EFFECTS OF MENTAL IMAGERY AND COGNITIVE STYLE ON SOURCE MEMORY

by

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Abstract

Eyewitness testimony plays a crucial part in the legal system. One type of information that witnesses are often asked about relates to how they obtained the information they have. Did they see it? Hear it? Read about it? The present paper examines two factors that might influence how well a person can remember the source of the information they have: (1) cognitive style and (2) vividness of visual imagery. Cognitive style refers to the modality in which an individual most readily processes information, and vividness of visual imagery refers to the clarity and precision with which someone conjures visual images in their mind. The literature is generally mixed on the effects of variations of these factors on source memory errors. Some studies show that people who have a visual cognitive style have an advantage over people with a verbal cognitive style, yet other studies show them to have no advantage. On the other hand, people with highly vivid mental imagery tend to have poorer memory for sources than do people with non-vivid imagery. These divergent results call for more research that examines these factors together in the same participants. Furthermore, there are notable limitations to the literature and the methods used therein. In the future, there should be studies that address the limitations considered in this article related to the way individual differences are measured and the order in which those tests are administered. Doing so would deepen our understanding of the role of mental imagery on source memory, which has important implications in the context of eyewitness testimony scenarios.

Effects of Mental Imagery and Cognitive Style on Source Memory

We often rely on the testimony of eyewitnesses for establishing the facts of an event, but it is important to keep in mind that there are a variety of ways in which eyewitnesses can misremember what they experienced. For example, when reporting that a suspect was wielding a gun, a witness might misremember how they got that information: perhaps they remembered seeing the gun themselves when in reality they heard someone else say that there was a gun present. The process by which an individual attempts to recall if information they encoded earlier was presented in a certain format (e.g., visually, aurally, pictorially, or verbally) or from a particular origin (e.g., first-hand experience, a second-hand description, a dream, a movie, or a reading) is called *source monitoring*. This paper will focus on the ways in which individual differences in how people process information might explain when and how source monitoring errors arise.

One factor on which people differ that might influence their ability to source monitor is cognitive style. One of the most commonly studied spectrums is between verbal and visual processing style (Mayer & Massa, 2003). People who have a visual cognitive style can be described as high imagers and those who have non-visual cognitive styles can be called low imagers. It is important to note, though, that two common questionnaires—the Visualizer-Verbalizer Questionnaire (VVQ) and the Style of Processing Questionnaire (SOP)—are designed to measure processing on a scale from verbal to visual processing (Richardson, 1977; Childers, Houston & Hecklers, 1985). As a result, low imagers are often described as verbalizers in the case of those two scales. Low imagers, then, are more attuned to verbal and auditory information; their thinking takes shape in words more than images. On the other hand, the thoughts of those with a visual style involve more imagery and their processing is more attuned to visually presented information. Cognitive style has been associated with differences in recognition memory, learning preference, and consumer behavior (Stephan-Otto et. al, 2017; Mayer & Massa, 2003; Childers, Houston & Heckler, 1985; respectively).

A second individual difference factor that might influence source monitoring is a person's mental imagery ability. Research has found that mental imagery activates many of the same regions in the brain as does visual perception of an external stimulus. It is possible that when individuals with high imagery precision recall events, they activate representations that are more similar to actual perception than do individuals with low imagery precision. In other words, they remember what they imagined with less differentiation from what they experience compared to individuals with low imagery precision. People who have high vividness in their visual imagery can be described as vivid imagers, while those who have low vividness can be called non-vivid imagers. Vivid imagers could therefor show higher rates of source misattribution than non-vivid imagers because their memories are more confusable with actual perception. Alternatively, the opposite might instead be true. It could be that people with vivid imagery precision also encode the source of the information with high fidelity, leading to lower rates of source misattribution than non-vivid imagers. This paper will examine how cognitive style and mental imagery ability might together explain source monitoring performance.

