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Do Cheaters Never Prosper? The Impact of Examples, Expertise, and Cognitive Load on Cryptomnesia and Inadvertent Self-Plagiarism of Creative Tasks

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Previous work has shown that the presence of examples may lead to cryptomnesia, or inadvertent plagiarism, on creative tasks. Various experiential and environmental attributes may magnify this finding. For instance, novices, with limited knowledge, may be more prone to inadvertently plagiarize examples, and increases in cognitive load may result in an inability to recall the source of an idea. The purpose of my research was to determine if providing examples leads to cryptomnesia on linguistic and visual creative tasks and to further examine whether expertise level and cognitive load magnifies this relationship. In study 1, participants were given plain instructions or instructions with either an auditory or print example before completing linguistic and visual divergent thinking (DT) tasks. Examples increased the likelihood of cryptomnesia for both tasks, especially with congruent modalities (print example and visual task). In study 2, participants were classified as novices or experts in engineering and completed two designs tasks, one with an example accompanying the instructions. The presence of an example fostered cryptomnesia and this effect was stronger for novices. Novices were also more likely to inadvertently self-plagiarize. In study 3, participants were exposed to examples under both cognitive taxation and no taxation conditions prior to completing linguistic and visual DT tasks. After controlling for error rate on taxation task, cognitive taxation resulted in a greater likelihood of cryptomnesia. Based on principles of schema theory and cognitive load, in order to reduce cryptomnesia it is recommended to avoid providing examples for higher level learning objectives and avoid simultaneous presentation of congruent task modalities.

After laboring for days, a student submits a written assignment to a professor, only to be later accused of plagiarizing the ideas from an online source. The student earnestly pleads innocence, even when confronted with the evidence. What could be the cause? Cryptomnesia is a form of *inadvertent plagiarism* whereby an individual, after having been exposed to an idea, later plagiarizes that idea, believing it to be an original inspiration (Brown & Murphy, 1989; Marsh & Bower, 1993; Taylor, 1965). In contrast, self-plagiarism is inadvertently copying one's own prior ideas (Brown & Murphy, 1989).

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Cryptomnesia on creative tasks is especially detrimental because creativity, by its very definition, requires something original to be produced (J. Plucker, Beghetto, & Dow, 2004). Creativity is strengthened by an assortment of skills such as flexible thoughts (Runco, 1985); adoption of unusual ideas (Runco, Dow, & Smith, 2006); taking a different perspective (Dow & Mayer, 2004); and synthesizing thoughts, ideas, and perspectives together to generate a novel schema (Eysenck, 1993). Any form of inadvertent plagiarism, whether it is cryptomnesia or self-plagiarism, during the act of creativity stands to undermine the essential component of originality.

Is it possible that students become so cognitively fixated on an idea that they are unable to divorce themselves from those views and instead absorb the content into their own schema and forget the origin of inspiration? Several researchers have found that students replicate examples on both linguistic (Galinsky, Gruenfeld, Magee, Whitson, & Liljenquist, 2008; Marsh, Ward, & Landau, 1999) and visual tasks (Christensen & Schunn, 2007; Dahl & Moreau, 2002; Smith, Ward, & Schumacher 1993). Examples may promote cryptomnesia because they provide information that could be plagiarized.

THE IMPACT OF EXAMPLES

To isolate the impact of examples on plagiarism of linguistic tasks, previous methods employed a round-robin word generation task from semantic categories (Brown & Murphy, 1989), a word search puzzle using a 4×4 matrix of letters (Marsh & Bower, 1993), and a creative generation task (Smith et al., 1993). In a series of experiments, Brown and Murphy instructed participants to generate a list of exemplars from conceptual categories including sports, instruments, clothing, and animals and then later recall their lists. Participants were either working in groups (who also generated lists) or had been given a predetermined set of exemplars and were explicitly instructed not to copy. They found that 41% of participants unknowingly plagiarized when generating a list of exemplars after having listened to others generate exemplars. Furthermore, when later asked to further expand on their original list of exemplars (a more difficult task), 71% restated exemplars they had previously reported. This translated into a self-plagiarism rate of 9%. Thus, cryptomnesia and self-plagiarism occurred and were more likely as the recall task increased in difficulty. Similar patterns of cryptomnesia, found on this linguistic recall task, are also found on visual creative tasks. For example Kray, Wong, and Galinsky (2006) found that, after presenting participants with an example of a product label, they were more likely to replicate salient features from that example even after being instructed to generate a novel label. Similarly, Smith et al. (1993) presented participants with either plain instructions or instructions with an accompanying example of a creative generative task. They found that participants were more likely to plagiarize key features in their drawing of toys and creatures after having viewed an example. An individual may be more likely to rely on an example, and thus engage in cryptomnesia, if he or she has limited prior knowledge of the task. Thus, expertise could also impact cryptomnesia.

