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The truth about lying: the memorial effects of deliberately producing misinformation

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THE TRUTH ABOUT LYING: THE MEMORIAL EFFECTS OF DELIBERATELY PRODUCING MISINFORMATION

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Abstract

There are different ways of lying and these lies may have different impacts on memory. In this study, participants studied pictures of objects, and later lied and told the truth about these and other objects by describing them or by denying they had seen them. Forty-eight hours later, participants were tested on their source memory. Results revealed that participants had good memory for having falsely described a never-seen object, but poor memory for having falsely denied seeing a studied object. These results suggest that telling certain types of lies may make a person more likely to forget having lied at all. In addition, repeated truthful denials of having seen a picture paradoxically increased false memories for having seen it. Thus, telling the truth does not always prevent the possibility of memory distortion.

Introduction

Imagine a scenario in which a criminal investigator is interviewing a suspect. In this situation, it is very possible that the suspect may lie to the investigator in order to avoid prosecution. If the suspect does in fact lie, this can clearly affect the outcome of the investigation. Because of this, there has been great interest in finding ways to detect lies as a means to help investigators (e.g., Vrij, Granhag, & Porter, 2010). However, the act of lying may also impact the person who lies (i.e., his or her own memory). There is substantially less research on this question (e.g., Pickel, 2004). The current study asks whether people are able to correctly monitor when they have lied and when they have told the truth, as well as whether the act of lying can affect what is later remembered about the original event.

Research has amply demonstrated that people can confuse one memorial source for another (e.g., for a review, see Johnson, Hashtroudi, & Lindsay, 1993). For example, research has shown that a person can come to believe that information that was suggested following a witnessed event was actually viewed during that event (e.g., Loftus, Miller, & Burns, 1978; Zaragoza & Lane, 1994). However, this and other research has also demonstrated that the likelihood of making a source confusion error can vary according to a number of factors (e.g., Lane, 2006; Marsh & Hicks, 1998; for a recent review see Lindsay, 2008). One common trait of these studies is that participants are told to try to be accurate in the way they learn, rehearse, or report information. In contrast, very few studies have examined the consequences of deliberately fabricating information on subsequent memory (e.g., Pickel, 2004). The goal of the following study is to examine how different types of lies affect source memory accuracy.

Lying involves willfully generating information that is counter to the actual truth in an attempt to deceive another person (Zuckerman, DePaulo, & Rosenthal, 1981). Although few

studies have examined the effects of this behavior on memory, there is substantial research on situations where people are asked to read, hear or generate information that is inconsistent with their original memory. One prominent literature examines *eyewitness suggestibility* (e.g., Loftus et al., 1978; Zaragoza & Lane, 1994), in which participants are provided with misleading information concerning an event that was previously witnessed. More specifically, participants are shown an event in the laboratory, and are then given information that does not coincide with specific details of the original event. Providing participants with such misleading post-event information can distort their memories for what was actually seen or experienced, a phenomenon known as the "misinformation effect" (see Loftus, 2005 for review).

In a series of studies, Loftus et al. (1978) investigated the memorial effects of such misleading post-event information. Participants viewed a series of slides, during which a car was shown stopped at a road sign. Some participants saw the car stopped at a stop sign, whereas others saw the car stopped at a yield sign. After viewing the slides, all participants completed a questionnaire concerning what they had seen. One of the questions either corresponded or conflicted with information from the slideshow (i.e., either mentioned the same or a different road sign from what participants had seen). Participants who were given contradictory information after witnessing the event had less accurate memories for the original slides. In other words, the misinformation affected their reports of what they had actually seen.

This "misinformation effect" can be explained as ineffective source monitoring. The source-monitoring framework explains how source monitoring – the processes used to determine the origin of a memory – occurs (Johnson et al., 1993). According to this framework, memories contain features or characteristics that represent the conditions under which they were encoded (e.g., perceptual information, affective information, and cognitive operations). Different sources

of information have particular associated features or characteristics. The differences between the features of different possible sources can be used to decide the source of a memory. Source monitoring errors occur when people don't have or don't use these types of characteristic information to distinguish between possible sources of a memory. Such monitoring errors can lead people to incorrectly attribute their memories of suggested information to their memories of an actual event. Furthermore, research has shown that sometimes people really do come to "remember" the suggested information as coming from the original event (Zaragoza & Lane, 1994). In a series of experiments, Zaragoza and Lane (1994) had participants view slides depicting an office theft, and then exposed them to misinformation concerning what they had seen. In Experiment 4 of this study, some participants were explicitly warned that they had received misleading information concerning the original event. In Experiment 5 of this study, participants' possible bias to respond that they had seen suggested items in both the original slides and the subsequent questions was addressed by removing this *both* option from the memory test. Despite alleviating potential demand characteristics and responses biases, misinformation effects were still found. These results indicate that sometimes source misattributions after exposure to misinformation are in fact due to false memories of seeing the suggested information in the original event. Zaragoza and Lane refer to this phenomenon as the source misattribution effect.

Most studies of eyewitness suggestibility rely upon manipulations where participants are exposed to misinformation without being told the information is false. Furthermore, the misinformation is provided and thus they do not have to generate this information or even explicitly elaborate upon it (although see Lane & Zaragoza, 2007). One exception to this methodology comes from a line of research on *forced fabrication* (e.g., Ackil & Zaragoza, 1998;

for a review see Chrobak & Zaragoza, 2008). Ackil and Zaragoza (1998) looked at the effects of self-generated misinformation by having participants confabulate responses to unanswerable questions. Participants watched a video depicting two brothers at summer camp. After watching the video, participants answered questions concerning what they had just seen. Some of the questions were unanswerable in that their answers would require knowledge of details that were not actually seen in the video. However, some participants were instructed to provide an answer for all questions, even when they did not know the answer. Therefore, experimenters were forcing these participants to fabricate answers and produce misinformation themselves. Ackil and Zaragoza found that participants were later more likely to misattribute the details they had fabricated to the original video than they were to misattribute control details to the original video. They interpreted these results to mean that forcing participants to confabulate answers can lead to false memories for these confabulated details.