Source Monitoring

Source monitoring is best described as a form of memory. It refers specifically to the processes involved in attributing the content of certain memories to the context, material, and source from which it was derived (Johnson, Hashtroudi, & Lindsay, 1993). In their review, Johnson and colleagues parse out the characteristics of memory as including "perceptual information…contextual information…semantic detail…affective information…and cognitive operations…that were established when the memory was formed" (Johnson, Hashtroudi, & Lindsay, 1993, pg 4). These components could shine a light on the areas of source monitoring with which mental imagery and cognitive style might interact. Perceptual information, for example, is likely going to be more visual in nature for a high imager. Consequently, high imagers may be more likely to retrieve information using the perceptual information as a guide, which may cause them to skip over other parts of their memory that would fill in missing data or show a perceptual detail to be false.

The task of accessing perceptual information, context, semantic details, and cognitive operations likely means engaging in a deeper, more naturalistic form of recollection. If a person looks at a series of decontextualized pictures, and then has to look at another series later and indicate if any were previously presented, they need not access most of the information normally used in retrieval. This is because all they would need to do to succeed in the task is simply decide if the item itself is familiar or not, as opposed to activating a specific, episodic memory of being presented with that object. A familiarity criterion such as this one, though, might cause participants to make more errors. For example, seeing a beaker during the test phase of an experiment might be perceptually similar enough to an image of a graduated cylinder that was previously presented to produce a sense of familiarity. If this sense of familiarity is strong enough, it could result in a false alarm. However, according to Johnson and colleagues, using a source monitoring task reduces errors like this one.

Source monitoring tasks involve showing participants information in one of two possible formats, like pictures and words, and then showing them items again later and asking in which format they saw the original item. In tasks such as this one, participants must recall the specific episode of being presented with the original object as opposed to being able to respond based on whether the item vaguely rings a bell. This task is more naturalistic because we never encounter decontextualized items in everyday experience. It tends to lead to better memory performance because it requires that people activate specific episodes; that is, good performance requires that people activate the perceptual context of each item more so than do other measures of memory. At the same time, Johnson and colleagues reported that there were times when using a source monitoring paradigm was insufficient to reduce error. This raises questions for future research about what kinds of variables may affect the way that people perform on source monitoring tasks. One possibility is that individual differences in participants such as cognitive style and vividness of imagery might modulate performance in source monitoring tasks.

The perceptual role of imagery in memory

Visual, auditory, gustatory, and olfactory information is processed and represented in different parts of the brain. To what extent are these modality-specific brain areas involved in the formation and retrieval of memory? In one study on the topic of imagery, participants performed a source memory task in an fMRI so that the relative roles of the hippocampus and perceptual cortex could be measured (Gordon, Rissma, Kiani, &Wagner, 2013). The strength of hippocampal activation was greater at both encoding and retrieval when there was also greater signal strength from the modality-specific parts of the brain forming cortical representations of the perceptual or imaginal experience. In other words, when the task was visual, the hippocampus activated strongly while the visual parts of the brain were engaged in response to external stimuli or in the process of imagination.

In this article, they use the term “cortical reinstatement”, and it refers to the reactivation of regions in the brain during retrieval that correspond with the retrieval of a mental representation formed during encoding. They created a model of cortical reinstatement by measuring the contrast between the differences in activation across successful versus unsuccessful retrieval and the encoding that came prior. They learned that stronger activations representing cortical reinstatement predicted more accurate retrieval. For the present review, this can have implications. The scaled activation of the hippocampus with modality-specific regions--like visual regions--can be interpreted as a source of both memory error and accuracy in high visual imagers. If the hippocampus is more strongly active along with the regions that are correlated with forming both imaginary and perceptual details, then it makes sense that there would be more complications during retrieval if the person remembering had vivid mental imagery at time of encoding. There may be a higher likelihood of source confusion, but there could also be stronger accurate representations if they are perceiving visual stimuli and pairing that with hippocampal activation.