THE IMPACT OF EXPERTISE

Does level of expertise impact the likelihood of exhibiting cryptomnesia? The distinction between novices and experts is found to impact problem solving strategies (Chi, 2006), cognitive effort (Davidson, 2003; Sweller, 2003), and the quantity of error rates and factual knowledge (Hmelo-Silver & Pfeffer, 2004). It is believed that a strong foundation of knowledge, often from an expert's educational experience (J. A. Plucker & Dow, 2010), provides an advantage when engaged in a creative task because the expert can draw from more diverse information. Because novices lack this foundation of knowledge to draw upon, they may be more likely to over rely on a given example and plagiarize key components. While research has established that experts are more likely to be victims of plagiarism because they are viewed as a more credible source than novices (Bink, Marsh, Hicks, & Howard, 1999) little research has been conducted on the likelihood of novices and experts *committing* cryptomnesia. Regardless of drawing inspiration from previous knowledge or presented examples, if individuals forget the source of inspiration they may be more prone to cryptomnesia. Therefore, cognitive load, which has been shown to interfere with source monitoring, is also a concern for cryptomnesia.

THE IMPACT OF COGNITIVE LOAD

Cognitive load, which is any cognitive strain evoked due to the nature, presentation, or instructions of the task, rather than the problem solving goals of the task (Sweller, 2005; Sweller & Chandler, 1994), has been found to negatively impact performance, problem solving, and learning (Chandler & Sweller, 1991; Mayer & Moreno, 2003; Roskes, De Dreu, & Nijstad, 2012). Cryptomnesia may result from a failure in source-monitoring (Defeldre, 2005) given excess cognitive load (Marsh, Landau, & Hicks, 1997). When the cognitive effort exerted to engage in the task increases, it is possible that the individual is too focused on the task, or perhaps too overwhelmed by the task requirements, to pay attention to the source of ideas (Brown & Murphy, 1989; Marsh & Bower, 1993). To manipulate the impact of cognitive load or mental effort, Gardiner, Passmore, Herriot, and Klee (1977) exposed participants to white noise during a recall task, and found the error rate increased. To determine the impact of cognitive load on cryptomnesia, Marsh and Bower (1993) manipulated both the retention interval and amount of interfering material presented between the idea generation and subsequent recall phases. Working with a partner, participants generated words from a Boggle-like 4×4 matrix of letters, recalled their words, and then generated additional words. Concurring with Brown and Murphy (1989), they concluded that participants exhibited cryptomnesia and inadvertent self-plagiarism. They further noted that rates of cryptomnesia paralleled interference material, thus implying that as cognitive taxation increases, the likelihood of source forgetting and cryptomnesia increases. Although cognitive load has been found to lead to cryptomnesia in recall and word generation tasks, and also to hinder convergent creative thinking (Roskes et al., 2012), its impact on cryptomnesia of divergent thinking (DT) tasks has not been investigated.

In summary, in standard recall tasks, examples can lead to cryptomnesia (Christensen & Schunn, 2007; Marsh et al., 1999; Smith et al., 1993), novices may be more likely to plagiarize (Plucker, Kaufman, Temple, & Qian, 2009) and cognitive load may increase this risk (Defeldre, 2005; Marsh & Bower, 1993).

The purpose of this research was to investigate the impact of examples, expertise, and cognitive load on cryptomnesia. Through a series of three studies I am able to offer a unique contribution to the field of creativity research by distinguishing the impact of both auditory and pictorial examples on both linguistic (e.g., generate names for an analgesic) and visual (e.g., design a toy) DT tasks. Moreover, this is the first to investigation to include the role of expertise and cognitive load on cryptomnesia. My global hypothesizes are that examples will increase the rate of cryptomnesia; this impact will be stronger for novices and more likely to occur when the ability to monitor available input sources is impaired due to a cognitively taxed working memory. In study 1, which employed a mixed-subjects experiment, it was hypothesized that providing examples in pictorial and auditory formats prior to completing a linguistic and a visual DT task would increase the likelihood of cryptomnesia.

