constraints on multimedia learning: When presenting more material results in less understanding. *Journal of Educational Psychology, 93*, 187-198.

Moreno, R., & Mayer, R. E. (2000). A coherence effect in multimedia learning: The case for minimizing irrelevant sounds in the design of multimedia instructional messages. *Journal of Educational Psychology, 92*, 117-125.

Moreno, R., & Mayer, R. E. (2002). Verbal redundancy in multimedia learning: When reading helps listening. *Journal of Educational Psychology, 94*, 156-163.

Schraw, G. (1998). Processing and recall differences among seductive details. *Journal of Educational Psychology, 90*(1), 3-12.

Citations

Carney, R. N., & Levin, J. R. (2002). Pictorial illustrations *still* improve students' learning from text. *Educational Psychology Review, 14*, 5-26.

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*, 155-159.

Gagné, R. M., Briggs, L. J., & Wager, W. W. (1988). *Principles of Instructional Design. Third Edition*. New York: Holt, Rinehart, and Winston.

Ghodsian, D., Bjork, R. A., & Benjamin, A. S. (1997). Evaluating training during training: Obstacles and opportunities. In M. A. Quiñones & A. Ehrenstein (Eds.) *Training for a rapidly changing workplace: Applications of psychological research* (pp. 63-88). Washington, DC: American Psychological Association.

Goetz, E. T., & Sadoski, M. (1995). The perils of seduction: Distracting details or incomprehensible abstractions? *Reading Research Quarterly, 30*, 500-511.

Gyselinck, V., & Tardieu, H. (1999). The role of illustrations in text comprehension: What, when, for whom, and why? In H. van Oostendorp & Susan R. Goldman (Eds.) *The construction of mental representations during reading*. Mahwah, NJ: Erlbaum.

Levie, W. H., & Lentz, R. (1982). Effects of text illustrations: A review of research. *Educational Communication and Technology Journal, 30*, 195-232.

Mayer, R. E. (1989). Systematic thinking fostered by illustrations in scientific text. *Journal of Educational Psychology, 8*1, 240-246.

Mayer, R. E. (1997). Multimedia learning: Are we asking the right questions? *Educational Psychologist, 32*, 1-19.

Mayer, R. E., & Gallini, J. K. (1990). When is an illustration worth ten thousand words? *Journal of Educational Psychology, 82*, 715-726.

Mayer, R. E., & Moreno, R. (1998). A split-attention effect in multimedia learning: Evidence for dual processing systems in working memory. *Journal of Educational Psychology, 90*, 312-320.

Rothkopf, E. Z. (1966). Learning from written instructive materials: An exploration of the control of inspection behavior by test-like events. *American Educational Research Journal, 3*, 241-249.

Rothkopf, E. Z. (1982). Adjunct aids and the control of mathemagenic activities during purposeful reading. In W. Otto & S. White (Eds.) *Reading expository material*. New York: Academic Press.

Rothkopf, E. Z., & Billington, M. J. (1979). Goal-guided learning from text: Inferring a descriptive processing model from inspection times and eye movements. *Journal of Educational Psychology, 71*, 310-327.

Sadoski, M. (2001). Resolving the effects of concreteness on interest, comprehension, and learning important ideas from text. *Educational Psychology Review, 13*, 263-281.

Smith, S. M., Glenberg, A., and Bjork, R. A. (1978). Environmental context and human memory. *Memory and Cognition, 6*, 342-353.

Thalheimer, W., & Cook, S. (2002, August). *How to calculate effect sizes from published research articles: A simplified methodology.* Retrieved November 31, 2002 from http://work-learning.com/effect_sizes.htm.

Wade, S. E., & Adams, B. (1990). Effects of importance and interest on recall of biographical text. *JRB: A Journal of Literacy, 22*, 331-353.

Wade, S. E., Alexander, P., Schraw, G., & Kulikowich, J. (1995). The perils of criticism: Response to Goetz and Sadoski, *Reading Research Quarterly, 30*, 512-515.

Wade, S. E., Schraw, G., Buxton, W. M., & Hayes, M. T. (1993). Seduction of the strategic reader: Effects of interest on strategies and recall. *Reading Research Quarterly, 28*, 3-24.