The effects of forced fabrication can be considered an inability of participants to correctly attribute misinformation to themselves. This inability can be explained by the source-monitoring framework (Johnson et al., 1993). Reality monitoring refers to the processes involved in discriminating between memories from internal and external sources (Johnson & Raye, 1981). In other words, reality monitoring is a type of source monitoring where one of the sources of information is the person themself. According to this model, internally generated and externally generated memories differ on several dimensions. More specifically, internally generated memories will be associated with more cognitive operations, and externally generated memories will have more contextual, sensory, and semantic details. Reality monitoring errors can occur when a memory does not exhibit such characteristic features or when the characteristics of the different sources are very similar (Johnson & Raye, 1981). In the forced fabrication study

previously mentioned (Ackil & Zaragoza, 1998), forcing participants to confabulate answers led them to construct memory representations that were more perceptually and contextually elaborate, and thus increased misattributions of the self-produced misinformation to the original event.

One thing to note about forced fabrication research is that although participants do confabulate their responses (because the questions are not answerable using information from the witnessed event), they are not always *aware* they are producing incorrect information. Because the generation phase is often days or weeks after the original event, participants may believe they have simply forgotten what they had seen. Often they express that they have low confidence in their responses or that they are speculating. Only in some cases do participants actively resist producing a response because they are certain the specified circumstances did not occur. Furthermore, the misinformation is provided in the context of questioning (e.g., "It [the chair] broke, and Delaney fell on the floor. Where was he bleeding?" when Delaney fell but was not bleeding during the event) and participants are asked to elaborate upon it (e.g., Ackil & Zaragoza, 1998). This situation is very different from the act of deliberately creating false information in an attempt to deceive another person. Lying, in this case, is a deliberate act of deception that is "an intentional and conscious act that is directed at another person" (Zuckerman et al., 1981, p. 3). If participants produce lies concerning stimuli or an event that they previously witnessed, they are essentially producing self-generated misinformation in a deliberate manner.

Whether or not lies will produce effects similar to those found in previous misinformation studies is a question that has only recently been studied. Pickel (2004) attempted to investigate this issue by having participants deliberately produce lies during a series of interview questions. Participants watched a video of a mock crime involving two characters and

were later interviewed about what they had witnessed. Some participants were instructed to intentionally fabricate details about the target character, and others were instructed to answer all questions truthfully. The results indicated that deliberately lying about the target character led to less accurate memories for that target character, had no effect on memory for the secondary character, and in some cases seemed to lead participants to believe their own lies.

Although Pickel (2004) showed that lying could decrease the accuracy of memory for the person (i.e., *item* memory), she did not assess whether participants remembered which person they lied about (although there were only two possible targets, a robber and a clerk). In other words, the impact of lying on source memory cannot be ascertained from Pickel's study. Although different in format from classic misinformation studies (e.g., Loftus et al., 1978), one other study examined the impact of lying on memory and may offer insight into the potential effects of lying on source memory. Interestingly, this autobiographical memory study found that deliberately fabricating details about childhood events that did not occur led participants to become *more* confident that these events did not happen (Polage, 2004). Specifically, Polage (2004) had participants complete a Life Events Inventory (LEI) where they rated the likelihood of different events happening to them before they were 10 years old (e.g., if they had been hospitalized overnight). Two weeks later, participants returned and were again presented with the LEI items, but this time responses of "yes" (indicating that the event did happen to the participant) or "no" (indicating that the event did not happen to the participant) were provided for each item. If an item had the response "yes" listed, the participant had to write about the event. If the item had the response "no" listed, the participant had to write about how they knew the event did not happen to them. If the response listed contradicted the participant's actual response (i.e., if an item that participants had originally rated as very unlikely to have happened

to them before the age of 10 was listed with a "yes" response), they were told to lie in their written description (i.e., to describe the event as if it had happened). One week later, participants returned and verbally provided the same stories. One week after that, participants returned for a final time and were tested on their memories for what events were truthful and which were lies. Polage found that repeatedly lying about a childhood event (i.e., creating a fabricated story about an event that never happened) led most participants to become more confident that the false event had *not* actually happened to them as children. In both experiments of her study, however, Polage did find a minority (10% and then 16%) of participants who eventually became extremely confident that the fabricated event did happen to them.

One thing to note about Polage's (2004) study is that participants only told one type of lie: lying by describing an event that did not occur. However, there are different ways of lying, and these lies may have differential effects on memory. For instance, Ganis, Kosslyn, Stose, Thompson, and Yurgelun-Todd (2003) showed that different types of lies can activate different brain areas (e.g., lies that were based on a well-rehearsed story more strongly activated the right anterior middle frontal gyrus than did lies that were spontaneously generated). And although lying is understood to be a more cognitively demanding process than telling the truth (see Vrij et al., 2010 for review), some lies may be more or less cognitively demanding than others. For example, having to create a false description of something you never actually saw may be more cognitively demanding than falsely saying you did not see something you really did see. Given the varied nature of lying, these different types of lies may impact memory differentially. This issue has implications not only for theoretical understanding, but also for the legal system. Witnesses may lie to investigators for various reasons, and in various ways. If a witness loses the ability to distinguish between what he or she has lied and told the truth about, this could have

serious ramifications for the outcome of an investigation. The current study, therefore, investigated the impact of telling different types of lies (i.e., falsely describing never-seen items and falsely denying having seen studied items) on a person's source memory.

The first type of lie used in the current study – lying by describing something that was not actually seen – is similar to the type of lies Polage (2004) had her participants tell (although Polage's study was more autobiographical in nature). The memorial effects of creating false descriptions have also been studied in eyewitness suggestibility paradigms (Lane & Zaragoza, 2007). Across two experiments, Lane and Zaragoza (2007) showed that generating false descriptions of suggested items increased accurate source memory of having read the suggested items in the post-event questions, but also increased inaccurate source memory for having seen the suggested items in the originally viewed slides. Although these results seem to differ from Polage's, it is important to remember that participants in Lane and Zaragoza's study were not deliberately producing misinformation. Furthermore, Lane and Zaragoza's procedure included items that were actually in both sources (i.e., "both" items). Thus, having a clear memory of having generated details about a suggested item did not necessarily exclude the possibility that they had also seen it in the slides. Lying by describing is also a very resource-intensive process (e.g., Gombos, 2006; Walczyk, Roper, Seeman, & Humphrey, 2003). According to the source-monitoring framework (Johnson et al., 1993), this cognitively demanding process could generate features consistent with a seen item, but would also generate cognitive operations involved in producing the description. If this information is remembered at test, this would allow people to accurately remember having lied.