STUDY 1

Method

Participants

The sample included 66 undergraduate students from Christopher Newport University who received for credit toward a research option in their introductory psychology course. The percentage of men was 41%. Sixteen participants served in the control group, 29 participants served in an auditory example group, and 21 participants served in a pictorial example group. All participants were tested on linguistic and visual DT.

Measures

DT tasks. A linguistic DT task was created based on Kray et al.'s (2006) creative generative task in which participants were instructed to generate new names of a nuclear element. A visual DT task was created based on Smith et al. (1993) and Ward's (1994) creative generative tasks in which participants were instructed to imagine a planet similar to earth in another galaxy, and to draw a creature that might be found living on that planet. Two unrelated DT tasks were selected to isolate cryptomnesia from inadvertent self-plagiarism (which was addressed in the subsequent study 2).

Manipulation. Presentation modality was manipulated through three sets of instructions. In the first set, participants were given no accompanying examples to the linguistic and the visual DT tasks. In the second set, participants were presented with a pictorial example of the DT tasks. In the third set, participants were presented with auditory examples for both the DT tasks.

Pictorial examples. For the linguistic DT task, the print example included two words, one ending with *-on* and another with *-ium* (e.g., *Mogluon* and *Ram-din-ium)* in printed text. For the visual DT task, the pictorial examples consisted of a drawing of an alien creature that contained a number of key features such as a specific shape for the body, nose, mouth, and eyes, a specific number of legs, and presence of a tail, antennae, and a retractable neck. These key features were presented in a drawing and each feature also contained a label.

Auditory examples. For linguistic DT task, the auditory example consisted of the same two words read aloud. For the auditory example of the visual DT, the same eight key features that were presented in the pictorial example of the alien, and highlighted with labels, were now described out loud.

Procedure

Participants were randomly assigned to either a control group that received no example, a group that received an auditory example, or group that received a printed example. Participants completed both the linguist and visual DT tasks.

Participants in the linguist example conditions were given 10 sec to read the two examples (both printed on one page) or spent approximately 10 sec listening to the example words read aloud. Participants in the pictorial example conditions were given 1 min to look at the pictorial example of an alien drawing or spent approximately 1 min listening to the example of the same alien described. All participants were then given 30 min to complete both the linguistic and visual DT tasks. They were instructed to "try to think of something new that no-one else has thought of" and, if given an example, "try not to copy the example." Presentation order of the linguistic and visual DT tasks was counterbalanced.

Scoring

Both the linguistic and visual DT tasks were scored for fluency of elements (e.g., total number of words or total number of alien features). Two cryptomnesia scoring manuals were created for the purpose of this experiment. The linguist cryptomnesia manual consisted of the various word elements from the example (e.g., includes hyphen or ends with *-ium*). For example, after being given the example *Ram-din-ium,* a response of *lolo-polio*, would receive a cryptomnesia score of one for the hyphen, whereas a response of *lolo-ium* would receive a cryptomnesia score of two for the hyphen and the ending. Thus, a higher cryptomnesia score was given for a greater degree of plagiarism. The visual cryptomnesia manual consisted of the eight key features from the example (e.g., retractable neck, tail, four legs, etc.). Features that were in the example but considered more common (e.g., four legs) resulted in a cryptomnesia score of one, whereas features that were in the example but considered more unique (e.g., retractable neck) resulted in a cryptomnesia score of two.

Two blind-independent coders reviewed both the linguistic and the visual DT tasks from the three conditions (control, auditory example, and pictorial example) and scored them for cryptomnesia using the scoring manuals. Consistent with the literature, any discrepancies were later discussed until both coders reached 100% agreement. For the linguistic task, a proportion score (e.g., Dixon, 1979; Hocevar & Michael, 1979; Lee & Dow, 2011) was then calculated by dividing the cryptomnesia score by total fluency to yield a final cryptomnesia score for the linguist DT task. For the visual task, the total cryptomnesia scores were summed.