Gonsalves and colleagues (2004) set out to examine what activations in the brain occur during the encoding of a memory when participants use visual imagery at the time of study. While each of the eleven participants were in an MRI scanner, researchers presented written words, images, and spoken words and told participants to generate a visual image corresponding to each object. After this study phase and a retention interval, researchers read out words that had been presented with a photo, words that had been presented without a photo, and words that were not presented at all; participants had to indicate if they saw a picture of the item or not. Their imaging results showed similar activation of the precuneus and right inferior parietal cortex between the encoding of word-only trials later remembered incorrectly as including a photo and the encoding of forgotten word-plus-photo trials. The precuneus is known for involvement in memory retrieval, mental self-representations, sense of agency, and visuo-spatial imagery (Cavanna & Trimble, 2006). The right inferior parietal cortex is known for its involvement in sensory feedback during motor learning, sense of agency, and attention (Halsband & Lange, 2006; Chambon, Moore, & Haggard, 2015; Singh-Curry & Husain, 2009, respectively). Their theory is that conjuring strong visual imagery at encoding could either cause, in a word-only trial, the production of an image that is later misremembered as perceived or, in a word-plus-photo trial, distracting from the perception, and subsequently distracting from encoding of the image that was present. It is possible, however, that the results of this study are skewed because there are no measures that account for individual differences in imagery. That leaves possibilities for research in this area that take individual differences into account.

Some studies show that memory of imagined items indeed competes with memory of real ones. Mathews, Ridgeway & Holmes (2013) set out to find if source monitoring confusion is more likely with visual imagery than with verbal thought. Participants looked at three sets of word captions, half of which had negative emotional valence and half of which were neutral in valence. Depending on which set, each caption was primed by the words, “look”, “imagine”, or “sentence”. Anytime the cue was “look”, the word was followed by an image depicting the content of the caption, and anytime the cue was “sentence”, the caption was followed by a sentence. The next day, participants returned to answer a questionnaire composed of the captions they were shown previously, and they indicated whether the caption had been followed by an image. There were more instances where people confused imagined images with perceived images than there were where people confused imagined images with perceived sentences. This suggests that using mental imagery when encoding something is more likely to disrupt retrieval of perceived visual information than verbal information.

In sum, it appears that activation of modality-specific cortex results in better encoding and retrieval, spontaneous imagery during encoding leads to false recognition at retrieval, and intentional mental imagery at encoding also leads to false recognition at retrieval. Together, these findings suggest that imagistic representations are important to the formation and retrieval of memories.

Cognitive Style and Source Monitoring

Different regions and neural circuits in the brain are responsible for verbal versus visual processing and for verbal versus visual memory, and individuals differ in their tendency to activate these representations from memory (Childers et al., 1985; Kiat & Belli, 2018; Kraemer, Rosenberg, & Thompson-Schill, 2009; Mayer &Massa, 2003, Nori, Bensi, Gambetti, & Giusberti, 2014; Richardson, 1977; Stephan-Otto et al,, 2017) . Those who use visual information more readily and frequently are said to have a visual cognitive style, and they are referred to in this paper as high-imagers. Individuals with a different type of cognitive style, such as verbal, are referred to in this paper as low-imagers. Do high versus low imagers recruit perceptual areas of the brain differently in the absence of a perceptual stimulus, and, if so, does this lead to differences in source monitoring?

To study cognitive style, researchers have to reliably and accurately measure it. One of the most prevalent measures is the Verbalizer-Visualizer Questionnaire, or the VVQ (Mayer & Massa, 2003). The VVQ is designed to measure the primary modality, between verbal and visual, in which an individual most readily processes information. In Mayer & Massa's (2003) study, they tested measures of different dimensions: learning preference, general achievement, cognitive style, and cognitive ability. Upon analysis, the VVQ was among three out of four other measures of cognitive style that loaded onto the same factor (these measures included the VVQ, the Santa Barbara Learning Style Questionnaire, and the Verbal–Visual Learning Style Rating). Loading onto the same factor indicates that these measures are tapping a similar construct, which means that the VVQ does show some convergent validity with regards to cognitive style. However, despite its popularity, studies have found poor internal consistency and test-retest reliability (Richardson, 1977; Nori, Bensi, Gambetti, & Giusberti, 2014). The highest Cronbach's alpha, a measure of internal consistency, was .61, and test-retest reliability was .91 after one week, but that dropped to .48 after 3 weeks. Given that the construct being measured is meant to be a stable quality in the participant, test-retest reliability should be high over time.

