THE EFFECT OF "GROUND" ON "FIGURE": THE IMPACT OF CONTEXT REINSTATEMENT AND CONTEXT INTEGRATION ON EYEWITNESS TESTIMONIES

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Abstract

Eich (1985) found that participants' recall benefited especially from context reinstatement when they integrated the target with the contextual features in their environment (i.e., context integration). We explored the relationship between these two contextual manipulations in an eyewitness situation. All participants (N = 160) viewed a video of a staged theft and were asked to identify the culprit and recall the event after a one-week delay. Results suggested that context reinstatement (but not context integration) enhanced the perceived familiarity of the target/foil and their willingness to identify someone in the lineup. Although context reinstatement improved facial identification when the target was present, it also artificially boosted participants' confidence. In terms of recall, reinstating the study context improved participants' free recall of both central and peripheral details and cued recall of peripheral details. The results were consistent with the (mis)attribution of familiarity and the outshining hypothesis.

Keywords: Contextual Associations; Memory; Recall; Free Recall; Cued Recall; Witnesses; Face Identification; Confidence Judgment

Dedication

This thesis is dedicated to my loving parents, Sonny Wong and Rosalina da Rosa, and to my late supervisor at the Matsqui Institution, Dr. Claus A. Hallschmid.

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Table of Contents

List of Tables

List of Figures

Introduction

> [A] young Gentleman, who having learnt to Dance, and that to great Perfection, there happened to stand an old Trunk in the Room where he learnt. The Idea of this remarkable piece of Household-stuff, [sic] had so mixed itself with the turns and steps of all his Dances, that though in that Chamber he could Dance excellently well, yet it was only whilst that Trunk was there; nor could he perform well in any other place, unless that, or some such other Trunk had its due position in the Room. (Locke, 1700, pp. 224-225)

As suggested by the excerpt above, it is common for people's recall of information (e.g., steps to a dance) to be facilitated by the availability of external cues in their environment, even when the cue itself (e.g., the trunk) might not be particularly relevant or apparent to the learning of the task at hand. The intuitive validity of this phenomenon can be illustrated with the example of nostalgia. Many incidents and detailed experiences that were once forgotten suddenly seem to find their way back to one's memory when revisiting one's hometown. Cognitive psychologists call these reminiscences "redintegrative memories," which are reconstructed by using other memories as cues to related memories (Horowitz & Prytulak, 1969; Rozeboom, 1969). Even when these memory lanes are seldom visited, they can be vividly elicited by a single landmark. The environmental contexts thus provide us with the basic implicit cues to reconstruct our conscious recollections.

The word, *context*, has been used widely and flexibly in cognitive research (for a review, see Davies & Thomson, 1988b). According to Davies and Thomson (1988a), "all distinctions of context assume a distinction between stimulus and setting, figure and ground" (p. 336). However, these authors also concede that there is great difficulty in constructing a concrete partition between the figure and the ground, because components of the latter tend to interact with that of the former. Alternatively, some researchers conceptualize context as positioning on a local-global continuum (e.g., Dalton, 1993; Glenberg, 1979), with local context being (the characteristic of) an item, such as a color or a word, that was paired with a target during encoding and global context being the physical environment at study or at test. In this paper, context refers to those global features of the setting that are presented alongside with the to-be-remembered stimuli. Depending on the experimental conditions, participants' attention to the available contextual information was encouraged or simply incidental.

There are two widely accepted theoretical principles that help explain the significance of contextual information in facilitating memory performance. First, there is the assumption that in any learning situation a great variety of memory cues is available to enhance memory, especially when they are distinctive (Tulving, 1974): When these distinctive cues are encoded, they provide access paths to the stored information beyond the specific characteristics of the information (see Anderson & Bower, 1973, for a review). Second, it is believed that a memory representation is comprised of various features along a variety of dimensions (e.g., visual, verbal, and spatial; Bower, 1967; Wickens, 1970) and, to maximize memory performance, an effective retrieval cue needs to include as many of these features as possible. Context provides cues that enhance feature overlap between initial witnessing and retrieval contexts (Flexser & Tulving, 1978).

Because a wealth of information is being encoded in one's memory, how do people organize the data in their minds to generate memory experiences? According to Whittlesea's (1997, 2002a) SCAPE theory (Selective Construction And Preservation of Experiences), there are two functions of the human mind: production and evaluation. Specifically, the mind produces percepts, cognitions, and overt responses, and simultaneously evaluates these productions and other past information. The evaluation process then leads to feelings of subjective experiences that serve as the basis for making an attribution about memory. The belief that one is remembering is one possible result of the evaluation process. In general, individuals incessantly construct and preserve their ongoing psychological experiences (Whittlesea, 1997, 2002a). They become effective in controlling their subjective experiences (e.g., feelings of familiarity or remembering) "through assessing the coherence of salient aspects of their experience, interpreting the significance of that conclusion within the broader context of environmental affordance and intuitive theory, and making an attribution that maximizes the chances of success [in remembering]" (Whittlesea, 2002b, p. 327). One's environmental context therefore provides one of the key sources by which information can be evaluated. For example, if a person witnessed a car theft in a parking lot and is asked about the color of the vehicle, s/he may produce a number of percepts, or mental images, regarding the color of the car. Within the context of the parking lot, the mental image of the car as red may come to mind in a way that is surprisingly fluent, complete, and coherent, leading to the individual's attribution that s/he is remembering. The image is *surprising* to the individual because there is no reason to predict that the image of a red car being stolen would be more fluently, completely, and coherently produced than the image of, for example, a yellow car in one's mind.

To quote Masson and MacLeod (1992), "remembering is not a single routine; it is a family of skills that we learn to use alone or in combination to meet demands placed on us by our contexts" (p. 145). In the present work, one of the major goals is to enhance performance in eyewitness testimony situations: An eyewitness is typically asked to recall details of a witnessed event (e.g., a theft) and persons involved in it and may be asked to identify one or more of these individuals from photographs or a lineup. Because studies have found that context can serve as an effective memory aid, this study will examine the impact of two contextual manipulations on the recall of crime event details and facial identification of the culprit: context integration and context reinstatement. Context integration encourages participants to link or integrate the to-be-remembered targets with various features provided in their ambient encoding environment. In contrast, context reinstatement is achieved by matching participants' study and test environments, thereby increasing the global or contextual retrieval cues available during recall or recognition. These two concepts will be further clarified in subsequent sections.

Context Integration

In one of the earlier studies on cognition, Horowitz and Prytulak (1969) argued that compound stimuli (i.e., stimuli that are formed by multiple parts) tend to be recalled as a single entity and rarely as isolated components. In this sense, recall is experienced by the process of redintegration, such that when a stimulus compound is formed, recall of one partial element will likely lead to the recall of the entire compound (Rozeboom, 1969). Mnemonics are strategies for placing information into an organized context that takes advantage of such redintegration. One simple but powerful mnemonic that draws on the integration of targets with contextual cues is called the *method of loci* (Bower, 1970), or the method of places. To use this mnemonic strategy, participants learn to visualize an ordered series of places and associate each of these places with an object or a word on a list based on their self-generated associations. When they want to retrieve the same list of items, they visualize the same locations in the same order. Vivid images of interactions or relationships seem to be particularly effective (Kline & Groninger, 1991); for example, one might encode the word, *laptop*, by picturing it swinging at the door of one's bedroom. This method has been shown to reliably improve serial word recall (e.g., Kliegl, Smith, & Baltes, 1989; Yesavage & Rose, 1984).

Similar to the method of loci, other studies have explored the integration of contextual cues and targets within one's encoding environment. Instead of asking participants to imagine a list of loci from their familiar environment, these studies used contextual cues that could be found in participants' current study environment (e.g., Earles, Smith, & Park, 1996; Eich, 1985). In Earles et al. (Experiment 2), for example, 25 line-drawings of easily identifiable objects were presented to both young and older adult participants. In the *integrated* condition, participants were read a sentence relating the target object to an item located in the physical environment in the room (e.g., "the *key* [i.e., the target line-drawing] fit in the lock on the *file cabinet*" [i.e., the environmental contextual cue]; p. 274), whereas in the *isolated* condition, participants were read a sentence relating the target object to an item not present in the room (e.g., "The *key* fit the lock on the *car*"; p. 275). A free recall test was administered about 5 minutes later in either the same or different room. Earles et al. found that the integration process assisted adults from both age groups, suggesting that the more closely the item and the context are associated at encoding, the larger the facilitative effects of the presence of the same contextual cues at retrieval.

In another study on context integration by Eich (1985), undergraduate participants were asked to read a list of common objects and to imagine them one by one either alone (*isolated-imagery items*) or as being integrated with a distinct aspect of their ambient environment (*integrated-imagery items*). Unlike the Earles et al. (1996) study, however, integrations in Eich's study were generated by participants rather than provided for them. Participants were then asked to return in two days to perform other imagery tasks and were not informed about the upcoming recall test. After the delay, participants were asked to recall the list in either the same or alternative environment as compared to that of the study phase. Eich found that recall of list items was not simply enhanced by reinstating the contextual environment but was contingent upon asking participants to create integrated item/context images. Whereas a contextual change between the presentation and test phases of the study significantly impaired the free recall of those who had generated an integrated relationship between targets and contextual cues, it did not adversely affect the performance of those who had imagined the items alone.

Research has yet to examine whether an integrative relationship between an event (instead of isolated pictures or words) and the environmental context is important in determining the degree of context facilitation on memory performance. In the present study, the manipulation of context integration involved increasing the attention to one's contextual environment and incorporating the contextual knowledge into the to-be-remembered event. It is important for the participants to become acquainted with their environment because prior studies on integration have generally used cues that are familiar to the participants (e.g., Earles et al., 1996; Park et al., 1990; A. D. Smith, Park, Earles, Shaw, & Whiting, 1998). Specifically, in this study participants in the "integrated" condition first examined the details of their environment, whereas those in an "isolated" condition examined a picture for the same period of time. After the observation, the former group of participants integrated their current physical context with the event that they were about to witness on video, as if the event was happening in their current environment. Participants in the isolated condition simply watched the presented video. It was expected that participants would recall more details about the event in the integrated-context condition than in the isolated-context condition when they returned to the same viewing environment.