Results and Discussion: Descriptive Statistics and Analysis

A one-way MANOVA revealed a significant multivariate main effect for the impact of examples, Wilks' $\lambda = .62$, $F(4, 124) = 8.36$, $p < .001$, $np^2 = .21$. Power to detect the effect was .998. Furthermore, the univariate main effects produced significant main effects for presentation modality on both the linguistic DT task, $F(2, 63) = 11.84$, $p < .001$, $np^2 = .27$, power = 1.00, and the visual DT task $F(2, 63) = 16.13$, $p < .001$, $np^2 = .34$, power =.99. Significant pairwise differences were obtained in the linguistic DT tasks between control and both auditory and pictorial examples. The mean numbers of cryptomnesia were 1.76% in the control, 11.78% in the auditory, and 13.73% in the pictorial examples. Significant pairwise differences were obtained in the visual DT tasks among control and auditory and pictorial examples. The mean numbers of cryptomnesia were 3.52% in the control, 15.74% in the auditory example, and 21.32% in the pictorial example. Descriptive statistics are reported in Table 1.

TABLE 1
Means and Standard Deviations of Cryptomnesia for Example Type and DT Type—Study 1

	Divergent Thinking Task			
	Linguistic		*Visual*	
Example Type	*M*	*(SD)*	*M*	*(SD)*
Control	1.76%	2.98%	3.52%	4.75%
Auditory	11.78%	11.10%	15.74%	12.92%
Print	13.73%	9.28%	21.32%	11.55%

Note. $N = 66$.

Thus, exposing students to auditory or pictorial examples can increase the likelihood of cryptomnesia on a linguistic task. Similarly, students who were given an example prior to a visual DT task were more likely to engage in cryptomnesia and this effect was stronger for the pictorial example.

These results confirmed previous findings that specially instructing participants to generate original ideas does not prevent cryptomnesia (Smith et al., 1993). Further supporting previous research (Chrysikou & Weisberg, 2005; Smith, 2003), it was found that participants exhibit a higher rate of cryptomnesia when presented with examples, perhaps because they had become cognitively fixated on the examples, thus impairing their creative performance in both the linguistic and visual DT tasks. Becoming fixated on prior examples is problematic for several reasons. It hinders brainstorming (Smith, 2003), impairs performance when attempting to be original, and fosters the likelihood of replicating the same ineffective solutions when engaged in problem solving (Chrysikou & Weisberg, 2005). Because experts have a larger knowledge base to draw upon when engaged in a creative task, they may be less prone to cryptomnesia. The goal of the Study 2 was to determine if providing pictorial examples prior to completing a visual DT task increases the likelihood of cryptomnesia and inadvertent self-plagiarism, and if this effect is moderated by level of expertise. It was hypothesized that novices would be more likely to exhibit cryptomnesia and self-plagiarism.

STUDY 2

Method: Participants

The participants were physics, computer science, or engineering majors enrolled in either an introductory ($n = 47$) or graduate level ($n = 34$) physics course at Christopher Newport University and participated for course extra credit. Participants who were enrolled in the introductory courses were classified as novices, whereas those enrolled in the graduate level physics courses were classified as experts. The percentage of men was 89%.

Measures

Demographic Information

Participants were asked to report gender, year in college, and major.

DT Tasks

Two visual DT tasks were created based on Jansson and Smith's (1991) creative generative task. The first visual DT task was to design a measuring cup for a visually challenged person and the second visual DT task was to design a spill-proof coffee cup. Two similar DT tasks involving a cup design were specially selected to measure the transfer of similar design features from one task to another. This served as a measure of inadvertent self-plagiarism.

Manipulation

Presentation modality was manipulated through two sets of instructions. One set included directions to design either a measuring cup for someone who is visually impaired or to design a spill-proof coffee cup. The second set consisted on the same directions, but also included a pictorial example of each cup, containing a number of key features with corresponding labels. The measuring cup key features included a specific size and shape, a handle, multiple compartments, and an audible click once a compartment is full. The coffee cup's key features included a specific size and shape, an insulted surround, a plastic top, and straw that made a hairpin-turn inside the cup.