The second type of lie used in the current study was lying by falsely denying having seen an item that was actually seen. Denying seeing something is conceptually similar to directed

forgetting research, where participants are told to forget specific items or lists of items (e.g., Bjork & Woodward, 1973; see also the think/no think paradigm, e.g., Anderson & Green, 2001). The general finding of this research is that intentional forgetting (or suppression) reduces later memory for the item. Note that researchers in this area typically don't ask participants to retrospectively remember what they were trying to do during the previous "rehearsal period" (i.e., to remember or forget), but instead evaluate item memory. This second type of lie may also be similar to research on simulated amnesia, where participants pretend that they do not remember details of an event (e.g., Christianson & Bylin, 1999; Van Oorsouw & Merckelbach, 2004). For instance, Van Oorsouw and Merckelbach (2004) had participants commit a mock crime and then had some participants simulate amnesia (i.e., pretend that they had trouble remembering what happened). They found that one week later, participants who had simulated amnesia and those in a no-rehearsal control group had worse memories for details of the original crime event compared to participants who had previously described the event truthfully. Although the participants who simulated amnesia were only claiming that they could not remember the crime details, rather than explicitly stating they did not take part in the crime, the memorial effects of "forgetting" certain details may be similar to the memorial effects of denying having seen certain items. But again, this study only evaluated item memory, rather than memory for having simulated amnesia or not. Another thing to note about falsely denying having seen something is that it may be a less cognitively demanding process than lying by falsely describing something. Rather than having to create false details that would seem believable, the participant only need say that they did not see the item. According to the source-monitoring framework (Johnson et al., 1993), this process should generate relatively few cognitive operations, thereby making this act of lying less memorable.

In addition to the type of lie that is told, another key manipulation in the current experiment concerns the manipulation of repetition. Specifically, participants will either lie or tell the truth about a picture once or thrice. The effect of this manipulation will be measured according to accuracy on source memory (i.e., whether items were studied or not, whether items were rehearsed or not, and if rehearsed, how so). The impact of repetition has the potential to improve memory for having lied or told the truth about an item. For example, in research examining the impact of repetition of misinformation in the eyewitness suggestibility paradigm (e.g., Zaragoza & Mitchell, 1996), repetition increases memory for having encountered the items in the context of the questionnaire. However, repetition also has the potential to harm source memory. For instance, Goff and Roediger (1998) had participants perform, imagine performing, or not perform a series of simple actions. Participants then imagined performing these actions various amounts of times. Later, they returned and were tested on their memories for which actions they had actually performed. Goff and Roediger found that the more participants imagined performing an action they had originally just heard or imagined, the more they incorrectly believed that they had actually performed the action in real life. Consistent with the source-monitoring framework, Goff and Roediger argued that repeatedly imagining the perceptual features of an event led the imagined actions to have similar perceptual features to the actually performed actions. Because of this similarity, the sources of imagined and perceived memories were highly confusable. Similarly, one can assume that when a person lies by describing something they haven't seen, they are imaging perceptual details about an event. When a person repeatedly lies they will be repeatedly imagining these perceptual details, making them more similar to and therefore more confusable with actually perceived details. Similarly, repeatedly suggesting misinformation increases participants' misattributions to the witnessed

event (e.g., Zaragoza & Mitchell, 1996) despite improved memory for also having read it in the questionnaire.

Current Experiment

The goal of the current study was to investigate the impact of telling different types of lies (i.e., falsely describing never-seen items and falsely denying having seen studied items) on a person's ability to determine the origin of a memory (i.e., their source memory). Furthermore, we assessed whether repetition would influence the effects of these different types of lies. This study consisted of three phases: a study phase, a rehearsal phase, and a test phase. During the study phase, participants viewed a series of pictures of objects and object labels. Then in the rehearsal phase, all participants later lied about some items and told the truth about others by describing the picture items or by denying they had seen them (i.e., a within-subjects design). Some items were rehearsed (i.e., lied or told the truth about) once, while others were rehearsed thrice. There was also a set of control items that did not appear during this rehearsal phase. Of these control items, some appeared during the study phase (i.e., they were studied but not rehearsed), and some did not appear during the study phase (i.e., they were neither studied nor rehearsed). Participants were videotaped while they provided their verbal responses, and a monetary reward was offered for the most successful deceiver (i.e., the person who provided the most believable lies). After completing the rehearsal task, participants returned two days later to complete the test phase, where they were tested on their memories for what happened during Session 1. Specifically, they completed a test that assessed their memories for the sources of information they encountered in Session 1 (i.e., whether items were studied or not, whether items were rehearsed or not, and if rehearsed, how so).

The first hypothesis is that participants will be more likely to remember having lied by falsely describing something than to remember having lied by falsely denying something. This hypothesis is based on the assumption that lying by describing involves greater effort and constructive processing such that participants should have better memory for the cognitive operations involved. According to the source-monitoring framework (Johnson et al., 1993), this should allow participants to more accurately remember the source of their memories. Note this hypothesis also suggests that participants will have poor memory for having previously denied seeing a studied picture.

The second hypothesis is that repetition will generally increase the accuracy of source memory for all rehearsed items, with one potential exception. In the case of descriptions, this is particularly clear because participants are cued repeatedly to construct descriptions, which should mean that participants should have stronger memory for the cognitive operations involved. Although repetition is likely to improve source accuracy for denials too, there is a potential that repetition could increase source-monitoring errors to items that were truthfully denied as well. This is because denial involves far less effort and constructive processing and thus, fewer cognitive operations. Thus, participants are likely to have poor memory for having made a denial. However, repetition is also known to increase the fluency of such items (e.g., the illusory truth effect; Begg, Anas, & Farinacci, 1992). If such fluency is not accompanied by memory for having denied seeing the item, this could increase erroneous claims of having studied it.

Method

Participants

Twenty-four undergraduate students (19 females, 5 males) from Louisiana State University participated for partial course credit. Normal, or corrected to normal, vision was required for participation. Mean age was 20.08 years. Sign-ups were conducted through the SONA system.

Materials

Stimuli were pictures of simple objects taken from Brady, Konkle, Alvarez, and Oliva (2008). Participants' verbal responses during the rehearsal phase in Session 1 were recorded using a camcorder, which sat on top of a tripod.