Context Reinstatement

Whereas contextual information is represented and manipulated at the encoding stage in context integration, context reinstatement refers to the manipulation of the physical environment of the context at the retrieval stage. Any aspect of an environment in which a to-be-remembered event is encoded can, in theory, serve as a contextual cue at retrieval (Memon & Bull, 1991). Take Mandel's (1980) passage as an example: "I am going about my business when something happens and I "get" a memory. Whenever a certain tune plays on the radio, it triggers a memory of the high-school prom ... Something happens *now* and a memory is triggered. What happens now is unpredictable, while the memory is hinged on the mysterious, fleeting present more than to the past" (p. 51). Many cases of inadvertent recall are triggered by a certain contextual cue, and the memory takes on significance only within that context, or what can be known as an *enabling* context (Spence, 1988).

One of the more prevalent accounts of the context reinstatement effect centers on the encoding specificity principle (Tulving & Thomson, 1973). This concept posits that there is a positive impact on memory performances (e.g., recall or recognition) when cues available during study are also available at test, provided that those cues were encoded together with the to-be-remembered targets at the time of study (Mori & Graf, 1996). In the case of the *context reinstatement effect*, the encoding-specificity principle predicts that retrieval of information will be improved when individuals are tested in the same environment experienced at study as compared to a different environment. Tulving (1982, 1983) claimed that contextual factors play an important role in both recall and recognition tasks. This effect was demonstrated in an early and classic finding that suggested scuba divers' recall was better when the environment at test matched the study environment (Godden & Baddeley, 1975). Thereafter, other studies have demonstrated similar results (see Davies & Thomson, 1988b, for an extensive review of context effects). In particular, a recent meta-analysis indicates that the environmental context effect "has a modest (d = .28) but reliable ... effect on memory performance" (S. M. Smith & Vela, 2001, p. 213).

The potential ability of context reinstatement to improve the accuracy of eyewitness memory is a crucial issue in criminal investigation. It is believed by many researchers (e.g., Hershkowitz et al., 1998) and police officers (Kebbell, Milne, & Wagstaff, 1999) that returning eyewitnesses to the scene of the crime or reminding them about certain features of the crime scene may enhance the witnesses' ability to identify suspects and accurately provide other forensically relevant information. To date, most memory studies concerning forensic issues have focused on eyewitnesses' identification of the culprit. Although many studies have demonstrated a robust context effect on word-list recall (e.g., Godden & Baddeley, 1975; Fernández & Alonso, 2001; S. M. Smith, Glenberg, & Bjork, 1978), there has been a paucity of research examining its effect on the recall of content related to a critical event, such as an eyewitness scenario.

In the eyewitness literature, context reinstatement is achieved in two main ways. First, participants may be asked to *imagine* the context of the to-be-remembered situation. For example, better recall of a filmed crime scenario has been found with the employment of guided-imagery mnemonics (Malpass & Devine, 1981) and other interview techniques, which help participants to reinstate mentally the environmental and personal context that existed at the time of the crime (Geiselman, Fisher, MacKinnon, & Holland, 1985). In particular, the Cognitive Interview (Fisher & Geiselman, 1992), which emphasizes mental reinstatement of the context, has been shown to improve both the quantity and quality of information in eyewitness testimony (Köhnken, Milne, Memon, & Bull, 1999) and reduce the influence of erroneous information and misleading questions on participants' recall (Geiselman, Fisher, MacKinnon, & Holland, 1986; Gibling &

Davies, 1988). The second method of context reinstatement is physical rather than mental in nature and involves simulating the environment of the original situation or reinstating the physical environment of the location in which an event was originally witnessed. For instance, significant improvement in free recall of a critical live-staged event was found with the physical reinstatement of context (Emmett, Clifford, & Gwyer, 2003). Further, this type of context reinstatement appears to elicit additional details from young victims of alleged abusive incidents (Hershkowitz et al., 1998). In relation to this finding, exposure to the physical context information 24 hours prior to an interview has been shown to be as effective as providing context at the time of the interview as a means of increasing recall in children (Priestley, Roberts, & Pipe, 1999).

Studies of environmental context (S. M. Smith et al., 1978) and of pharmacological context (or drug state; Eich, 1980) have reported large effects of context reinstatement on free recall, intermediate-sized effects on cued recall, and minimal effects on recognition. To account for this trend, the *outshining hypothesis* (S. M. Smith, 1988) holds that whereas context provides a useful additional source of retrieval information in the relatively impoverished free-recall setting, in a recognition task the presentation of a copy of the target at test constitutes such a powerful cue that context information becomes redundant in the retrieval process. Similarly, the cue specificity rule proposed by Eich states that the more specific the cues provided by a memory test, the less effective the manipulations of experimental context. In the present experiment, therefore, performance on a free-recall test was used as one of the main dependent variables. However, a cued-recall test was also administered to explore whether effects of context would be diminished by the provision of more retrieval information in cued recall.

Types of Information Recalled: Central versus Peripheral

Aside from replicating the influence of the context effect on recall of forensically relevant information, one additional goal of the present study was an examination of its impact on the type of information reported by participants. For instance, fact finders in the legal context are often more concerned with details about central information (e.g., Who committed the crime? What is the nature of the crime?) than about peripheral information (e.g., information about the minor crime-scene environment). However, peripheral information may at times be gathered from witnesses to enhance their credibility (Bell & Loftus, 1988; Wells & Leippe, 1981), especially considering that witnesses who provide more details to an event are generally rated as having a better memory and as having paid more attention to the crime (Bell & Loftus, 1989).

In general, the distinction between central and peripheral information is defined by its relevance to the plot (Heuer & Reisberg, 1990). A detail is identified as being central if it could not be omitted or substituted without a major alteration to the basic story line or the content of the event; otherwise, the detail is identified as being peripheral. Considerable research has suggested that details that are perceived as central rather than peripheral are recalled much better and for longer periods (e.g., Migueles & Garcia-Bajos, 1999; L. R. Shapiro, Blackford & Chen, 2005; Wright & Stroud, 1998). However, a few studies have demonstrated that memory of peripheral information may be improved or be comparable to that of central information under some circumstances. For instance, when participants were provided with correct post-event information about peripheral aspects of an event, they provided more details in general as compared to when no post-event information was provided; this improvement was not found in the exposure of information about the central aspects of the same event (Sutherland & Hayne, 2001). More importantly, there are reasons to believe that recall of peripheral information may benefit more by the presentation of contextual cues than the recall of central information. For instance, Brown (2003) systematically examined the impact of context on participants' memory performance for central versus peripheral details of a series of slides and found an improvement in recognition of peripheral details and in facial identification of a peripheral character under context reinstatement when the presented event was emotionally neutral.

Although Brown's (2003) findings support the premise that recall of peripheral components is more affected by context reinstatement procedures than are central components, the generalizability of this research is in question. For instance, whereas Brown adopted a spatial definition of centrality (i.e., referring to central as the position of a target item in the visual field), other research has used a thematically-driven definition of centrality (i.e., defining central as being the main part of the target event). In addition, Brown used only one mode of memory performance in his study: recognition. As suggested above, memory recall, as opposed to recognition, is more influenced by the availability of contextual information in general. Moreover, the context reinstatement procedure used in Brown's study was introduced immediately after the viewing of the slides, and the lineups were then presented without delay. However, Cutler, Penrod, O'Rourke, and Martens (1986) suggested that the effect of context is likely to be most effective when memory tasks are made more difficult, as by a long delay. More importantly, in most forensic situations there is usually a delay between the witnessing and the questioning of an incident. Finally, the context reinstatement procedure used in Brown's study was quite different from the one usually adopted by other studies; instead of reinstating the actual environment, participants in Brown's study were provided with a picture of the background of the critical scene only. The reinstatement effect of this kind of background could be limiting not only because merely a certain aspect or angle of the scene was shown but also because only visual information was provided; in most of the studies on physical context reinstatement, participants can potentially take advantage of other sensory (e.g., olfactory and tactile) information in their environment to cue recall.

In the present study, the effect of context reinstatement on memory performance after viewing a video of a staged theft was examined in light of the centrality of the information recalled, which was measured in two ways. First, each critical detail of participants' free recall was evaluated based on its relevance to the main plot. Second, participants responded to several specific questions about the central and peripheral components of the target event (i.e., cued recall). As mentioned, based on the outshining hypothesis, environmental influences will be reduced (or outshone) when there are strong retrieval cues present at the time of the memory test, such as memory cues of central details of an event; however, it is conceivable that incidentally or deliberately encoded contextual information can cue memory when better cue sources are absent (e.g., recall of peripheral information). The present study examined this possibility.

Eyewitness Identification

It is well known that human recognition performance is imprecise, and the unreliability of eyewitness identification has been well documented (e.g., Brigham, Maass, Snyder, & Spaulding, 1982; Loftus, 1979; Loftus & Greene, 1980; Wells et al., 1998). However, the identification testimony of eyewitnesses has an intuitive and commonsense appeal that makes its continued usage quite probable (Ellison & Buckhout, 1981). Therefore, it is appropriate to find means of improving eyewitness identification, and context integration is herein suggested as one means for doing so. In a manner similar to Eich (1985) who proposed a differential impact of integrated and isolated contexts on recall, Baddeley and Woodhead (1982) also differentiated between the effect of interactive and independent contexts on face recognition performance. An "interactive context is one that influences the way in which the subject encodes the stimulus" (p. 162), and it appears that "unless the target item and its elaborated context are clearly integrated ... recognition will not be enhanced" (pp. 156-157).