Procedure

Novices and experts were presented with plain instructions and instructions with an accompanying pictorial example. Presentation order was counterbalanced. Participants in the pictorial example condition were given 1 min to look at the printed example of the visual DT task, then they were given 20 min to complete the DT task after being instructed to "try not to copy the example." Participants in the control condition were given instructions, then 20 min to complete the visual DT task. In both conditions, participants were instructed to "try to design something new that no one else has thought of" and, when completing the second DT task, "try not to copy your previous drawing."

Scoring

A scoring manual, generated for the purpose of this experiment, consisted of key features from the visual DT examples (e.g., multiple compartments or straw) provided. Two blind-independent coders reviewed both DT tasks and scored them for total idea elements (fluency) and for cryptomnesia (key features that were in the examples) and inadvertent self-plagiarism (idea elements that were in the participant's previous drawing) using the scoring manual and the participants previous drawing. In the event, a participant engaged in both cryptomnesia of a key feature from the example in task one and subsequently engaged in inadvertent self-plagiarism of the same idea element for task two without an example this would be scored as *carry over cryptomnesia*, rather than inadvertent self-plagiarism. Consistent with the literature, any discrepancies were later discussed until both coders reached 100% agreement. Again, proportion scores were was then calculated by dividing the number of plagiarized idea elements from the example, or self-plagiarized idea elements from the previous drawing, by total fluency for each DT task yielding a cryptomnesia score for each DT tasks and an inadvertent self-plagiarism score.

Results and Discussion

Preliminary Analysis

There was no significant order effects for either cryptomnesia ($p = .88$) nor inadvertent self-plagiarism ($p = .64$). Only one participant (a novice) engaged in carry over cryptomnesia so that score was discounted in subsequent analysis.

Cryptomnesia

A two-way mixed-subjects ANOVA was conducted to compare the impact of examples on visual DT tasks among novices and experts. Similarly to study 1, there was a significant main effect for the impact of examples, Wilks' $\lambda = .37$, $F(1,\ 79) = 135.79$, $p < .001$, $np^2 = .63$, power $= 1.00$. Participants given examples were more likely to exhibit cryptomnesia ($M_{\text{example}} = 15.20\%$, $SD = 9.51\%$; $M_{\text{control}} = 4.85\%$, $SD = 5.01\%$). There was also a significant main effect for the impact of level of expertise, $F(1,\ 79) = 19.10$, $p < .001$, $np^2 = .19.01$, power $= .99$. Novices were more likely to exhibit cryptomnesia ($M = 12.36\%$, $SD = 5.67\%$) than experts ($M = 6.79\%$, $SD = 5.66\%$).

Moreover, there was a significant interaction of effect of example and level of expertise on visual DT tasks, Wilks' $\lambda = .71$, $F(1,\ 79) = 31.99$, $np^2 = .29$, power $= 1.00$, $p < .01$. Although there was minimal difference between the novices and experts who were solely given instructions ($M_{novice} = 5.23\%$, $SD = 5.21\%$; $M_{expert} = 4.32\%$, $SD = 4.86\%$) rates of cryptomnesia increased when examples accompanied the instructions and this increase was at a much greater rate for novices ($M_{novice} = 19.49\%$, $SD = 8.19\%$; $M_{expert} = 9.26\%$, $SD = 7.93\%$).

Inadvertent Self-Plagiarism

To determine the impact of expertise on inadvertent self-plagiarism, the second DT task was scored for plagiarism of original idea elements that the participants had generated for their first DT task. A test of between subjects-effects yielded a significant difference between novices and experts on inadvertent self-plagiarism, $F(1, 79) = 19.01$, $p < .001$, $np^2 = .19$, power $= .99$. Novices were more likely to inadvertently self-plagiarize ($M = 15.13\%$, $SD = 7.26\%$) than experts ($M = 9.18\%$, $SD = 9.37\%$). Table 2 provides descriptive statistics for impact of expertise level and example on cryptomnesia (under both example conditions) and inadvertent self-plagiarism.