Design and Procedure

This study followed a 2 (Veracity: Lie, Truth) x 2 (Rehearsal Type: Deny, Describe) x 2 (Repetition: Once, Thrice) within-subjects factorial design. There were two additional types of control items: studied-no rehearsal items and unstudied- no rehearsal items. Thus, there were 10 types of items: 1) *studied lie-deny once* items (items that participants studied and later rehearsed once by falsely denying they had seen the corresponding picture), 2) *studied lie-deny thrice* items (items that participants studied and later rehearsed three times by falsely denying they had seen the corresponding picture), 3) *studied truth-describe once* items (items that participants studied and later rehearsed once by truthfully describing the corresponding studied picture), 4) *studied truth-describe thrice* items (items that participants studied and later rehearsed three times by truthfully describing the corresponding studied picture), 5) *studied no-rehearsal* items (i.e., items that participants studied but did not rehearse), 6) *unstudied truth-deny once* items (i.e., items that participants did not study and later rehearsed once by truthfully denying they had seen the

corresponding picture), 7) *unstudied truth-deny thrice* items (i.e., items that participants did not study and later rehearsed three times by truthfully denying they had seen the corresponding picture), 8) *unstudied lie-describe once* items (i.e., items that participants did not study and later rehearsed once by falsely describing the item as if they had seen the corresponding picture), 9) *unstudied lie-describe thrice* items (i.e., items that participants did not study and later rehearsed three times by falsely describing the item as if they had seen the corresponding picture), and 10) *unstudied no-rehearsal* items (i.e., items that participants did not study and did not later rehearse). Item type was counterbalanced so that across the experiment, each item was presented as each item type.

Participants were run individually across two sessions. Upon arrival to the lab for the first session, participants read and signed an informed consent. Participants then began the study phase, before which they were told that they would view a series of pictures on the computer screen, and to pay close attention to all of the items as they would be tested on them later. They then viewed a series of 26 pictures (two of which were later used as practice items). Under each picture appeared an item label (e.g., *apple*). Each study item appeared on the screen for 5000 ms, with a 1000 ms ISI between items.

After the study phase, participants entered the rehearsal phase (which began with four practice trials). During this phase, a series of labels was presented on the screen. Some of these labels corresponded to pictures that were presented during the study phase (i.e., studied items) and others did not correspond to pictures presented during the study phase (i.e., unstudied items). Along with each label were instructions to lie or tell the truth about the corresponding picture. For studied items, participants would lie by falsely saying that they had not seen the picture (i.e. studied lie-deny once items and studied lie-deny thrice items), or they would tell the truth by

accurately describing the picture they saw (i.e., studied truth-describe once items and studied truth-describe thrice items). For unstudied items, participants would tell the truth by saying that they had not seen the picture (i.e., unstudied truth-deny once items and unstudied truth-deny thrice items), or they would lie by falsely describing the picture as if they had seen it (i.e., unstudied lie-describe once items and unstudied lie-describe thrice items). So, for example, participants would see the word *house* on the screen. If a picture of a house *was* studied during the study phase, they would see one of the following instructions under this label: *tell the TRUTH by accurately describing the house* or *LIE by saying that you did not see the house*. If a picture of a house *was not* studied during the study phase, they would see one of the following instructions under the label: *tell the TRUTH by saying that you did not see the house* or *LIE by falsely describing the house*. Participants were told to keep their responses consistent for repeated items. There were four items of each item type presented during the rehearsal phase (i.e., studied lie-deny once, studied lie-deny thrice, studied truth-describe once, studied truth-describe thrice, unstudied truth-deny once, unstudied truth-deny thrice, unstudied lie-describe once, and unstudied lie-describe thrice items). Therefore, with repeats, the 32 rehearsal items were presented across 64 rehearsal trials. Control items (i.e., studied no-rehearsal items and unstudied no-rehearsal items) did not appear during the rehearsal phase.

Participants responded aloud to each item according to the presented instructions while being video recorded. The camcorder was positioned so that their faces and upper bodies were captured, but not the computer screen or keyboard. Participants were told that another group of people would later be watching their video footage and attempting to detect their lies, and that the participant who was rated to be the most believable would receive $50. After participants provided a response to any given item, the experimenter clicked the mouse and the next rehearsal

item appeared on the computer screen. After completing the rehearsal phase, participants answered a series of post-session questions. After answering these questions, they were dismissed from Session 1.

Forty-eight hours later participants returned for Session 2, during which they completed a 48-item source test. It was emphasized to them that their responses during Session 2 should be completely truthful (i.e., based on what they actually saw). During the source test, a series of labels naming both studied and unstudied pictures appeared on the screen. For each label, participants chose one of six response options that best described the corresponding item: 1) I studied this item but falsely denied seeing it on camera, 2) I studied this item and truthfully described it on camera, 3) I studied this item but did not talk about it on camera, 4) I did not study this item and truthfully denied seeing it on camera, 5) I did not study this item but falsely described it on camera, and 6) I did not study this item and did not talk about it on camera. There were eight test items that corresponded to each of the six possible response options (i.e., "sources"). After the source test, participants completed a cued recall measure. This measure is not the focus of this paper and will not be discussed further. Then, they were debriefed and dismissed.

Results

Post-Session Questions

One key assumption of the hypotheses is that participants would exert more effort (and thus increase the availability of cognitive operations) when they described pictures than when they denied having seen them. After completing the rehearsal phase, participants were asked to rate the difficulty of rehearsing each different item type on a scale of 1 (*not at all difficult*) to 7 (*very difficult*). On average, participants rated the difficulty of truthfully describing an item as 3.67 (SD = 1.71), the difficulty of truthfully denying an item as 2.13 (SD = 1.57), the difficulty of falsely describing an item as 4.21 (SD = 2.15), and the difficulty of falsely denying an item as 2.08 (SD = 1.28). A 2 (Veracity: Lie, Truth) x 2 (Rehearsal Type: Deny, Describe) repeated measures ANOVA was conducted on reported difficulty. There was a significant main effect of Rehearsal Type, $F(1, 23) = 23.10$, $p < .001$, $\eta_p^2 = .50$. As predicted, participants rated describing (M = 3.94, SE = .30) as more difficult than denying (M = 2.10, SE = .26). There was no main effect of Veracity, $F(1, 23) = .59$, $p = .45$, $\eta_p^2 = .03$. There was no significant interaction, $F(1, 23) = 1.02$, $p = .323$, $\eta_p^2 = .04$.

Source Memory Accuracy

As mentioned previously, participants had six possible response options for each test item: I studied this item but falsely denied seeing it on camera, I studied this item and truthfully described it on camera, I studied this item but did not talk about it on camera, I did not study this item and truthfully denied seeing it on camera, I did not study this item but falsely described it on camera, and I did not study this item and did not talk about it on camera. Source test responses were considered accurate if the participant correctly categorized what happened with that item in both the study phase and the rehearsal phase (e.g., a studied lie-deny once item that

was correctly classified as "I studied this item but falsely denied seeing it on camera"). Source test responses were considered inaccurate if the participant did not correctly categorize what happened with that item in both the study and rehearsal phases (e.g., if a studied lie-deny once item was incorrectly classified as "I did not study this item and truthfully denied seeing it on camera").