Later, a group of other researchers set out to improve upon the VVQ, and they developed the style-of-processing (SOP) scale (Childers, Houston & Hecklers, 1985). The SOP showed higher internal consistency than the VVQ, with an alpha of .88. The SOP also showed discriminant validity by not being correlated with measures of ability, thus distinguishing it as specifically a measure of style. These various measures are crucial to the interpretation of studies that use them. Studies that use the VVQ, for example, must be examined critically with the limitations of their chosen measure in mind.

To examine the psychological reality of cognitive style, Kraemer, Rosenberg, and Thompson-Schill (2009) looked at whether people with a preference for verbal or visual processing engage brain regions associated with their preferred processing style when the stimulus presented is not in their preferred modality. Participants took an altered version of the Verbalizer-Visualizer Questionnaire, or VVQ (Kirby et al, 1988), to test for either a verbal or visual cognitive style. They also took six subsets of the Wechsler Adult Intelligence Scale (WAIS) to test for visual and verbal abilities. Next, while the researchers took an fMRI, participants performed a similarity judgement task. In this task, one shape or three words describing a shape appeared on screen, followed by two shapes or two sets of three words from which the participant had to select one as the most like the previously presented image. There were four within-subjects conditions defined by the order of the type of test object and the type of probe object that followed: picture-picture, word-word, word-picture, and picture-word. Neither VVQ scores nor WAIS scores were significantly correlated with accuracy for any of the four conditions. Participants with verbal style showed increased activation in the supramarginal gyrus, known to be associated with verbal processing, even during the picture-picture condition compared to those with visual style. Those with visual styles showed increased activation in the fusiform gyrus, known to be associated with visual processing, compared to those with verbal styles, even during the word-word conditions. The fact that participants with verbal styles showed activation in an area thought to be involved in verbal processing even during visual tasks supports the hypothesis that cognitive style drives the method of processing even when the stimulus is in a different modality. The same hypothesis is supported again by visual style participants' processing of verbal information within areas associated with visual processing.

How might cognitive style influence memory? The broader literature on imagery and memory suggests that imagining the information to be remembered should improve retention (Foley, Foy, Schlemmer, & Belser-Ehrlich, 2010), so it stands to reason that people who tend to engage in mental imagery (high imagers) should have better memory and therefore fewer source misattributions than people who tend not to engage in mental imagery (low imagers). Evidence of the benefits of mental imagery comes from Foley et al., who used a modified DRM, or Deese-Roediger-McDermott task. The DRM is a picture/word task in which participants look at pictures and words at the time of study, and then at test they look at words and say whether each item is "old" or "new". If "old", participants then indicate whether it was originally presented in a picture or a word format during the study phase. Foley et al. separated their participants into four groups and gave each group one of four types of instruction. The researchers instructed the participants in the spontaneous imagery, or “Object Function”, condition to describe a function of each object with which they were presented, be it picture or word. This group was the spontaneous imagery group because the researchers did not give explicit instructions to visualize anything, meaning that any visualization on their part would be inherently spontaneous. Participants in the “Visualize object/Describe function” group were told, if it was a picture, to describe a function of the object, or if it was a word, to conjure a clear visual image in their mind of the object and then describe a function of the object. In a third condition, titled “Visualize Object/Describe Visual feature”, participants were told, if it was a word, to visualize the object and then describe a feature of the image. In their article, they use the example of picturing the “round handle” of a mug. If it was a picture, the instructions were just to describe a feature of the object. In the fourth and final condition of this experiment, “Visualize Word/Assess Visual Feature”, participants were told, if presented with a word, to count either the number of descending letters (like a p or a q) or ascending letters (like a d or a b). If the item was a picture, they were told to conjure an image of that word in their mind and then count the ascending or descending letters present. As for results, participants in the spontaneous imagery group made more errors in which they misattributed a word as having been presented as a picture than did participants in the groups that were instructed to construct mental images of the objects. That finding suggests an advantage in source monitoring for visual imagery of objects.