Novices, given an example, are very likely to engage in cryptomnesia of key idea elements perhaps because they are still developing their schemas for principles and concepts required to navigate their field (Dufresne, Gerace, Mestre, & Hardiman, 1992). As they gain expertise, their schemas become more elaborate, increasing in both complexity and organization (Ford, 2002). Therefore, expert physics students may not have fallen prey to cryptomnesia of presented examples nor inadvertent self-plagiarism of their own work because their schemas are more developed, allowing them to interpret the assignment with less reliance on examples and their own recent work. Because experts have acquired more experiences over a longer period of time to draw from, their subsequent creative work may be a synthesis of experiences and content knowledge from the field and therefore, appear more unique. This is an important finding, given recent recommendations to foster creative thinking in science education (National Research Council, 2009). Another possibility is that experts may have had more experience in navigating novel and difficult tasks. Experts may be resistant to plagiarism because they are less cognitively taxed by generating ideas required by the DT task. To address this possibility, the goal of Study 3 was to determine if increasing cognitive load during idea generation on linguistic and visual DT tasks increases the likelihood of cryptomnesia of provided examples. It was hypothesized that as cognitive load increase cryptomnesia is more likely to result.

TABLE 2
Means and Standard Deviations of Cryptomnesia Under Example Condition and Inadvertent Self-Plagiarism by Expertise Level for Visual DT Task—Study 2

	Expertise Level			
	Novice		*Expert*	
Measure	*M*	*SD*	*M*	*SD*
Cryptomnesia				
Control	5.23%	5.21%	4.32%	4.86%
Example	19.49%	8.19%	9.26%	7.93%
Self-plagiarism	15.13%	7.26%	9.18%	9.37%

Note. $N = 81$.

STUDY 3

Method

Participants

Participants included 114 undergraduate students from Christopher Newport University who received for credit toward a research option in their introductory psychology course. The percentage of men was 36%. All participants served in the cognitively taxed and the non-cognitively taxed condition and were tested on both linguistic and visual DT tasks.

Measures

Demographic information. Participants were asked to report their gender, year in college, and major.

DT tasks. Two versions of a linguistic DT task and two versions of a visual DT task were employed in this study. The linguistic DT tasks consisted of instructions to generate a list of potential names for nuclear element with accompanied print examples (e.g., *Mogluon* and *Ram-din-ium* from study 1) and instructions to generate a list of potential names of a new analgesic with accompanying examples (e.g., *Relax-a-prin and Brain Strain Relief*) adapted from Kray et al. (2006). The visual DT tasks were based on Smith et al. (1993) and Ward's (1994) creative generative task and included the creature design with accompanying pictorial example from study 1 and a toy design in which participants were instructed to design a toy suitable for both boys and girls between the ages of 5 and 10. A picture and brief printed description were provided of Mobi Mobile, a toy car that comes in a fun carrying case shaped like a garage, with pockets to hold accessories, was provided. Both pictorial examples for the visual DT tasks contained a number of key features with corresponding labels.

Manipulation. Cognitive load was manipulated using a recall task adapted from Patterson and Stockbridge (1998) whereby four lists of company names were recorded on a digital tape recorder. The first list and second lists were used for the linguist DT tasks and consisted of 20 names of companies in the nuclear sector and 20 names of pharmaceutical companies. The third and fourth lists were used for the visual tasks and consisted of 20 names of toy companies and 20 names of private spaceflight companies. The names were recorded at a 5-sec interval and looped resulting in an exposure to each list six times.

Procedure

Participants were exposed to four conditions consisting of both the cognitive taxed and nontaxed conditions of both the linguistic and visual DT tasks. Presentation order was counterbalanced. Participants in the cognitively taxed condition were instructed that they were to complete an activity while memorizing a list of 20 names that were potential companies that were interested in the results of their activity. They were further informed that they would be later assessed on their ability to recall these companies. After being given 1 min to look at the printed example and instructed to "try not to copy the example," they were then given either 20 min to complete the visual DT task or 10 min to complete the linguistic task, while listening to the loop of 20 corresponding companies read aloud. Upon completion, participants began the other remaining tasks. The procedure for the nontaxed condition was the same with the exemption of the memorization of words read aloud.

Scoring

Both the visual and the linguistic tasks were scored using the same method as developed for study 1 (e.g., scoring for total idea elements and key features that were in the examples). A resulting proportion score for cryptomnesia was generated.

Results and Discussion

Preliminary analysis There was no significant order effects for cryptomnesia on either linguistic ($p = .55$) or visual ($p = .47$) DT tasks.