To compare source test accuracy for the different item types, a 2 (Veracity: Lie, Truth) x 2 (Rehearsal Type: Deny, Describe) x 2 (Repetition: Once, Thrice) repeated measures ANOVA was conducted on the mean proportion of accurate source test responses for all item types that were rehearsed. As seen in Figure 1, there was a main effect of Rehearsal Type, $F(1, 23) = 243.98$, $p < .001$, $\eta_p^2 = .91$. As predicted, source accuracy was significantly higher for items that

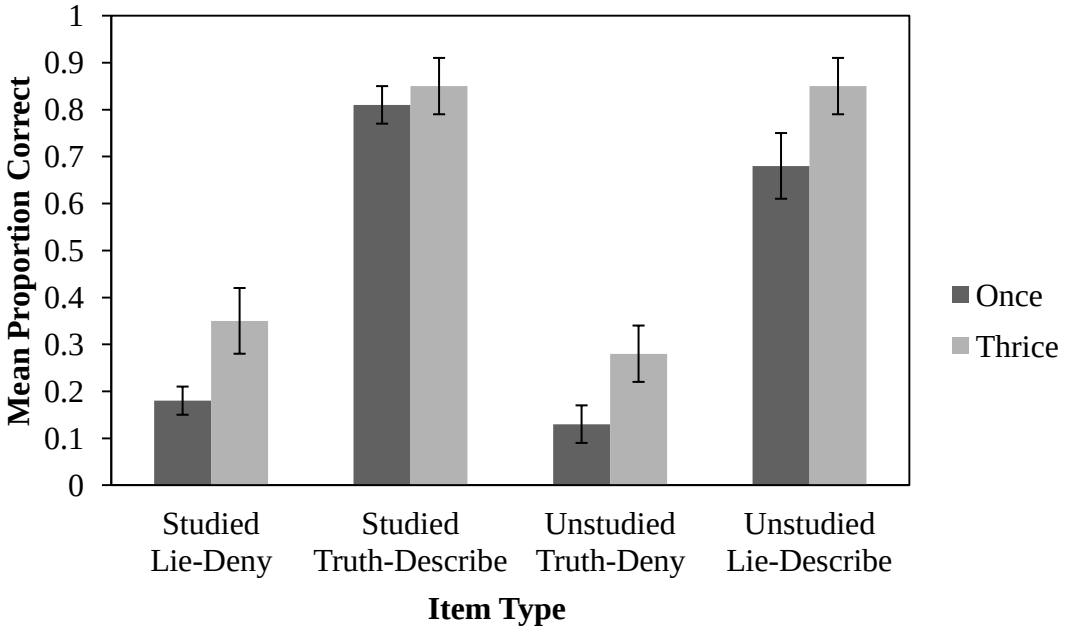

Figure 1. Mean proportion of correct source responses for each item type. Error bars represent mean standard errors.

were described ($M = .80$, $SE = .03$) than for items that were denied ($M = .23$, $SE = .03$). Notably, the reduced source accuracy for studied lie-deny once and studied lie-deny thrice items resulted

primarily from forgetting the act of denying rather than forgetting having studied the item. As can be seen in Table 1, the predominant source response to studied lie-deny once and studied lie-deny thrice items was "I studied this item but did not talk about it on camera." As predicted, there was also a main effect of Repetition, $F(1, 23) = 8.06$, $p = .009$, $\eta_p^2 = .26$. Source accuracy was significantly higher for items that were rehearsed thrice ($M = .59$, $SE = .04$) than for items that were rehearsed once ($M = .45$, $SE = .03$). There was no main effect of Veracity, $F(1, 23) = 0.01$, $p = .928$, $\eta_p^2 \approx .0001$. Source accuracy did not differ for items that were lied about ($M = .52$, $SE = .03$) and those that were told the truth about ($M = .52$, $SE = .03$). There was no significant interaction between Veracity and Rehearsal Type, $F(1, 23) = 1.94$, $p = .177$, $\eta_p^2 = .08$. There was no significant interaction between Veracity and Repetition, $F(1, 23) = 1.83$, $p = .189$, $\eta_p^2 = .07$. There was no significant interaction between Rehearsal Type and Repetition, $F(1, 23) = .89$, $p = .355$, $\eta_p^2 = .04$. Finally, there was no significant three-way interaction between Veracity, Rehearsal Type, and Repetition, $F(1, 23) = .98$, $p = .332$, $\eta_p^2 = .04$. See Table 1 for descriptive statistics of accurate and inaccurate responses for each item type.

Accurate and False Memory for Having Studied Items

The above analysis assessed how precisely participants remembered encountering the items in both the study phase and the rehearsal phase. However, another important question concerns how the manipulations affected participants' memories for having studied a picture, regardless of whether or not they remember if and how it was rehearsed. Thus, source performance was assessed in two additional ways: 1) the rate of accurately remembering having seen a studied item during the study phase, and 2) the rate of inaccurately "remembering" having seen an unstudied item during the study phase. To obtain these measures, participants' responses were classified as "studied" or "unstudied." More specifically, for any given test item, responses

Table 1

Mean Proportion of Source Responses for Each Item Type

	Response Options					
Item Type	"I studied this item but falsely denied seeing it on camera"	"I studied this item and truthfully described it on camera"	"I studied this item but did not talk about it on camera"	"I did not study this item and truthfully denied seeing it on camera"	"I did not study this item but falsely described it on camera"	"I did not study this item and did not talk about it on camera"
Studied Lie-Deny Once	**.18** (.03)	.03 (.02)	.53 (.05)	.08 (.03)	.02 (.01)	.16 (.04)
Studied Lie-Deny Thrice	**.35** (.07)	.05 (.03)	.34 (.05)	.09 (.04)	.00 (.00)	.16 (.04)
Studied Truth-Describe Once	.04 (.02)	**.81** (.04)	.04 (.02)	.00 (.00)	.09 (.03)	.01 (.01)
Studied Truth-Describe Thrice	.02 (.02)	**.85** (.06)	.01 (.01)	.00 (.00)	.08 (.04)	.03 (.03)
Studied No Rehearsal	.02 (.01)	.01 (.01)	**.51** (.04)	.03 (.01)	.03 (.01)	.41 (.04)
Unstudied Truth-Deny Once	.01 (.01)	.00 (.00)	.10 (.03)	**.13** (.04)	.00 (.00)	.76 (.05)
Unstudied Truth-Deny Thrice	.06 (.03)	.00 (.00)	.22 (.06)	**.28** (.06)	.02 (.01)	.42 (.06)
Unstudied Lie-Describe Once	.02 (.01)	.05 (.02)	.05 (.02)	.06 (.03)	**.68** (.07)	.14 (.05)
Unstudied Lie-Describe Thrice	.03 (.02)	.07 (.04)	.00 (.00)	.01 (.01)	**.85** (.06)	.03 (.03)
Unstudied No Rehearsal	.01 (.01)	.01 (.01)	.08 (.03)	.04 (.02)	.01 (.01)	**.86** (.04)