In addition to examining the effect of integrated context on eyewitness recall, the present research tested whether it was possible to facilitate person identification by the integration of contextual cues with the target face. In particular, after watching the target event, participants in the integrated condition further mentally reconstructed the culprit's visage by picturing his face on the wall in front of them, whereas those in the isolated condition pictured his face on a blank piece of paper. Through an integrative binding of the culprit and the physical environment, it is conceivable that the re-presentation of the contextual cues at test would create a redintegrative process and improve identification.

Context Reinstatement and Face Identification

As mentioned, studies have shown that recognition performance on verbal material tends to be less susceptible to the effects of contextual reinstatement than recall (for a review, see S. M. Smith, 1988). Nevertheless, staged field studies (e.g., S. M. Smith & Vela, 1992) and other experiments involving video presentations of simulated crime scenarios (Cutler, Penrod, & Martens, 1987; Gibling & Davies, 1988; Krafka & Penrod, 1985) have found eyewitness identification improvements from environmental context reinstatement. Furthermore, P. N. Shapiro and Penrod (1986) performed a meta-analysis of 960 experimental conditions from over 190 studies on memory for faces and found that the effect of context reinstatement is robust in improving face recognition and identification performances. The differential impact of context reinstatement on memory for verbal materials and for faces can potentially be accounted for by at least two factors.

First, according to the overshadowing hypothesis (S. M. Smith & Vela, 2001), verbal recognition memory tasks allow participants to employ the conceptual links amongst words as an encoding strategy that minimizes the role of context to one of simply providing redundant information. For example, S. M. Smith (1986) demonstrated context-dependent effects in verbal recognition when the items were encoded using a shallow incidental learning task (e.g., considering only the physical or phonological properties of words), but not when items were encoded using a deep orienting task (e.g., considering the meaning of words). Because faces contain more perceptual details that involve shallower processing, it is possible that the physical environment can exert more influence during the encoding stage on such information and in turn improve participants' recognition during retrieval.

A second reason that may account for the differential impact of context effects on word and facial recognition also focuses on the characteristics of these stimuli: the familiarity of the visual display. According to Dalton (1993), multiple pre-experimental presentations of an item allow that item to be represented independent of the context, and therefore minimize the role of context during encoding and retrieval. For instance, Russo, Ward, Geurts, and Scheres (1999) demonstrated that changes in context had an impact on recognition memory in discriminating unfamiliar verbal material (i.e., nonwords) but not familiar words. Because eyewitnesses are generally called upon to identify an initially unfamiliar culprit, they may benefit from contextual cues in the environment during the lineup procedure.

To explore the issue of familiarity further, Read (1994) noted that witnesses tend to adopt a decision strategy that is based more on conscious recollection than a mere response of familiarity with the target face; it is a response shift from the nature of "*have seen [this face] before*" (for recognition) to that of "*that's the perpetrator*" (p. 59; for identification). According to Higham and Vokey (2004; see also Bodner & Lindsay, 2003; Whittlesea, 2002b), recollection and familiarity "are not necessarily tied to the operation or activation of particular processes or systems, but what counts as recollection or familiarity depends on the situation and context" (p. 25). Both the familiarity of the context and the item may contribute to the familiarity judgment of that item (McKenzie & Tiberghien, 2004; Tiberghien, 1986). In fact, Read (1995) found that participants presented with additional contextual information were more likely to identify someone from a lineup because of their (misguided) increased familiarity gained from the contextual knowledge. The availability of reinstated contextual cues at test may therefore (erroneously) increase familiarity judgment of targets. To better understand the effect of context on familiarity judgment and identification performance, participants in the present study were asked to indicate whether any faces in the lineup were familiar before they attempted to identify the culprit.

Although the reinstatement of the encoding context at the time of test seems to improve facial identification, the significance of such impact on identification may depend on the nature of the reinstatement. For example, a few studies have failed to show that mental reinstatement is helpful in enhancing participants' lineup performance (e.g., Memon, Gabbert, & Hope, 2004; Searcy, Bartlett, Memon, & Swanson, 2001). In order to explain these null effects, it has been suggested that although mental reinstatement of context increases the availability of verbal details that relate to the event (including verbal descriptions of specific facial features), the performance on face identification is instead mediated by holistic, pictorial information (e.g., the overall shape of the face; Dodson, Johnson, & Schooler, 1997; Fisher, McCauley, & Gieselman, 1994). This proposition has been supported by S. M. Smith and Vela's (1992) finding; whereas performance on face identification was not enhanced by reinstating the context through verbal instructions, physically reinstating the original context did. Therefore, the context was reinstated physically in the present study.

Face Misidentification

So far, I have suggested that physical reinstatement of the context seems to have a positive effect on eyewitness identification; that is, when the target is presented at test, it is more likely that participants will be able to correctly identify this person when the contexts between learning and test are constant, as compared to when there is an alteration between the two contexts. However, in real life the culprit may not be present in the lineup, and it is important for witnesses to reject all members of the lineup including the innocent suspect. Nevertheless, P. N. Shapiro and Penrod (1986), in a face identification meta-analysis, reported that reinstatement of original contextual cues can increase not only the likelihood that the perpetrator is correctly identified (i.e., hit rate) but also the rate of foil misidentifications (i.e., false alarm rate). Mistaken identifications can cause grave miscarriages of justice (Memon et al., 2004; Sporer, 1994).

One way to improve target/distractor *discrimination* is to introduce context integration in addition to context reinstatement. Murnane, Phelps, and Malmberg (1999) developed the Item-Context-Ensemble (ICE) theory to explain the mechanism of how the integration of target item and context might help in facilitating context-dependent discrimination performances. This model postulates that recognition functions according to the global matching theories and that three types of individual memory representations are activated based on the match between the encoded information in memory and the information in a retrieval cue: activation of *item* information (*I*), activation of *context* information that is associated with item information (*C*), and activation of an *ensemble* or integration of item and context information (*E*). The individual activations are combined to form a *global match value* that serves as input to a decision process. Like Eich (1985) and Baddeley and Woodhead (1982), Murnane et al. distinguish between two types of contexts: an *associated context* (*C*) and an *integrated context* that is formed by ensemble information (*E*). The researchers found that when the target and context information were integrated to form an ensemble, participants were better able to discriminate between target and distractors when the context was reinstated. On the other hand, when no such integration was formed at encoding and when the associated context was reinstated at test, both hit rate and false alarm rate increased because the associated context (*C*) being matched in same-context situations produced higher global match values for both targets and distractors than the associated context being mismatched in different-context situations. In order to explore this possibility in eyewitness identification, participants in the current study were presented either a target-present or a target-absent lineup. Our hypothesis was that when participants formed an ensemble between the target and the contextual environment during encoding, and when they were presented with the lineup in the same environment where they observed an event, they could better discriminate between the culprit and the foils.

Eyewitness Confidence

As a final point, eyewitness researchers are interested in not only the accuracy of eyewitnesses but also how confident they are about their decisions. Despite the general finding that eyewitness confidence is quite malleable and a relatively weak indicator of identification accuracy (Kassin, Tubb, Hosch, & Memon, 2002), witnesses confidence is one of the main factors driving jurors' perceptions of witness credibility (Brewer, Potter, Fisher, Bond, & Luszez, 1999; Penrod & Cutler, 1995; Shaw, Garcia, & McClure, 1999; Wheatcroft, Wagstaff, & Kebbell, 2004). The ability to match confidence with accuracy is represented in the confidence-accuracy (CA) relationship. Most reviews and meta-analyses report the average CA correlations as being in the range of 0 to .3 (e.g., Bothwell, Deffenbacher, & Brigham, 1987; Cutler et al., 1987; Sporer, Penrod, Read, & Cutler, 1995). Nevertheless, Read, Lindsay and Nicholls (1998) conducted a number of between- and within-subject correlational studies and demonstrated a strong relationship between confidence and accuracy in lineup performance. They also identified a variety of possible moderators of the CA relation that may suggest participants' insight in their accuracy (i.e., confidence judgment) may often be affected by information irrelevant to accuracy (e.g., number of response options available at test).

Other research has explored whether context reinstatement can enhance the CA relationship through, for example, increasing the accuracy of identification; however, the effect of context on this relationship is quite equivocal. For instance, studies have found a significant CA relationship with context reinstatement (Krafka & Penrod, 1985), no CA difference between context reinstatement and control (O'Rouke, Penrod, Cutler, and Stuve, 1989), and an inflation of witnesses' confidence when a cognitive interview was employed (Granhag, Jonsson, & Allwood, 2004; Hammond, Wagstaff, & Cole, 2006). These latter results of Granhag et al. and Hammond et al. also mirrored the finding that when the test cues were made familiar through priming or other pre-exposure techniques, it could increase confidence ratings beyond that warranted by an increase in accuracy (Metcalfe, Schwartz, & Joaquim, 1993; Schwartz & Metcalfe, 1992). Finally, and more to the point, Read (1995) posited that participants' confidence judgments could be faulty when participants "misattribute familiarity gained from contextual knowledge to familiarity arising from perceptual knowledge [or information available about the target's appearance]" (p. 92). Because of this heightened (misguided) sense of familiarity, it is conceivable that participants facing a reinstated context at test might be more likely to choose someone from the lineup (regardless whether the culprit was actually present) and be more confident about their decision, thereby lowering the CA relationship. This possibility was examined in the present work.

Current Experiment

A video on a staged theft was used to present the critical event in the present study, and the details of which were tested one week later. S. M. Smith and Vela (1992) criticized Sanders' (1984) method of using videotaped materials to examine the effect of context on memory, because using a video presentation instead of a real-life event confounded the impact of two environments: the physical environment within the video and the physical environment in which the video was presented. To remedy this problem, a blue-screen imaging technique was adopted in the current experiment to remove the background in the video. Thus, the only presenting environment was the viewing environment of the video. More importantly, because the video background was eliminated, participants might find it easier to adopt the existing viewing environment as the backdrop for the event, which might facilitate the integration of the contextual environment with the critical event.