Descriptive statistics and analysis. A two-way within-subjects ANOVA was conducted to compare the impact of cognitive load on linguistic and visual DT tasks. There was a significant main effect for cognitive load, Wilks' $\lambda = .35$, $F(1,\ 113) = 213.34$, $p < .001$, $np^2 = .65$, power = 1.00. Participants exhibited greater rates of cryptomnesia while under cognitive taxation ($M = 21.49\%$, $SD = 6.83\%$) than while not cognitively taxed ($M = 16.02\%$, $SD = 6.40\%$). As seen in Figure 1, after viewing the Mobi Mobile, participants in the taxed condition copied several key features on the visual DT task such as a carrying receptacle, the looped handle, and pockets whereas the participant in the nontaxed condition generated a novel hand held electronic game that synced to a computer.

There was a significant main effect for DT task type, Wilks' $\lambda = .94$, $F\ (1,\ 113) = 8.80$, $p < .01$, $np^2 = .07$, power =.84. Participants exhibited greater rates of cryptomnesia for the visual tasks ($M = 19.63\%$, $SD = 7.64\%$) than the linguistic tasks ($M = 17.88\%$, $SD = 6.41\%$). Moreover, there was a significant interaction of cognitive load on DT task type, Wilks' $\lambda = .97$, $F(1,\ 113) = 4.09$, $np^2 = .04$, power =.52, $p < .05$. Although cryptomnesia increased under cognitive taxation for both DT tasks, the impact of taxation was more pronounced for the linguist DT task (M increase = 6.04%) than the visual DT task (M increase = 4.89%). Table 3 provides means and standard deviations for cognitive load manipulation and DT task type.

Given the limited capacity of working memory (Baddeley 1992; Baddeley & Hitch, 1974; Chandler & Sweller, 1992; Mayer, 2005, Miller, 1956; Sweller, 1988, 1994), the need required to generate linguistic and visual designs when also attempting to memorize

Pictorial example | Taxed condition | Non-taxed Condition

FIGURE 1 Pictorial example and participant responses under taxed and nontaxed conditions.

TABLE 3
Means and Standard Deviations of Cryptomnesia for Cognitive Load Manipulation and Task Type—Study 3

	Divergent Thinking Task			
	Linguistic		*Visual*	
Cognitive load	*M*	*SD*	*M*	*SD*
No taxation	14.86%	6.65%	17.18%	7.75%
Cognitive taxation	20.90%	7.05%	22.07%	8.38%

Note. $N = 11$.

a list of words may have exceeded the available resources (Mayer & Moreno, 2003) resulting in the replication on a recently presented example. The inadvertent plagiarism of the DT task was also impacted by the modality of the task. As confirmed with Hedge's G measure of effect size (Hedges, 1981; linguistic =.88; visual =.60), cognitively taxed participants were more likely to copy letter features on a linguist DT task than design features on a visual task. Paivio's (1986) dual coding theory of multimodality theorizes that our cognitive processing system has dual channels, verbal and visual, and that each channel has a limited capacity to processes information (Mayer, 2005), thus presenting the information in a congruent modality as the task (linguistic and linguist or visual and visual) may tax working memory further than a task in an incongruent modality. As witnessed in these findings, the linguistic task suffered much higher rates of inadvertent plagiarism than the visual task, perhaps due to the linguistic nature of the working memory load which required memorizing a list of names.

GENERAL DISCUSSION

Plagiarism is a concern among many educators. Because direct plagiarism includes verbatim copying of text, it is easily detectable with the use of contemporary online search tools. Cryptomnesia, however, is copying ideas, which is more difficult to detect and, therefore, perhaps more troublesome.

Returning to the student in the opening paragraph, on the surface, a plagiarized paper provides evidence for intent to defraud the professor. However, in this case the student engaged in unknowingly using another's ideas. It was accidental and unintentional. Although determining the just consequences is beyond the score of this article, addressing some of the factors that promote inadvertent plagiarism may provide a deeper understanding to the occurrence of cryptomnesia.