Note. Values for correct source responses are in boldface. Standard errors are in parentheses.

of “I studied this item but falsely denied seeing it on camera”, “I studied this item and truthfully described it on camera”, and “I studied this item but did not talk about it on camera” were collapsed into a *studied* response category (i.e., the participant indicated that the test item was seen during the study phase). Likewise, responses of “I did not study this item and truthfully denied seeing it on camera”, “I did not study this item but falsely described it on camera”, and “I did not study this item and did not talk about it on camera” were collapsed into an *unstudied* response category (i.e., the participant indicated that the test item was not seen during the study phase). See Table 2 for descriptive statistics.

Table 2

Mean Proportion of “Studied” Responses for Each Item Type

Item Type	Mean	SE
Studied Lie-Deny Once	**.74**	.05
Studied Lie-Deny Thrice	**.75**	.06
Studied Truth-Describe Once	**.90**	.03
Studied Truth-Describe Thrice	**.89**	.05
Studied No Rehearsal	**.53**	.04
Unstudied Truth-Deny Once	.11	.03
Unstudied Truth-Deny Thrice	.28	.05
Unstudied Lie-Describe Once	.13	.04
Unstudied Lie-Describe Thrice	.10	.04
Unstudied No Rehearsal	.09	.03

Note. Values for correct “studied” responses are in boldface.

A one-way repeated measures ANOVA was conducted to compare the effect of each studied item type (i.e., studied lie-deny once, studied lie-deny thrice, studied truth-describe once,

studied truth-describe thrice, and studied no rehearsal) on the mean proportion of accurate "studied" responses (i.e., accurate recognition). There was a significant effect of item type, $F(4, 92) = 13.35$, $p < .001$, $\eta_p^2 = .37$. Four follow-up paired samples t-tests were conducted to compare accurate recognition for each studied item type that was rehearsed (i.e., studied lie-deny once, studied lie-deny thrice, studied truth-describe once, and studied truth-describe thrice) to performance on the studied no-rehearsal control items. One follow-up paired-samples t-test was conducted to compare accurate recognition for studied lie-deny items and studied truth-describe items (i.e., when collapsed across repetition). A Bonferroni correction was applied to these follow-up t-tests ($p < .01$). All four rehearsal types differed significantly from the studied no-rehearsal condition. Specifically, accurate recognition was greater for studied lie-deny once items ($M = .74$, $SD = .24$) than for studied no-rehearsal items ($M = .53$, $SD = .21$), $t(23) = 4.92$, $p < .001$. Accurate recognition was greater for studied lie-deny thrice items ($M = .75$, $SD = .29$) than for studied no-rehearsal items, $t(23) = 3.0$, $p = .006$. Accurate recognition was greater for studied truth-describe once items ($M = .90$, $SD = .16$) than for studied no-rehearsal items, $t(23) = 7.23$, $p < .001$. Accurate recognition was greater for studied truth-describe thrice items ($M = .89$, $SD = .23$) than for studied no-rehearsal items, $t(23) = 6.89$, $p < .001$. Thus, both lying and describing had the effect of increasing accurate claims of having studied relative to a control condition. However, as can be seen in Table 2, denials appeared to lead to poorer retention than descriptions. In order to compare accuracy for studied lie-deny versus studied truth-describe items, studied lie-deny once and studied lie-deny thrice items were collapsed into one studied lie-deny category, and studied truth-describe once and studied truth-describe thrice items were collapsed into one studied truth-describe category. Participants were significantly more accurate

in remembering having studied items that were later truthfully described (M = .89, SD = .15) compared to items that were later falsely denied (M = .74, SD = .23), $t(23) = -3.34$, p = .003.

A one-way repeated measures ANOVA was conducted to compare the effect of each unstudied item type (i.e., unstudied truth-deny once, unstudied truth-deny thrice, unstudied lie-describe once, unstudied lie-describe thrice, and unstudied no rehearsal) on the mean proportion of inaccurate "studied" responses (i.e., false recognition). Mauchly's Test of Sphericity indicated that the assumption of sphericity had been violated, $\chi^2(9) = 17.59$, p = .041. Therefore, degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity ($\varepsilon = 0.7$). There was a significant effect of Item Type, $F(2.80, 64.36) = 4.97$, p = .004, η_p^2 = .18. Four follow-up paired samples t-tests were conducted to compare false recognition for each unstudied item type that was rehearsed (i.e., unstudied truth-deny once, unstudied truth-deny thrice, unstudied lie-describe once, and unstudied lie-describe thrice) to false recognition for unstudied no-rehearsal control items. A Bonferroni correction was applied to these follow-up t-tests ($p < .01$). The only unstudied rehearsal type that differed significantly in false recognition from the unstudied no-rehearsal items was the unstudied truth-deny thrice item type. Specifically, false recognition did not differ for unstudied truth-deny once items (M = .12, SD = .16) and unstudied no-rehearsal items (M = .09, SD = .17), $t(23) = .68$, p = .504. False recognition did not differ for unstudied lie-describe once items (M = .13, SD = .18) and unstudied no-rehearsal items, $t(23) = .86$, p = .397. False recognition did not differ for unstudied lie-describe thrice items (M = .10, SD = .22) and unstudied no-rehearsal items, $t(23) = .36$, p = .726. However, false recognition was significantly greater for unstudied truth-deny thrice items (M = .28, SD = .27) than for unstudied no-rehearsal items, $t(23) = 3.20$, p = .004. To follow-up on this finding, and to demonstrate the role of repetition in increased false recognition, performance in the unstudied

truth-deny once and thrice items were contrasted in a final t-test. This revealed that participants were in fact more likely to falsely recognize an unstudied item when that item had previously been truthfully denied three times (M = .28, SD = .27) than when it had previously been truthfully denied once (M = .11, SD = .16), $t(23) = -4.00$. Thus, repeated truthful denials of having seen unstudied items had the paradoxical effect of later increasing false recognition.