In an effort to explore whether people who spontaneously tend to generate visual images for objects indeed have better source memory for them, a group of researchers investigated the relationship between individuals’ tendency towards source misattribution and individuals’ processing preferences towards either visual or verbal style (Kiat & Bellie, 2018). For this experiment, participants performed a picture/word source-monitoring task. After the study phase, participants took the Style-of-Processing (SOP) questionnaire to determine their visual or verbal tendencies (Childers, Houston & Heckler. 1985). During the test phase, participants were shown some items they had seen before and some new ones. Upon viewing, participants had to indicate whether they had seen it before as a word, seen it before as a picture, or not seen it before at all. The main result was that people with higher visual scores on the SOP scale showed fewer word-picture errors than people with low scores on the SOP. Word-picture errors refer to when someone mistakes something that was presented as a word for having been presented as picture. This suggests that high imagers form more accurate memories than do low imagers, which is inconsistent with the idea that the increased tendency to form images for word items leads to memory errors. Instead, it may be that high imagers encode the items in the picture condition with greater precision, too, which prevents the word items from being confusable with the picture items. One limitation to this study is that the researchers did not counterbalance the order in which they did the memory task and the SOP administration. There could have been carry-over effects as a result.

However, a different group of researchers conducted a functional magnetic resonance imaging (fMRI) study investigating visual imagers while encoding and recalling pictures or words (Stephan-Otto et al., 2017) and found results that were somewhat at odds with the findings of Kiat and Belli. They compared activation in high versus low imagers—visual cognitive style or other—during encoding and retrieval. To test the participants for high versus low imagery, two questions, rated on a scale of zero to three, were added on to the Launay-Slade Hallucination Scale (LSHS), a subjective survey for detecting sub-threshold hallucinations of multiple senses. The two added items were "'I can easily identify animals or things in the clouds', and 'When I see spots (of painting, humidity. . .), I can see faces, silhouettes or objects in them'." These questions are a better measure of cognitive style than of vividness of visual imagery because they focus more on the ease with which a participant conjures visual imagery, as opposed to the detail and clarity of the images themselves.

For the picture/word task, participants sat in an MRI scanner and watched as different items were presented as either words or pictures. During the recall phase, participants, still in an MRI scanner, looked at words and had to indicate if they remembered them as having been a word or a picture during the study phase. Errors were counted as omissions—pictures remembered as words—and false memories—words remembered as pictures. Ultimately, individuals with high visual imagery did not have a significantly different number of false memories than low imagers did. However, when high imagers were encoding the words that they later mistakenly remembered as photos, fMRI imaging showed that they had greater activation than low imagers in an area of the brain that is known to process images—the left inferior occipital gyrus. Additionally, the amygdala, insula, and precuneus showed more activity during recall in high imagers when encoding words that they later incorrectly remembered as pictures. They theorized that, due to the consistent activation differences in high imagers, imagery processes are likely reflected in those brain regions. Some problems with the study are the small sample size and that their measure of visual imagery was two new questions tacked on to a different scale. Overall, Stephan-Otto et al.'s study did not yield results that indicate a difference in source monitoring among high imagers, but they did find differences in neural activity. This could mean that there is a common neural substrate among high imagers that activates differently or more efficiently even when the difference is not enough to result in behavioral effects. It would also be useful to know whether grouping participants based on a more commonly used scale, such as the VVQ or SOP, would have produced different results.