The present study sought to replicate Eich's (1985) findings concerning the interaction between context integration and context reinstatement; that is, participants were expected to benefit especially from a constant or unchanged environment between study and test when they were encouraged to integrate the target with the contextual features in the room. This experiment also extended Eich's study by exploring the contextual impact on an eyewitness testimony situation: instead of testing word recall, the details of the events and the face of the culprit were used as the objects of study.

To address these issues, dependent measures related to face identification performance (i.e., familiarity judgment of lineup members, lineup identification accuracy, willingness to choose, and confidence judgment[1]) were assessed in a 2 (Context Integration: integrated vs. isolated) X 2 (Context Reinstatement: same vs. different context) X 2 (Lineup Type: target present vs. absent) between-subjects factorial design, and dependent measures related to recall performance (i.e., free and cued recall) were assessed in a 2 (Context Integration) X 2 (Context Reinstatement) X 2 (Centrality of Information: central vs. peripheral) mixed design. Participants in the present study watched a video about a mock theft and were asked to identify the culprit and recall

[1] Identification accuracy was also included as a predictor for confidence judgment.

details of the video after a one-week delay. To manipulate context integration, one-half of the participants were asked to imagine that the event presented in the video was happening at their current environment and were also asked to picture the culprit's face on the wall after the video viewing. At the end of the first session, they were asked to return at the same time one week later to perform another experimental task. The manipulation of context reinstatement occurred at this delayed test. Half of the participants from each condition returned to the same environment, and the rest went to a different location for testing. Upon their return, all participants were presented with either a target-present or -absent lineup and were first asked to identify if someone from a photo lineup appeared familiar to them in general. They then attempted to identify the culprit from the video using the same lineup and made a confidence judgment of their decision. Finally, they were asked to recall as much detail as possible based on the information provided in the video and answered a few questions regarding the central and peripheral details of the event.

There were four main hypotheses. First, it was expected that participants who returned to the same study environment would be more likely to find a face in the lineup familiar and identify someone as the culprit than those who were tested in a different environment. Second, participants who integrated the context and the event and returned to their study environment were expected to be best at discriminating between lineup members regardless of whether the culprit was present or absent in the lineup. Third, the confidence ratings of participants in the *same* condition were expected to be higher than those in the *different* condition. In particular, it was expected that context reinstatement would lead to overconfidence in participants that was not warranted by an increase in identification accuracy, thereby lowering the CA relationship and replicating the findings of Granhag et al. (2004) and Hammond et al. (2006). Finally, it was predicted that the recall of participants would be better when they integrated the event with their environment and when they returned to the same environment at test; more specifically, based on the outshining hypothesis, it was predicted that the effect size of contextual manipulations would be stronger for free recall and recall of peripheral information than for cued recall and recall of central information.

Method

Participants

Participants were 160 Introductory Psychology students of Simon Fraser University (SFU) who took part in the study for course credit. Twenty additional students participated in the pilot study. The average age of participants was 20.22 years (*SD* = 2.86 years), and the majority of participants were female (60%).

Video

A colored video with a professional blue-screen backdrop was prepared, and the recording lasted approximately 3.5 minutes. The physical background of the video was removed in order to avoid the confusion between the physical context of the video and that of the environment in which the video was viewed. The video was filmed by a professional cameraman and played by one professional actor (the culprit) and two non-professional actresses (the victim and her peer). The culprit was a middle-aged male of European descent. The video simulated a theft, in which a female's laptop, her VISA card, and rent money were stolen.

Pilot Study

The photo lineups were constructed specifically for use in this study. To do so, 20 photos were selected from the Internet based on three broad selection criteria (age, gender, and race) fitting the description of the perpetrator: middle-aged male of

Caucasian descent. All men had a neutral expression, and all photos were edited so that only their faces were presented. To select five foils (or the distractors) for the lineup, a pilot study was conducted to evaluate the foils' judged similarity to the culprit. Specifically, pilot participants were asked to compare the mugshots with that of the culprit. The similarity ratings were made on a 7-point scale with end-points labeled 1 (*not at all similar*) and 7 (*very similar*), and the foils were randomly selected from the mugshots that received an average rating of *3* to *5* with low variability. This range of rating was chosen to ensure that the target was not too distinctive compared to the foils and that the other foils did not resemble the target so closely that it would render the facial identification impossible (which might create a floor effect). For the target-absent lineup, however, the target was replaced by an additional distractor who received the highest overall similarity ranking of all distractors to the target.

Design and Procedures

Two distinct rooms were chosen for the present study, and assignment to these rooms was counterbalanced. Area A was a large testing room within the SFU Mental Health, Law, and Policy Institute, and Area B was a small vacant study room close to the General Office of the SFU Psychology Department. To ensure that there were no systematic differences in performance between participants who encoded or retrieved information across the two areas, the experimental location was treated as an independent variable prior to data analyses. There were no room effects and the effect of environmental location did not interact significantly with any of the key manipulations.

Therefore, these analyses will not be discussed further.

In either Area A or B, after attaining their informed consent, participants were told that the purpose of the experiment was to perform a few paper-and-pencil tasks, evaluate a video clip for another study, and perform an imagery task. First, to facilitate integration of the environmental context and the event, participants in the *integrated* condition were first asked to examine their current environment for one minute, whereas those in the *isolated* condition examined a photo of a group of people working in the library for the same length of time. After providing a few bogus ratings of the environment/picture as a distractor task, participants were asked to view and listen to a video on a laptop computer. They were told that the video clip was about an alleged theft that was caught on tape by a security camera. All participants were told that the physical environment of the video had been removed (i.e., by adopting the blue-screen background). Participants in the *integrated* condition were further instructed to imagine the event as if it was happening in their current environment and to make a special effort to incorporate the environmental features of their context with the event. For example, participants were asked to think about how far away the characters were from various objects (e.g., a door) in the participants' environment. Participants in the *isolated* condition were simply told to pay attention to the event to the best of their ability. After viewing the video, participants completed a 3-item measure to assess the quality of the video on a 9-point scale ("How clear was the video?" "How believable was the video?" "Did the blue screen in any way distract you from the content of the video?"). This measure was included to ascertain that the participants' performances did not suffer because of quality of the video. It was also designed to maintain the deception about the real purpose of the experiment and to minimize rehearsal of the event details during the one-week delay. Participants in the integrated condition further completed two manipulation check items in which they described how they managed to integrate the video event to their environment and rated the difficulty level of this task on a 9-point scale ranging from 1 (*not at all difficult*) to 9 (*very difficult*).

Subsequently, participants were told that they would now start the "main part of the experiment" by imagining the face of the culprit with their eyes open. In the integrated condition, participants imagined the face on the wall with items, such as a bookcase, in front of them, whereas in the isolated condition participants imagined the face on a letter-sized white paper. While they were imagining the face, participants verbally responded to an imagery questionnaire (Dean & Morris, 2003). In general, the questionnaire required participants to rate the ease of evoking and maintaining an image. All ratings, except for a few questions, were made on a scale of *1* to *9*. In the present experiment, in order to minimize the testing time, participants generated these ratings based on the image of the culprit only, instead of employing the same two-dimensional and three-dimensional shapes used in Dean and Morris's study.

At the end of the first session, participants were invited to return in one week to perform another separate experiment. To adhere to the principle of encoding specificity (Tulving & Thomson, 1973), they were also requested to arrive for the experiment at about the same time they viewed the video. To manipulate context reinstatement, participants were asked either to return to the same area or to a different area. The two contexts (Area A and Area B) were counterbalanced to ensure that equivalent numbers of participants were in all four conditions (i.e., AA and BB [*same* condition]; AB and BA [*different* condition]). Finally, all participants were requested not to discuss the video with their peers.

Upon their return, participants were presented with either a target-present or a target-absent lineup. The lineup was composed of mugshots of the culprit (or in the case of a target-absent lineup, the distractor) and five other middle-aged males of European descent. In the lineup, the photo of the culprit/distractor was placed in position 4. Before reminding the participants about the video, they were first asked whether they found any of the presented faces familiar in a general sense. If they selected a face as appearing familiar, they were also asked to state the reason (e.g., "#5 looks like my neighbour.").

Then, participants were reminded of the video they saw last week and were asked to perform two memory tasks. The first task required participants to perform a facial identification test, in which they were asked to attempt to identify the culprit from the simultaneous lineup that they just examined. Participants were informed that a photo of the target may or may not be in the lineup. After identification, participants reported their level of confidence on a 9-point scale anchored at the extremes with *1* (*not confident*) and *9* (*very confident*). The second task examined the amount of information recalled. Participants were first asked to write down as much information as they could with regard to the video. Then, they were asked 14 cued-recall questions; half of which related to the central content of the video and the rest pertained to the peripheral kind of information. All participants were advised that they could withdraw from the study at any time.

Upon the completion of all tests, two additional measures were given to ensure that there were no major discrepancies in participants between various conditions. The Demographic Information Sheet included questions about age, gender, ethnicity, and native language, and the Mill Hill Vocabulary Test (Senior Set B, 1977 Revision; Raven, Court, & Raven, 1977) was used as a proxy of verbal skills to ensure that verbal ability did not differ between experimental conditions. Finally, participants were thoroughly debriefed and informed about the purpose of the study. They also received credit for their participation.