Source Accuracy Response Times

Participants' response times on the source test were collected and used as an indicator of the accessibility of information for source decisions. A 2 (Veracity: Lie, Truth) x 2 (Rehearsal Type: Deny, Describe) x 2 (Repetition: Once, Thrice) repeated measures ANOVA was conducted on mean median response time (RT) for source test responses. There was a main effect of Veracity, $F(1, 23) = 25.33$, $p < .001$, $\eta_p^2 = .52$. Participants were significantly slower in responding to items that were lied about during the rehearsal phase (M = 5821.16, SE = 292.13) than to items that were truthfully rehearsed (M = 4878.69, SE = 280.58). Thus, in contrast to the null effect of veracity in the source *accuracy* data, it appears that lying had the effect of slowing test responses 48 hours later. There was no significant main effect of Rehearsal Type, $F(1, 23) = 3.98$, $p = .058$, $\eta_p^2 = .15$. There was no significant effect of Repetition, $F(1, 23) = 3.89$, $p = .061$, $\eta_p^2 = .15$. However, there was a significant interaction between Rehearsal Type and Repetition, $F(1, 23) = 7.60$, $p = .011$, $\eta_p^2 = .25$. Follow-up t-tests revealed that participants were slower in responding to items that they had previously denied thrice (M = 6053.97, SD = 2404.85) compared to items that they had previously denied once (M = 5026.72, SD = 1857.96), $t(29) = -2.70$, $p = .012$. However, response time did not significantly differ for items that they had previously described thrice (M = 4740.1, SD = 1387.01) compared to items that they had previously described once (M = 5146.5, SD = 1070.25), $t(29) = 1.60$, $p = .121$. In other words,

repeated denials (whether truthful or not) had the effect of slowing responses, while repeated descriptions (whether truthful or not) did not affect the speed of responding.

Discussion

In the current study, participants lied or told the truth by describing items or denying they had seen them, rehearsing some items once and others thrice. Two days later they returned to complete a source test. Consistent with the predictions of the source-monitoring framework, the act of denial was less memorable than was the act of falsely describing. Additionally, repeated lying increased source memory accuracy for both lie types. Interestingly, repetition did increase one type of source monitoring error: Repeated truthful denials of having seen never-studied pictures later increased incorrect claims of having studied those pictures.

These findings both support and extend Polage's (2004) work on lying and memory. Polage found that having participants repeatedly create false details of a childhood event that never occurred led most participants to become more confident that these events did not happen. In line with Polage's findings, having participants create false descriptions of items that were never actually seen led to more accurate memories that these items had never been studied, a finding that became stronger with repetition. However, the current study also showed that lying does not *always* strengthen source memory accuracy. When participants lied by falsely denying having seen an item, they were less likely to remember having lied about this item.

On the face of it, the current findings seem to conflict with those of Pickel (2004). Pickel found that falsely describing the appearance of a target character led to *less accurate* memories for that character. However, Pickel tested her participants one week after lying. Over the 48-hour delay of this experiment, participants seemed to remember having constructed their false description, which allowed them to accurately remember having lied. It may be possible that with extended time people would only remember the constructed details, but not the act of

construction. This forgetting might lead them to falsely claim to have seen the pictures in the present study.

The findings of the current study are consistent with the source-monitoring framework and previous empirical research on source monitoring. Participants' poorer source memory for deny items relative to describe items indicates that the deny items had fewer associated features – presumably the cognitive operations involved in creating the lie – that could be used to accurately discern their original source. Furthermore, the act of repetition increased source memory accuracy (see also Zaragoza & Mitchell, 1996), a finding that is consistent with the prediction that repetition should increase the number or strength of encoded features.

However, repetition also led to a certain type of false memory: With repetition, items that were truthfully denied were increasingly likely to be incorrectly called "studied." Because the act of denying was so easily forgotten, repeatedly denying an item may have simply increased that item's familiarity without increasing memory for the source of that familiarity. Such effects of repetition-induced familiarity and the resulting errors in source monitoring have been investigated in other lines of research. For instance, work on the illusory truth effect shows that repeatedly presenting statements that were previously classified as false can lead people to later rate these statements as true. This finding is presumably caused by the persistence of familiarity even when recollection is impaired (Begg et al., 1992). Work on the false fame effect shows that repeatedly presenting non-famous names can lead participants to later rate these names as famous, if they do not remember having previously studied the non-famous names (Jacoby, Woloshyn, & Kelley, 1989). This research emphasizes the role of recollection in opposing familiarity. The effects of relying on such familiarity in the absence of recollection can be conceptually related to the current study's finding of increased incorrect "studied" responses to

items that participants had truthfully denied seeing multiple times. If participants had in fact recollected how those items were processed in the rehearsal phase, they would have remembered truthfully denying them. But, because denials were not memorable, the familiarity associated with repeated rehearsals was apparently misattributed to the familiarity of having seen the item in the study phase.

The current study has several strengths. First, the findings show that different types of lies can have different effects on source memory. These findings, along with related neuroimaging research (e.g., Ganis et al., 2003; Ganis, Morris, & Kosslyn, 2008), suggest that researchers should take into account the variability of lies when studying deception. Second, unlike previous research on lying (e.g., Polage, 2004), repetition was directly manipulated. This manipulation was critical in uncovering, for example, the paradoxical effects of repeatedly denying seeing unstudied items on source misattribution errors. Third, through our post-session questions and response time measures, we were able to assess the impact of lying beyond what could be observed from test accuracy. The post-session questions revealed that lying, which is generally understood to be a very cognitively demanding task, can actually vary in perceived difficulty depending on what type of lie is told. Furthermore, the difference in response times between lie and truth items indicates that some effects of lying may persist even when memory accuracy is not affected.

Despite these strengths, the current study was not without limitations. First, although different types of lies were used (i.e., lying by describing and lying by denying), these are only two types of the many different lies that can be told. Therefore, future work on lying and memory should take into consideration other types of lies (e.g., self-related versus other-related lies; see Ganis et al., 2008). Second, although there was a benefit to our participants for lying

convincingly (i.e., the potential to win a $50 reward), there was essentially no consequence for them for not doing so. In other words, this task utilized low-stakes lies. In real life, however, there are high-stakes situations where being caught lying can have serious ramifications, such as prosecution. It is unclear whether lying in these situations would have more or less of an effect on memory (and a matter for future research). Regardless, these results still have relevance for real-world lying because people more commonly lie in lower stakes situations (e.g., a student who lies to a professor about the reasons for an absence). Consistent with this argument, participants in the current study rated the frequency of telling serious lies in their own lives as very low (and lower than the frequency of telling minor "little white" lies), thus supporting the relevance of using such low-stakes lies in studies of deception.