Other work examining the effects of cognitive style on an individuals' memory accuracy under different police interviewing procedures found mixed effects (Nori, Bensi, Gambetti, & Giusberti, 2014). The study compared the structured interview (SI) and the enhanced cognitive interview (ECI) techniques. The SI involves setting up a rapport, a questioning phase, three free recalls, and a summary. The ECI, on the other hand, shares the rapport and summary aspects but goes into greater detail with the rest. There is a "reinstatement of context" which is when the interviewer uses contextual details to try and put the interviewee into a frame of mind to retrieve associated details. An interviewer conducting an ECI also uses mental imagery during the questioning phase and uses both a phase which involves the witness changing the order of events in their mind as well as a phase where they examine the events from a changed perspective. Therefore, the ECI instructs witnesses to engage in extensive mental imagery, whereas the SI does not.

To test whether cognitive style modulated the effects of interview style on memory accuracy, participants in the study watched a video of a man shooting at detectives in a jewelry store and then fleeing. After the stimulus video, participants were interviewed according to one of the two interview styles. They also used the VVQ to designate participants as high or low imagers. Ultimately, they found that high imagers, remembered more correct items in the ECI condition than did verbalizers. However, visualizers also had fewer correct items in the SI condition. Therefore, it seems that, at least for overall memory accuracy, the benefit of having a tendency to engage in mental imagery is limited to instances where a person is explicitly instructed to imagine. This runs counter to the results from Kiat and Bellie (2018), who found better performance in high imagers even when not instructed to imagine. Perhaps the benefits of spontaneous imagery in high imagers are limited to tasks that invite imagery, such as the ECI and source monitoring tasks, which require the activation of specific episodes. Alternatively, it may be that the tendency to imagine by itself is insufficient in explaining individual differences in source monitoring performance and more factors are needed to understand this relationship.

Vividness of Visual Imagery

Perhaps the frequency or ease with which a person conjures mental images is not itself sufficient to capture the relationship between mental imagery and source monitoring errors. It could be that some high imagers are especially good at generating vivid and precise images, whereas others are especially poor in this ability. People who generate vivid visual images might represent their own imagined stimulus similarly to the way they encode and remember actual visual information. In other words, they might remember what they imagined with less differentiation from what they experience compared to individuals who do not generate vivid images.

There are different theories about the relationship between the vividness of mental imagery and memory quality: the encoding and the retrieval theories. The encoding theory holds that imagery is so powerful at encoding in vivid imagers that they experience the information similarly to visual perception and encode it as such. The retrieval theory is similar in that it involves the imagery being so vivid that it is experienced as perception, but instead of this happening at encoding, it happens at retrieval when cued to fill in memories that may not be intact. Vivid imagers could therefore show higher rates of source misattribution than non-vivid imagers because their memories at retrieval are more confusable with actual perception. Alternatively, the opposite might be true. Vivid imagers could encode the source of the information with high fidelity, leading to lower rates of source misattribution than non-vivid imagers.

Just as researchers needed measures for cognitive style, so too do they need measures for vividness of visual imagery. The primary means to that end is the Vividness of Visual Imagery Questionnaire (VVIQ; Marks, 1972). This measure has undergone a fair amount of scrutiny, but the main descriptive statistics are sufficient to validate it. The internal consistency measure, Cronbach's alpha, is .89, and this surpasses the .85 standard (McKelvie, 1995). The test-retest were also sound scores, with a .94 for immediate test-retest and a .735 for the delayed retest, where delayed means three weeks. While .735, with an upper bound of .782, is on the low end of acceptable, they are sufficient to evaluate the VVIQ a competent measure.

Dobson and Markham (1993) examined source attribution errors of vivid versus non-vivid imagers using a crime-specific stimulus. Participants took the VVIQ and watched a short video clip of an armed robbery that ended in someone getting shot. After performing a filler task, participants were given text that contained statements about the video they just watched, some of which were things they had seen in the video and some of which were new. After the text they performed a second filler task, and then took tests. Participants had to respond to a series of statements by indicating whether the statements were old information or new. If they chose old, they had to indicate whether they saw it in the text, the film, or both. After analysis, the results showed that vivid imagers made more source misattributions of text information to the video. These results oppose the hypothesis that vivid imagers have an advantage in source monitoring.