In sum, participants were assigned to a condition in which they received either the instruction of *integrating* the contextual information with the video (i.e., *integrated* condition) or no such instruction (i.e., *isolated* condition). A week later, they were assigned to conditions in which they were tested in either the *same* or a *different* environment as their study context and were presented with either a *target-present* or *target-absent* lineup. Finally, they were asked to recall information for both central and peripheral information. Therefore, for all identification data, a 2 (Context Reinstatement) X 2 (Context Integration) X 2 (Lineup type) factorial design was used, with all factors serving as between-subjects factors ($n \sim 20$), whereas a 2 (Context Reinstatement) X 2 (Context Integration) X 2 (Centrality) mixed factorial design was used for analyses of recall ($n \sim 40$).

Results

Before examining the primary results, demographic information (i.e., age, gender, and race) and other potentially mediating variables, such as English as a second language (ESL), vocabulary skill (as determined by Mill Hill Vocabulary Test, Raven et al., 1977), and imagery skill (as measured by the questionnaire of Dean & Morris, 2003), were separately added as additional independent factors in preliminary analyses of variance (ANOVA) on the dependent measures of recall and facial identification. Race was categorized as Caucasian, Asian, and Other, and gender and ESL were coded as dichotomous variables. For age, vocabulary skill, and imagery skill, dichotomous groups were created through median splits. There were no main effects of age, gender, race or imagery skills, but main effects of ESL and vocabulary skill were found for some recall performances. However, none of the variables significantly interacted with the major independent variables (i.e., context reinstatement, context integration, lineup types, and centrality). For the sake of parsimony, these analyses are not discussed further.

Video Quality and Manipulation Check

Participants rated the video as quite clear ($M = 7.91$; $SD = 1.39$) and moderately believable ($M = 4.56$; $SD = 2.23$), and they did not find the blue screen too distracting ($M = 2.75$; $SD = 1.99$). Participants in the integrated condition found it moderately difficult to integrate the video event with their environment ($M = 4.09$; $SD = 2.36$), and some were more successful than others in performing this task. Written reports of participants' integrating strategies were assigned to one of two categories: 1) successful (i.e., participants utilized specific details in their environment and incorporated them into the video (e.g., "replaced the blue screen with the walls of bookshelves"; 61.25%), 2) unsuccessful (i.e., participants made unspecific comments about their integrating strategy or did not integrate the event with their environment because they found the task unrealistic; 38.75%). This variability in how successful participants were in context integration had implications for the results of recall performances (as discussed below).

Coding

Free Recall

Three judges collaboratively identified all of the critical details of the entire event and categorized each detail according to its relevance to the plot. Central information was "any element pertaining to the basic story that could not be changed or excluded without changing the basic story line" (Heuer & Reisberg, 1990, p. 499). The remaining elements of the event were considered to be peripheral information. Using this definition, 138 pre-identified feature points of the theft were created (69 central and 69 peripheral details of the event; see Appendix A and B, respectively). Participants' written accounts of the event were evaluated based on these predetermined criteria. Participants received one point for each critical detail correctly reported. For example, for the statement, "a girl left her wallet and laptop behind," the participant would receive four points, one point each for *a girl*, *left behind*, *wallet*, and *laptop*. Then, each correct response was coded as either central or peripheral. Thirty-two (20%) randomly selected verbal accounts were each coded by two independent judges. It was deemed an agreement when the coding discrepancy between the two coders was less than or equal to 2. Percentage agreements of the two raters for the information recalled (as calculated by the number of agreements divided by the number of agreements plus disagreements) were 90.6% for central information and 87.5% for peripheral information. Any discrepancies between coders were subsequently discussed and resolved.

Cued Recall

Participants' responses to the specific questions were coded as correct or incorrect. As before, participants' responses were evaluated by the same two coders. The percentage agreement of the two raters was 97 %. Any discrepancies between judges were subsequently discussed and resolved.

Data Analyses

The significance level for all statistical tests was $p < .05$. Partial Eta Square (η_p^2) was used to determine the effect size for each comparison because it removed the effect of other factors from the denominator of the effect size formula.

All of the identification data were analyzed in the following ways. First, binomial logistic regressions were conducted to examine the extent to which contextual factors and lineup types influenced these factors: familiarity judgment of target/foils in lineup, identification accuracy, and willingness to choose. The outcome variables were binary variables (with *0* indicating negative and *1* indicating positive identification). The odds ratio (*Exp(B)*) reflects the changes in odds of identifying a person per unit of change for each condition. The *Nagelkerke* R^2 provides each model's predictive efficacy

(Nagelkerke, 1991). Of note, because the interaction terms of the independent variables were of interest in this study, the product terms were included in the regression model. However, the standard errors of the coefficients (*B*) will become inflated as the independent variables increase in correlation with each other, as in the case when the interaction terms are included in the regression model (i.e., multicollinearity; M. Maraun, personal communication, August 3, 2006). Therefore, all variables and product terms were initially entered into these models. Then, backward stepdown searching was used and the rule for hierarchically well-formulated models was followed; that is, a main effect could not be removed unless its corresponding interaction term was not significant and was removed first. The models were compared by computing the difference in their log-likelihoods using chi square (Tabachnick & Fidell, 2001, p. 526):

$$\chi^2 = 2[(\text{log-likelihood for bigger model}) - (\text{log-likelihood for smaller model})]$$

and the most parsimonious model that was not reliably different from the full model was used. Subsequently, an analysis of variance (ANOVA) was conducted to determine whether the predictive factors (including identification accuracy) affected confidence ratings, and Pearson correlations were conducted to evaluate the CA relations. Finally, ANOVAs were conducted to evaluate the effect of context reinstatement and context integration on recall performances on central and peripheral details in a free and cued recall test.

Face Identification

Overall, collapsed across lineup types 94 participants (58.75%) made a positive identification, whereas 66 subjects (41.25%) rejected the lineup. The overall correct performance rate (i.e., proportion of hits + proportion of correct rejections) was .60, and the correlation between confidence and identification accuracy was .25 (p = .001).

Familiarity Rating[2]

Before participants were reminded of the video from the previous week, 61 (76.2%) in the target-present and 44 (55%) in the target-absent condition identified someone in the lineup as appearing familiar in general. Further, amongst those who reported a sense of familiarity in the target-present lineup, 54 (88.5%) identified the robber as familiar, and all but seven of these individuals stated that he was the culprit when asked to provide a reason for the positive familiarity judgment. As for those who were presented a target-absent lineup and reported a sense of familiarity, 27 (61.4%) selected lineup member #4 (i.e., the foil who was considered by pilot participants as most similar to the culprit), and about half of these participants (n = 14) erroneously stated that he was seen from last week's video. In total, 30 (68.2%) participants who identified a face as familiar in the target-absent condition erroneously identified the familiar individual as the culprit.

To explore whether contextual factors and lineup type affected familiarity judgment, a binomial logistic regression was first computed on the full model (i.e., containing the three main predictors and all of the interaction terms; see Figure 1). A test of the full model against a constant-only model was statistically reliable, χ^2 (7, N = 160) = 26.35, $p < .001$ (*Nagelkerke* $R^2 = .21$), indicating that the predictors, as a set, reliably distinguished between those who identified a face as familiar and those who did not. However, the log-likelihood of the final model did not decrease significantly with the deletion of context integration and all of the interaction terms, χ^2 (5, N = 160) = 4.8, $p >$ .05, and this model explained 19% of the variance in positive familiarity judgment. With this simple model that included only context reinstatement and lineup type as predictors, both of the main effects were significant (as may be seen in Figure 1). Participants who returned to the same testing room were 4.13 times more likely to find a face in the lineup familiar than those who were tested at a different room, B = 1.42, *Wald*(1) = 14.54, $p <$ .001. In addition, participants who were presented with a target-present lineup were 2.92 times more likely to identify a face in the lineup as familiar than those who were presented with target-absent lineup, B = 1.07, *Wald*(1) = 8.52, p = .004.

Identification Accuracy

Of the 80 participants who were shown a target-present lineup, 52 (65%) correctly identified the robber, six (7.5%) mistakenly identified a foil, and 23 (27.5%) incorrectly rejected the lineup. Of the 80 participants shown a target-absent lineup, 44 (55%) correctly rejected the lineup, whereas 36 (45%) falsely identified a foil. Among this latter group, a nontrivial number of participants (n = 14; 38%) selected the foil who was

[2] None of the participants selected more than one person in the lineup as familiar

considered to be the most similar to the real culprit in the pilot study, and 22 participants selected one of the five other foils. However, the main independent variables did not affect the tendency to choose between foil #4 and the five other foils and hence will not be further examined, all *p*s > .09.

Figure 2 presents the percentages of correct identification (i.e., both hits and correct rejections) for context reinstatement, context integration, and lineup type conditions. To examine the extent to which contextual factors and lineup type were related to identification accuracy, a binomial logistic regression was computed, containing the three main predictors and all of the product terms. A test of the full model against a constant-only model was not statistically reliable, χ^2 (7, N = 160) = 9.53, p = .22 (Nagelkerke R^2 = .08); however, a test of the model that included only context reinstatement, lineup type, and their product term against a constant-only model was statistically reliable, χ^2 (3, N = 160) = 9.08, p = .028 (Nagelkerke R^2 = .08). In this model, because there was a significant interaction, B = 1.75, *Wald*(1) = 6.78, p = .009, tests of simple effects of context reinstatement were conducted at each lineup type. As illustrated in Figure 2, context reinstatement significantly improved identification accuracy when the target was present in the lineup; returning to the same location where one witnessed an event increased the chance of correctly identifying the culprit by over three fold, B = 1.14, *Wald*(1) = 5.3, p = .02. On the other hand, context reinstatement did not affect identification accuracy when the target was absent in the lineup, B = -0.61, *Wald*(1) = 1.8, p = .18.