One of the explanations for cryptomnesia is found in the conformity hypothesis (Smith, Ward, & Schumacher, 1993) in which individuals conform and replicate examples when engaged in a creative task. In their study, Smith et al. (1993) found that individuals will replicate common features when generating a novel drawing (alien and toy) after viewing examples. They concluded that presenting examples prior to a visual drawing task reduces creativity because the student becomes overly fixated on salient key features in the example. Similarly, when engaged in a creative task, it was found that providing examples increases the likelihood of cryptomnesia; yet, this study extended this pattern of finding beyond a visual DT task to also include a linguistic task. Thus, it was found that students were more likely to replicate key features presented in an example when subsequently engaged in both linguistic and visual creativity tasks. The implications of this finding must also address whether copying the example is really a cause for concern. Given a fundamental learning objective, such as remembering the information, providing examples has been found to enhance the student's ability to recall and comprehend (Mayer, Dow, & Mayer, 2003) and would, therefore, be beneficial. But, given higher-order learning objectives such as synthesizing (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956) or creating (Anderson & Krathwohl, 2001), providing examples promotes cryptomnesia, thereby reducing creativity and therefore would be detrimental and should be avoided. It is vital that the teacher is explicitly aware of the level in which that particular learning objective resides (whether lower order or higher order) to generate the optimal learning environment which may include providing examples.

This distinction between lower- and higher-level learning objectives may also explain the results from the second study, in which novices were found to be more prone to cryptomnesia. When engaged in creative problem-solving tasks, the novice typically has had limited experience with the initial state of the problem, yet must employ a novel approach to reach the solution (Ansburg, 2000; Barlow, 2000; Dominowski, 1995; Mayer, 1989; Sternberg & Lubart, 1996). Experts, who exhibit a greater degree of flexibility during problem solving (Hogan & Rabinowitz, 2009; Kohl & Finkelstein, 2008), may be relying less on lower-level problem-solving strategies, for they have become tacit, thus they may not need to rely so heavily on examples and are less likely to replicate components from those examples. With repeated practice in their engaged field, en route to expertise, novices may begin to view examples as inspiration, rather than as a source for replication. Therefore, instructors should require or establish a minimum proficiency level among students to ensure that higher-order learning objectives are not presented before a solid foundation of lower level objectives have been mastered. Once these fundamental objectives have been well established with the aid of examples, the use of examples should be reduced to prevent the possibility of cryptomnesia on subsequent higher order thinking tasks.

It has been well established that cognitive taxation reduces the ability to encode, store, and retrieve information (Ayres & Sweller, 2005; Chandler & Sweller, 1991, 1992, Mayer & Moreno, 2003, 2010). The results of the third study have confirmed this finding and include a new aspect that has extended this finding beyond the basic informational processing components to advanced higher learning objectives found in creative production. It was found that cognitive taxation also reduces linguistic and visual DT by increasing the likelihood of cryptomnesia. Furthermore, this increase was greatly pronounced in the linguist task, perhaps due to the single verbal channel being overloaded when engaged with a dual modality task (memorizing a word list while generating new words) resulting in an overload of processing demands (Mayer & Moreno, 2002). Moreover, our pattern of findings confirms the split-attention principle, as participants were required to split their attention between the task of memorization and the task of creative generation resulting in a decrease in performance.

This study is not without limitations. Although both linguist and visual measures of DT were employed, creativity is multifaceted (Csikszentmihalyi, 1990; MacKinnon, 1970; Runco & Charles, 1992) and extends to other areas such as problem-solving tasks, poetry, musical composition, and three-dimensional design. Additionally, my sample was predominately White women (with the exception of study 2, which had more male participants), thus the generalizability is limited.

Although this study has limitations, these should not overshadow its strengths. This study provides three unique contributions to the literature of creativity research. First, by identifying the specific factors (task modality, expertise level, and cognitive load) that explain some of the variability in cryptomnesia, educators may be able to reduce its occurrence. Second, by focusing on higher-order learning objectives for both linguistic and visual tasks, the results can generalize to a greater educational field. Third, by outlining learning objectives of the current task, cryptomnesia may be a necessary phase en route to developing expertise within the domain.

SUGGESTIONS TO REDUCE THE LIKELIHOOD OF CRYPTOMNESIA

Taken as a whole, the results of these three studies may provide some insight into the guidelines for reducing the likelihood of cryptomnesia on a task requiring higher-order learning objectives. It is recommended that teachers present examples when engaged in lower-level learning objectives, but then taper off the reliance on examples when transitioning to higher-order learning objectives, train novices to explicitly outline any sources of their inspiration, and to reduce cognitive load by avoiding the simultaneous presentation of congruent tasks.

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