One primary limitation to this study is that there was no counterbalancing of the order in which the scale was administered relative to the memory task. Counterbalancing refers to balancing across groups the order in which study materials and test materials are presented. In other words, if there is a survey or questionnaire and then a word/picture study task, there should be an equal number of participants who do the word/picture task first. If this is not the case, there is a risk of carry-over effects. In other words, a participant may perform differently if they are aware of traits or strategies that are relevant to the task. Having just answered questions about mental imagery might have made low imagers more likely to use it as a strategy than they otherwise would. Furthermore, having just described yourself as a vivid or non-vivid imager might become a self-fulfilling prophecy in the subsequent task.

Of course, visual imagery is not the only type of imagery people engage in. Do the findings from Dobson and Markham extend to vivid versus non-vivid imagers for verbal stimuli? Two other researchers later looked at a scenario designed to replicate the work of Dobson and Markham (1993), but with a few changes (Eberman & McKelvie, 2002). To do this, they investigated vivid versus non-vivid imagers' predispositions toward source monitoring errors and false memory of audio and text-based information. In order to measure the participants' vividness of imagery, the researchers used an expanded form of Marks' (1972) VVIQ. This version was the Vividness of Visual Imagery Questionnaire Revised Version (VVIQRV). The authors described the scale as "acceptably reliable and valid for research purposes," but they do not go further into these statistics, and the works they cited included a description of a VVIQ-2, but not the VVIQRV. As for the procedure, both groups were told to pay attention to the stimuli, but only one group, the imagery group, was told to visualize them. First, participants listened to the audio source--a fake radio news broadcast--and then, after a filler task, the participants read a text source that had some statements that had information from the audio source, and some statements with new information. Following those stimuli, participants were given a memory test; some statements referred to the audio tape, some referred to the text source, some referred to information that was in both, and some referred to new information that did not appear in either source. Participants had to judge statements as "old" or "new" information, and if they selected old, they had to say which source they remembered it from. In the end, vivid-imagers were more likely than non-vivid imagers to mistake text information for information that came from the audiotape. This is a classic source monitoring error, and it only appeared in the condition in which people were explicitly instructed to imagine.

Conclusions and Implications

Based on the studies examined here, there are several things to conclude about cognitive style, mental imagery ability, and source monitoring. The literature is mixed in terms of whether a visual cognitive style is a strength or a weakness regarding source misattribution, though the studies that most narrowly tested this question found either a benefit or no effect of high imagery. However, the studies examining effects of vividness of mental imagery on source monitoring performance showed that vivid imagers performed consistently worse than did non-vivid imagers. It is possible that having vivid imagery could be a disadvantage over just having a visual cognitive style because the vividness of the mental images may be a result of overlap between the imagining and the actual perceptual processes in the brain, resulting in competition for neural resources that weakens the perceptual memory itself. Given that these dimensions are, in theory, independent of one another, the stage appears to be set to test for effects of cognitive style and vividness of mental imagery on source misattribution in a single study. The literature also points to the importance of determining whether explicit instruction to imagine modulates these effects.

Generally, the measures that are used to assess cognitive style and vividness of mental imagery are limited. For example, they cannot account for people who may have both visual and verbal style, or neither (Childers, Houston, & Heckler, 1985). Furthermore, they are all self-report measures, which means that there is no objective way of assessing whether their selfevaluation is accurate. The administration of these self-report scales is also rarely counterbalanced with the administration of study and test materials, which means that there is a risk of carry-over. On top of those things, there is the poor reliability of a commonly used measure, the VVQ. As a consequence of the poor reliability, there were other measures created to replace it, such as the SOP. The problem there is the lack of consistency across studies, which makes it difficult to compare results.

More broadly, this research informs the study of eyewitness memory (Nori et al., 2004; Dobson & Markham, 1993). There is value in determining individual characteristics that can contribute to accuracy in reporting the source of remembered events, and in determining which characteristics are not relevant. In the case that cognitive style and mental imagery vividness are important, the next step is finding out how to minimize their negative effects by tailoring interview tactics to minimize bias.

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