Willingness to Choose

Participants' willingness to identify someone from the lineup was also explored in terms of the full model (see Figure 3). The test of the full model with all three predictors and product terms against a constant-only model was statistically reliable, χ^2 (7, *N* = 160) = 24.53, *p* = .001 (Nagelkerke R^2 = .19), indicating that the predictors, as a set, reliably distinguished between those who gave a positive identification and those who did not. The log-likelihood of the final model did not decrease significantly with the deletion of context integration and all of the interaction terms, χ^2 (5, *N* = 160) = 5.86, $p > .05$, and this model explained 14% of the variance in willingness to choose. There was a significant context reinstatement effect; participants who returned to the same testing room were 2.95 times more likely to choose someone from the lineup than those who were tested at a different room, *B* = 1.08, *Wald*(1) = 9.67, *p* = .002. In addition, there was a significant lineup effect; participants who were presented with a target-present lineup were 3.27 times more likely to identify someone from the lineup than those who were presented with target-absent lineup, *B* = 1.19, *Wald*(1) = 11.59, *p* = .001.

Confidence Rating and CA Relationship

The mean identification confidence was 5.48 (*max* = 9; *SD* = 1.26). A 2 (Context Reinstatement) X 2 (Context Integration) X 2 (Lineup Types) X 2 (Identification Accuracy) ANOVA was conducted to examine first whether experimental conditions and identification accuracy affected participants' confidence judgements. The ANOVA revealed three significant main effects: context reinstatement, *F*(1, 144) = 12.62, *p* =

.001, $\eta_p^2 = .08$, identification accuracy, $F(1, 144) = 6.97$, $p = .009$, $\eta_p^2 = .05$, and lineup type, $F(1, 144) = 4.6$, $p = .03$, $\eta_p^2 = .03$; participants who were in the *same* condition were more positive about their lineup decision than those in the *different* condition, those presented with a target-present lineup were more self-assured than those presented with a target-absent lineup, and those who were accurate were also more confident than those who were inaccurate. However, as may be seen in Figure 4, the main effects of context reinstatement and identification accuracy were qualified by a significant interaction effect between context reinstatement and identification accuracy, $F(1, 144) = 8.85$, $p = .003$, $\eta_p^2 = .06$. None of the other main effects or interactions was significant, all *p*s > .13.

Because context reinstatement was the only experimental condition that appeared to moderate identification accuracy and confidence judgments, this factor was further examined by conducting a bivariate Pearson correlation between identification accuracy and confidence level at each level of context reinstatement (i.e., *same* vs. *different*). In the *same* condition, identification accuracy and confidence judgment were not correlated, $r(80) = .054$, $p = .64$. In the *different* condition, however, participants displayed significant insight into accuracy, $r(80) = .42$, $p < .001$; that is, participants who were confident about their identification were also more likely to be accurate.

Recall Performances

Free Recall

Total Free Recall. Total free recall of the video scenario was measured by the total number of words recalled and was seen as a crude measure of recall performances.

A 2 (Context Reinstatement) by 2 (Context Integration) ANOVA revealed a significant context reinstatement effect; participants who returned to the same location (M = 119.89; SD = 40.08) wrote significantly more words than those who returned to a different location (M = 93.86; SD = 38.22), $F(1, 156) = 17.76, p < .001, \eta_p^2 = .10$. Neither the main effect of context integration nor the interaction of context integration and context reinstatement was significant, both $ps > .15$.

Free Recall of Central and Peripheral Information. To explore eyewitness performance further, participants' free recall of specific details was assigned to two categories: central and peripheral. Table 1 shows the mean scores (and standard errors) of free recall on central and peripheral information, as a function of context reinstatement and context integration. A three-way mixed ANOVA with context reinstatement and context integration as the between-subject variables, and centrality of information as the within-subject variable was conducted. Tests of within-subjects effects revealed a significant main effect for centrality of information; participants recalled significantly more central information (M = 25.52; SD = 9.48) than peripheral information (M = 9.24; SD = 5.6) in a free recall test, $F(1, 156) = 481.27, p < .001, \eta_p^2 = .76$. None of the interaction effects were significant in the tests of within-subjects effects.

In terms of between-subjects effects, a main effect of context reinstatement was found (as may be seen in Table 1); participants who returned to the same location recalled significantly more details than those who went to a different location for the recall test, $F(1, 156) = 43.42, p < .001, \eta_p^2 = .22$. To examine the context reinstatement effect further, separate t-tests revealed that context reinstatement significantly improved recall of both central, *t*(158) = 4.88, $p < .001$, $\eta_p^2 = .13$, and peripheral information, *t*(158) = 5.71, $p < .001$, $\eta_p^2 = .17$. In the tests of between-subjects effects, neither the main effect of context integration nor the interaction was significant, all *p*s > .46.

Context Integration. As mentioned, 38.75% of the participants (*same* condition: $n = 16$; *different* condition: $n = 15$) failed to properly integrate the environment with the event. After removing these participants from the analyses, two post-hoc 2 (Context Reinstatement) X 2 (Context Integration) ANOVAs were conducted to explore whether participants who were successful in integration and returned to the same testing room showed better free central and peripheral recall, respectively, than those who were in the *isolated* and *different* conditions. The same pattern of results was once again found for central free recall; participants in the *same* condition ($M = 29.23$; $SD = 8.91$) remembered more central information than did those who were in the *different* condition ($M = 22.65$; $SD = 9.06$), $F(1,125) = 14.06$, $p < .001$, $\eta_p^2 = .10$, but neither the main effect of context integration nor the interaction was significant, both *p*s > .25. With regard to peripheral free recall, in contrast, participants in the *integrated* condition did perform better than those who were in the *isolated* condition (as illustrated in Figure 5), $F(1,125) = 4.86$, $p = .03$, $\eta_p^2 = .04$, and participants in the *same* condition also performed better than those who were in the *different* condition, $F(1,125) = 24.91$, $p < .001$, $\eta_p^2 = .17$; the two contextual variables also did not significantly interact, $F(1,125) = .001$, $p = .98$.

Cued Recall

Participants answered seven central and seven peripheral cued recall questions regarding the video content (see Appendix C). Table 2 shows the mean scores (and standard errors) of cued recall on central and peripheral information, as a function of context reinstatement and context integration. A three-way mixed ANOVA with context reinstatement and context integration as the between-subject variables, and centrality of information as the within-subjects variable was conducted. Tests of within-subjects effects revealed a significant main effect for centrality of information; participants recalled significantly more central information (M = 6.15; SD = 1.07) than peripheral information (M = 3.48; SD = 1.25) in a cued recall test, $F(1, 156) = 568.89$, $p < .001$, $\eta_p^2 = .79$. None of the interactions were significant in the tests of within-subject effects.

In terms of tests of between-subject effects, as may be seen in Table 2 a significant effect of context reinstatement was found; participants who returned to the same location (M = 9.95; SD = 1.77) performed better on a cued-recall test than those who returned to a different location (M = 9.29; SD = 1.87), $F(1, 156) = 5.2$, $p = .025$, $\eta_p^2 = .032$. Neither the main effect of context integration nor its interaction with context reinstatement was significant, both ps > .5. To examine the context reinstatement effect further, separate t-tests revealed that context reinstatement did not significantly improve the cued recall performance on central information, $t(158) = .77$, $p = .44$, but significantly improved the cued recall performance on peripheral information, $t(158) = 2.72$, $p = .007$, $\eta_p^2 = .05$.

Discussion

The primary motivation of the present work was to investigate the effects of context integration and context reinstatement on eyewitness testimony. In particular, participants were presented with a brief video depicting a theft and we measured the familiarity of target/foils, willingness to choose, identification accuracy, and confidence level of target identification in a target-present or -absent lineup. We also assessed witnesses' free and cued recall of central and peripheral details of that video.

The results of the present experiment are consistent with the view that context reinstatement, for better or for worse, has an impact on eyewitness testimony. In terms of identification, reinstatement of environmental context increased participants' familiarity judgments about lineup members and willingness to choose someone (regardless of accuracy). In addition, it also improved identification accuracy, but only when the target was present in the lineup. Finally, returning the participants to their encoding environment at test lowered the relationship between identification accuracy and confidence, perhaps because of restricted range in memory for the target or because context reinstatement artificially boosted participants' confidence rating without the accompanying improvement in accuracy.

Interestingly, the lineup type significantly affected some of the key outcome variables. In particular, participants who were presented with a target-present lineup were more likely to find a face in the lineup (particularly that of the culprit) familiar than those who were presented with a target-absent lineup. These participants were also generally more likely to identify someone as a culprit (regardless of accuracy) and more confident than their counterparts.

We also compared the effects of context on adults' subsequent reports of both central and peripheral aspects of the target event in free-recall and cued-recall tests. As predicted, context reinstatement had a stronger impact on free than cued recall and on the recall of peripheral than central details in general; the effect size of context reinstatement was largest for the free recall of peripheral details, intermediate-sized effects with free recall of central details, and minimal effects on cued recall of peripheral details. Finally, the general null effect of context integration could be explained by the use of ineffective instructions, considering that participants who did attempt to perform the integration appeared somewhat able to benefit from such mental manipulation.

The Impact of Context on Lineup Performances

Because context integration seemed to have failed as a manipulation, the effect of context reinstatement in this study on facial identification replicated the results found in other studies; that is, although participants in the *same* condition were better able to identify the target than those in the *different* condition when he was present at the lineup, they performed no differently than their counterparts when the target was absent. Consistent with the ICE Theory (Murnane et al., 1999), it is conceivable that because participants in this study were generally not successful in creating an ensemble (*E*) using the target face (i.e., the item, *I*) and the associated context (*C*), an associated-context match between study and test increased the "global match" to both targets and distractors but led to poor discrimination. In other words, context reinstatement had the effect of increasing both hits and false alarms.