Although this is an initial study, there are nevertheless implications for the legal system. Although sometimes people may unwittingly describe their memories erroneously, other times such errors are deliberate, as with the opening example of a suspect being interviewed by an investigator. The findings here indicate that in such a scenario, the interviewee may not always remember the source of such deliberate misinformation (i.e., themselves), particularly when they deny having seen something they actually saw. In the context of repeated interviews, this might suggest that liars would be more likely to forget previous denials than they are to forget previous false descriptions. Thus, investigators may be able to capitalize on this by structuring questions in later interviews in such a way that liars might end up contradicting themselves (e.g., by endorsing something that they previously denied). However, the results also revealed a surprising way that repeated interviews might end up creating false memories. Specifically, truthful repeated denials of having seen an item later led participants to incorrectly remember approximately 30% of the time that they had in fact seen the item. Thus, there is a possibility

that interviewees might end up believing they actually remember incidents that they had been repeatedly questioned about.

Everyone lies, but we can lie in different ways. These differences matter when it comes to memory. Specifically, the current findings suggest that certain types of lies may harm or help a person's ability to accurately determine the source of such self-generated misinformation. Memory for such information is critical for consistently telling one's story over time. Thus, knowing more about how lying affects memory not only helps us to understand more about the nature of the cognitive processes underlying lying, but may also provide potential avenues for catching liars.

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Appendix: IRB Form

Application for Exemption from Institutional Oversight

Institutional Review Board
Dr. Robert Mathews, Chair
131 David Boyd Hall
Baton Rouge, LA 70803
P: 225.578.8692
F: 225.578.6792
irb@lsu.edu
lsu.edu/irb

Unless qualified as meeting the specific criteria for exemption from Institutional Review Board (IRB) oversight, ALL LSU research/ projects using living humans as subjects, or samples, or data obtained from humans, directly or indirectly, with or without their consent, must be approved or exempted in advance by the LSU IRB. This Form helps the PI determine if a project may be exempted, and is used to request an exemption.

– Applicant,Please fill out the application in its entirety and include the completed application as well as parts A-E, listed below, when submitting to the IRB. Once the application is completed, please submit two copies of the completed application to the IRB Office or to a member of the Human Subjects Screening Committee. Members of this committee can be found at http://www.lsu.edu/screeningmembers.shtml

– A Complete Application Includes All of the Following:
(A) Two copies of this completed form and two copies of part B thru E.
(B) A brief project description (adequate to evaluate risks to subjects and to explain your responses to Parts 1&2)
(C) Copies of all instruments to be used.
*If this proposal is part of a grant proposal, include a copy of the proposal and all recruitment material.
(D) The consent form that you will use in the study (see part 3 for more information.)
(E) Certificate of Completion of Human Subjects Protection Training for all personnel involved in the project, including students who are involved with testing or handling data, unless already on file with the IRB. Training link: (http://phrp.nihtaining.com/users/login.php.)
(F) IRB Security of Data Agreement: (http://www.lsu.edu/irb/IRB%20Security%20of%20Data.pdf)

1) Principal Investigator: Kathleen Vieira **Rank:** Graduate Student

Dept: Psychology **Ph:** (305) 608-5255 **E-mail:** kvieir1@tigers.lsu.edu

2) Co Investigator(s): please include department, rank, phone and e-mail for each

Sean Lane, Associate Professor, Dept of Psychology; x4098, slane@lsu.edu

IRB# E5167 LSU Proposal #

☒ Complete Application

☒ Human Subjects Training

3) Project Title: Communicating Descriptions

Study Exempted By:
Dr. Robert C. Mathews, Chairman
Institutional Review Board
Louisiana State University
203 B-1 David Boyd Hall
225-578-8692 | www.lsu.edu/irb
Exemption Expires: 8-22-2013

4) Proposal? (yes or no) No **If Yes, LSU Proposal Number**

Also, if YES, either ◯ **This application completely matches the scope of work in the grant**

OR ◯ **More IRB Applications will be filed later**

5) Subject pool (e.g. Psychology students) Psychology students

*Circle any **"vulnerable populations" to be used**: (children <18; the mentally impaired, pregnant women, the ages, other). Projects with incarcerated persons cannot be exempted.

6) PI Signature [signature] **Date** 8/20/10 (no per signatures)

** **I certify my responses are accurate and complete.** If the project scope or design is later changes, I will resubmit for review. I will obtain written approval from the Authorized Representative of all non-LSU institutions in which the study is conducted. I also understand that it is my responsibility to maintain copies of all consent forms at LSU for three years after completion of the study. If I leave LSU before that time the consent forms should be preserved in the Departmental Office.

Screening Committee Action: Exempted ✓ Not Exempted ____ Category/Paragraph 2

Reviewer Mathews **Signature** [signature] **Date** 8/23/10

Vita

Kathleen Vieira was born in Caracas, Venezuela, in 1987, to parents Anna and Andrew Vieira. She attended primary schools in London, England; Concord, California; and Miami, Florida. She graduated from Coral Reef Senior High School in Miami, Florida in 2005.

In the fall of 2005, Kathleen began her undergraduate studies at the University of Florida. While at university, she majored in psychology and worked as a research assistant in two cognitive psychology labs under the direction of Dr. Ira Fischler and Dr. Lise Abrams. She received additional training through summer internships in developmental psychology labs at the University of Maryland, College Park (American Psychological Association Summer Science Fellowship) and Furman University in Greenville, South Carolina (Howard Hughes Medical Institute Science for Life, Women in Science program). Kathleen received her Bachelor of Sciences degree in the spring of 2009, graduating *Cum Laude*.

In the fall of 2009, Kathleen received the Huel D. Perkins Diversity Fellowship, and began her graduate studies at Louisiana State University in the cognitive psychology doctoral program under the direction of Dr. Sean Lane. Since coming to Louisiana, she has co-authored four conference presentations at national and international conferences. She has co-authored one in-press article, and has several additional manuscripts in preparation. She will receive her Master of Arts degree in May 2012.