Another reason why context reinstatement did not boost identification accuracy when the target was absent could be related to its effect on participants' general feeling of familiarity to their environment at test. Feeling of familiarity reflects processing fluency but also involves attribution about the source of fluency which is located in the past, that is, previous encounters with the stimulus (Whittlesea, 1993). By returning to the study context, participants might have falsely attributed this heightened cue familiarity to familiarity of one of the foils presented in the lineup (the possibility that participants could mistake one kind of familiarity for another was explored in studies such as Jacoby, Kelley, & Dywan, 1989, and Whittlesea, Jacoby, & Girard, 1990). Further, according to Baddeley and Woodhead (1992) the use of contextual retrieval cues may provoke an 'illusory feeling of knowing,' which may lead participants to adopt a lax criterion and, in doing so, promote false alarms to the detriment of misses. This argument was supported by the increased likelihood of participants specifying a face in the lineup as appearing "familiar" (regardless of whether the target was present or absent) and the increased willingness to identify someone (regardless of accuracy) when context was reinstated in the current study.

To explore this account further, it was plausible that such eerie sense of familiarity might have misled some participants to believe that they were more accurate than they actually were (Read, 1995). In fact, a feeling of confidence has been shown to be influenced by feeling of familiarity (Efklides, 2002). This was consistent with our findings, in which participants who were inaccurate were as confident as those who were accurate in the *same* condition, but in the different condition those who were confident were also accurate. The discrepant CA relationships of participants in the *same* and *different* conditions shed light on this troubling reality that confidence judgments are not only based on a direct access to information in memory, but could also be manipulated by other analytic considerations of the study and test conditions (Koriat, 1993, 1995, 1997; Metcalfe et al., 1993). For the present, it appears that if context reinstatement is to be used as a brief memory facilitation procedure, the gains associated with correct identification for target-present lineup have to be balanced against the disadvantages associated with false confidence effects; the latter are particularly important in applied settings as confidence is one of the main factors influencing jurors' perceptions of witness credibility (Wheatcroft et al., 2004).

Interestingly enough, however, despite increasing participants' sense of familiarity, willingness to choose, and confidence assessment, context reinstatement did not significantly increase foil identification (although numerically more positive identifications were made) when the target was absent in the lineup. It is clear that if a response bias of choosing had been adopted because of a heightened sense of familiarity, more participants would have identified someone across both lineups with context reinstatement. Recall that identification requires more than a mere sense of familiarity but entails the recovery of the context in which the items were studied and logical consistency (Read, 1994). Perhaps it is comforting that participants did not simply "go with their hunch," since the contrary would just imply that an innocent foil would have been implicated when the culprit was not actually present in the lineup.

Finally, results regarding lineup types might have been due to demand characteristics (or change in response bias), which were further promoted by the adoption of simultaneous lineup in the present study. According to Lindsay and his colleagues (Lindsay, Lea, & Fulford, 1991; Lindsay & Wells, 1985; Steblay, Dysart, Fulero, & Lindsay, 2001), presenting witnesses with all lineup members in view at the same time allows, and possibly encourages, the use of relative judgments. When the criminal is present, this approach may be effective since the guilty suspect is more likely than any other lineup member to resemble the witness' memory of the criminal; however, when the criminal is absent from the lineup, the witness is still likely to identify someone as familiar and also identify someone as the culprit, namely the lineup member who most closely resembles their memory of the criminal. In the present study, the demand characteristic to choose someone might be counteracted by providing pre-identification instructions indicating that the target "may or may not be present." However, future studies could further rectify this problem by presenting the pictures in the lineup sequentially (which promotes the use of absolute judgment and thereby reducing false identification). This method has an additional benefit; participants may be more able to utilize the contextual information of the room when only one picture is presented at a time.

The Impact of Context on Recall

Consistent with other research (e.g., Migueles & Garcia-Bajos, 1999; L. R.

Shapiro et al., 2005; Wright & Stroud, 1998), the recall of central details was greater than that of peripheral details in the present study. The results also revealed that superior recall of central over peripheral information occurred in both free and cued recall tests. Participants' memory for peripheral details was quite poor, as an average of only 9.24 (out of 69) peripheral details recalled would indicate. Such a low level of peripheral recall might be due to a floor effect; however, this might also be due to the fact that participants generally tend to focus on the kernel of meaning rather than specific details (e.g., Stafford, Burggraf, & Sharkey, 1987; Stafford & Daly, 1984).

One of the more noteworthy results of this study was the finding of greater memory facilitating effects for context reinstatement relative to controls for the recall of peripheral details in both cued and particularly free recall tests. These results lend support to the outshining hypothesis, which predicts that context effects should be greatest when the memory strength of the context information is large relative to the memory strength of the target information. As the memory strength of the item increases (as in the case of recalling central details), it tends to outshine any benefits of testing in the same context as study. The results of cued recall indicated that there were effects of contextual reinstatement on recall that were not necessarily apparent when only relevant, closed questions were asked. In particular, although the cued recall of central details was not significantly improved with context reinstatement, the cued recall of peripheral details was.

However, what is the purpose of improving participants' recall of information that is not relevant to the plot? Other than enhancing witness credibility (Bell & Loftus, 1988;

Wells & Leippe, 1981), it could be argued that by improving participants' ability to generate peripheral contextual details, context reinstatement could improve the recall of central detail (a strategy adopted by cognitive interview; Fisher & Geiselman, 1992). Nevertheless, given that what appears to be peripheral to a witness may actually be of central importance to an investigating officer, the possibility of raising peripheral detail memory to the level of central detail memory appears to offer a fruitful line for further investigation.

Limitations and Future Research

Context Integration

One of the principal purposes of this experiment was to assess the following question (as inspired by Eich, 1985): If witnesses actively create a contextual link between the target person/event and their context, can they be more benefited by the reinstatement of this very environment? In the present study, participants in the *integrated* condition were asked to imagine the event as if it was happening in their current environment and to imagine the face of the culprit in their environment with their eyes open to facilitate the integration of the event and the culprit's face with the participants' context. Imagery as an encoding mnemonic has been well documented (e.g., Canelos, 1981; Leighbody, Alsum, Tsao, & Evans, 1984), and the imagery literature suggests that spontaneous use of imagery is common (Kosslyn, Behrman, & Jeannerod, 1995). Unfortunately, context integration did not improve memory performances and did not seem to moderate the effect of context reinstatement. Because of this null effect, we explored whether participants were able to integrate the event with the context. Generally, participants found the task moderately difficult (with a mean rating of 4.09 out of 9) and seven participants (out of 80) did comment that such integration was unrealistic. In addition, it was unclear whether some participants understood the instructions. For example, when asked "how did you manage to incorporate the event to your environment," some participants wrote “going to inform security” as if they were imagining what they would have done in a similar situation involving a burglary.

In total, 31 participants out of 80 stated that they did not or could not integrate the event with their ambient environment. After removing data of these participants from the analyses, preliminary results suggested that free recall of peripheral information was moderately facilitated by context integration. Although the effect was small, it is conceivable that context integration might still facilitate participants' memory performance if clearer and more effective instruction was given. That said, it is plausible that some of participants in the *isolated* condition were incidentally performing such context integration, thereby bringing about this null effect. Such proposed automaticity of context integration has also been corroborated by neurophysiological data. Cohen et al. (1999) have argued that the hippocampus plays a central role in relational processing of elements within a complex, meaningful scene as well as in associative bindings of targets to context. Cohen et al. view the hippocampus as the machinery that allows one to make sense of the environment and suggest that relational processing is automatic and obligatory, and that the hippocampus is always engaged for processing of complex pictures. Alternatively, in hindsight context integration might actually have posed a negative effect on participants during the study phase by taking away their attention from the video or distracting them from observing some details of the event. Future endeavours that include context integration as manipulation might consider asking participants in the isolated condition to deliberately pay attention to their environment in addition to watching the event (without performing integration) in the hopes of creating a better control condition.

Decomposing the Video and the Viewing Environment

Most of the existing research that presents the critical event in a video format failed to consider the potential influence of the physical environment presented in the video (e.g., Sander, 1984). In the present study, a blue-screen background video was adopted to remove the potential competing impact of the video environment with the physical context in which the video was viewed. Although the current integration strategy did not facilitate participants' memory performance, other integration strategies could be considered. For instance, participants may be asked to watch the event in the environment where the video was filmed. Because the video and the physical environments are identical, it might help participants integrate the information provided in the viewing environments to the event happening in the video. Another reason for using a taped event that occurred in the same context as the environment that the video is viewed is to provide participants the opportunity to become familiar with the context prior to viewing the video. Campos and Alonso-Quecuty (1998) found that participants who had more prior knowledge of the crime context benefited more from the cognitive interview than those who were not familiar with the crime context. In addition, Read and Bruce (1984) demonstrated that familiarity of the context could potentially make participants less vulnerable to the misleading information provided. In that case, having an initial exposure to a context may help participants better evaluate the information presented to them. Future research can consider the effect of such manipulation.

Furthermore, there is little research to date that examines the qualitative aspects of different contexts. One of the important benefits of using the blue-screen imaging technology is the potential of future manipulation of the video background. By doing so, the interaction between the qualitative characteristics of the video and the actual environments can be easily manipulated. From a theoretical perspective, this kind of research can help decompose the environmental context as an entity and promote further understanding of its effect.

Context Effects and Aging

One of the major limitations of the present study was the use of only students from an introductory psychology class. Future studies should systematically examine the effects of context on memory performance in different adult age groups as older adults may benefit more from the availability of contextual information than younger adults do (e.g., Park et al., 1990; A. D. Smith et al., 1998). Two reasons have been proposed to indicate why contextual cues may be more important in facilitating the memory performance of older adults, as compared to that of young adults. First, it has been found that cues that accompany the to-be-remembered items assist older adults' cued-recall performance more so than that of young adults (Park et al., 1990). Environmental cues, acting as a backdrop, can be easily integrated with the targets and may therefore assist the memory of older adults. Second, substantial research has demonstrated that elderly adults are, on the average, more field dependent than are younger adults (e.g., Karp, 1966; Lambert & Fleury, 1994; Schwartz & Karp, 1967), and the effectiveness of context on memory varies depending on the individual's level of field dependency (Emmett et al., 2003; S. M. Smith & Rothkopf, 1984). Future studies should examine the impact of context reinstatement and integration on the memory performances of older adult population and determine whether these interventions could help facilitate their memory performances in their everyday settings.

The Interaction of the Internal and External Context

Finally, participants' mood was not manipulated in the current experiment, and the shoplifting scenario that was featured in the video was intended to be emotionally neutral. However, mood-congruent and mood-dependent memories are quite related to the context effect. As suggested by Whittlesea (2002b), "the specific phenomenology that a person experiences depend on his or her interpretation, within some specific context, of the significance of those aspects of performance which are salient within the event" (p. 325). An obvious example taps into the question of whether such memory will be enhanced by returning a real-life eyewitness to the scene of a witnessed event. Witnesses of crimes usually have stronger emotional involvement with the experienced events. Studying the reinstatement of emotional context and its interaction with physical context on subsequent memory performance will be helpful in cases such as sexual abuse, for example.

References

Anderson, J. R, & Bower, G. H. (1973). *Human associative memory.* Washington, DC: Winston.

Baddeley, A., & Woodhead, M. (1982). Depth of processing, context, and face recognition. *Canadian Journal of Psychology, 36*, 148-164.

Bell, B. E., & Loftus, E. F. (1988) Degree of detail of eyewitness testimony and mock juror judgements. *Journal of Applied Social Psychology, 18*, 1171-1192.

Bell, B. E., & Loftus, E. F. (1989). Trivial persuasion in the courtroom: The power of (a few) minor details. *Journal of Personality and Social Psychology, 56*, 669-679.

Bodner, G. E., & Lindsay, D. S. (2003). Remembering and knowing in context. *Journal of Memory and Language, 48*, 563-580.

Bothwell, R. K, Deffenbacher, K. A., & Brigham, J. C. (1987). Correlation of eyewitness accuracy and confidence: Optimally hypothesis revisited. *Journal of Applied Psychology, 72*, 691-695.

Bower, G. H. (1967). A multicomponent theory of memory trace. In K. W. Spence & J. T. Spence (Eds.), *The psychology of learning and motivation* (Vol. 1, pp. 229-325). New York: Academic Press.

Bower, G. H. (1970). Analysis of a mnemonic device. *American Scientist, 58*, 496-510.

Brewer, N., Potter, R., Fisher, R. P., Bond, N., & Luszez, M. A. (1999). Beliefs and data on the relationship between consistency and accuracy of eyewitness testimony. *Applied Cognitive Psychology, 13*, 297-313.

Brigham, J. C., Maass, A., Snyder, L. D., & Spauldin, K. (1982). Accuracy of eyewitness identifications in a field setting. *Journal of Personality and Social Psychology, 42*, 673-680.

Brown, J. M. (2003). Eyewitness memory for arousing events: Putting things into context. *Applied Cognitive Psychology, 17*, 93-106.

Campos, L., & Alonso-Quecuty, M. L. (1998). Knowledge of the crime context: Improving the understanding of why the cognitive interview works. *Memory, 6*, 103-112.

Canelos, J. (1981). The function of imagery mental representations of perceptual information as the cognitive basis of applied learning strategies. *Journal of Instructional Psychology, 9*, 3-12.

Cohen, N. J., Ryan, J., Hunt, C., Romine, L., Wszalek, T., & Nash, C. (1999). Hippocampal system and declarative (relational) memory: Summarizing the data from functional neuroimaging studies. *Hippocampus, 9*, 83-98.

Craik, F. I. M., & Jennings, J. M. (1992). Human memory. In F. I. M. Craik, & T. A. Salthouse (Eds.), *The Handbook of Aging and Cognition* (2nd ed., pp. 51-110). Hillsdale, NJ: Erlbaum.

Cutler, B. L., Penrod, S. D., & Martens, T. K. (1987). Improving the reliability of eyewitness identification: Putting context into context. *Journal of Applied Psychology, 72*, 629-637.

Dalton, P. (1993). The role of stimulus familiarity in context dependent recognition. *Memory and Cognition, 21*, 223-234.

Davies, G. M., & Thomson, D. M. (1988a). Context in context. In G. M. Davies & D. M. Thomson (Eds.), *Memory in context: Context in memory* (pp. 335-345). New York: John Wiley and Sons.

Davies, G. M., & Thomson, D. M. (Eds.). (1988b). *Memory in context: Context in memory.* New York: John Wiley and Sons.

Dean, G. M., & Morris, P. E. (2003). The relationship between self-reports of imagery and spatial ability. *British Journal of Psychology, 94*, 245-273.

Dodson, C. S., Johnson, M. K., & Schooler, J. W. (1997). The verbal overshadowing effect: Why descriptions impair face recognition. *Memory and Cognition, 25*, 129-139.

Earles, J. L., Smith, A. D., & Park, D. C. (1996). Adult age differences in the effects of environmental context on memory performance. *Experimental Aging Research, 22*, 267-280.

Efklides, A. (2002). The systemic nature of metacognitive experiences. In P. Chambres, M. Izaute, & P.-J. Marescaux (Eds.), *Metacognition: Process, function, and use* (pp. 19-34). Dordrecht, The Netherlands: Kluwer Academic Publishers Group.

Eich, J. E. (1980). The cue-dependent nature of state-dependent retrieval. *Memory and Cognition, 8*, 157-173.

Eich, J. E. (1985). Context, memory, and integrated item/context imagery. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 11*, 764-770.

Ellison, K., & Buckhout, R. (1981). *Psychology and criminal justice*. New York: Harper & Row.

Emmett, D., Clifford, B. R., & Gwyer, P. (2003). An investigation of the interaction between cognitive style and context reinstatement on the memory performance of eyewitness. *Personality and Individual Differences, 34*, 1495-1508.

Fernández, Á., & Alonso, M. A. (2001). The relative value of environmental context reinstatement in free recall. *Psicológica, 22*, 253-266.

Fisher, R. P., & Gieselman, R. E. (1992). *Memory-enhancing techniques for investigative interviewing: The cognitive interview*. Springfield, IL: Charles C. Thomas.

Fisher, R. P., McCauley, M. R., & Geiselman, R. E. (1994). Improving eyewitness testimony with the cognitive interview. In D. Ross, J. D. Read, & M. Toglia (Eds.), *Adult eyewitness testimony: Current trends and developments* (pp. 245-269). London, England: Cambridge University Press.

Flexser, A. J., & Tulving, E. (1978). Retrieval independence in recognition and recall. *Psychological Review, 85*, 153-172.

Gibling, F., & Davies, G. (1988). Reinstatement of context following exposure to post-event information. *British Journal of Psychology, 79*, 129-141.

Gieselman, R. E., Fisher, R. P., MacKinnon, D. P., & Holland, H. L. (1985). Eyewitness memory enhancement in the police interview: Cognitive retrieval mnemonics versus hypnosis. *Journal of Applied Psychology, 70*, 401-412.

Gieselman, R. E., Fisher, R. P., MacKinnon, D. P., & Holland, H. L. (1986). Enhancement of eyewitness memory with the cognitive interview. *American Journal of Psychology, 99*, 381-401.

Glenberg, A. M. (1979). Component levels theory of the effects of spacing of repetitions on recall and recognition. *Memory and Cognition, 7*, 95-112.

Godden, D. R., & Baddeley, A. D. (1975). Context-dependent memory in two natural environments: On land and underwater. *British Journal of Psychology, 66*, 325-331.

Granhag, P. A., Jonsson, A-C., & Allwood, C. M. (2004). The cognitive interview and its effect on witnesses' confidence. *Psychology, Crime, and Law, 10*, 37-52.

Hammond, L., Wagstaff, G. F., & Cole, J. (2006). Facilitating eyewitness memory in adults and children with context reinstatement and focused meditation. *Journal of Investigative Psychology and Offender Profiling, 3*, 117-130.

Hershkowitz, I., Orbach, Y., Lamb, M. E., Sternberg, K. J., Horowitz, D., & Hovav, M. (1998). Visiting the scene of the crime: Effects on children's recall of alleged abuse. *Legal and Criminological Psychology, 3*, 195-207.

Heuer, F., & Reisberg, D. (1990). Vivid memories of emotional events: The accuracy of remembered minutiae. *Memory and Cognition, 18*, 496-506.

Higham, P. A., & Vokey, J. R. (2004). Illusory recollection and dual-process models of recognition memory. *The Quarterly Journal of Experimental Psychology, 57A*, 714-744.

Horowitz, L. M., & Prytulak, L. S. (1969). Redintegrative memory. *Psychological Review, 76*, 519-531.

Jacoby, L. L., Kelley, C. M., & Dywan, J. (1989). Memory attributions. In H. I. Roediger & F. I. M. Craik (Eds.), *Variety of memory and consciousness: Essays in honor of Endel Tulving* (pp. 391-422). Hillsdale, NJ: Lawrence Erlbaum Associates.

Karp, S. (1966). Field dependence and aging. *Research Reports*, 1-19.

Kassin, S. M., Tubb, V. A., Hosch, H. M., & Memon, A. (2002). 'Eyewitness researchers as experts in court: Responsive to change in a dynamic and rational process': Comment. *American Psychologist, 57*, 378-379.

Kebbell, M. R., Milne, R., & Wagstaff, G. F. (1999). The cognitive interview: A survey of its forensic effectiveness. *Psychology, Crime, and Law, 5*, 101-115.

Kliegl, R., Smith, J., & Baltes, P. B. (1989). Testing-the-limits and the study of adult age differences in cognitive plasticity of a mnemonic skill. *Developmental Psychology, 25*, 247-256.

Kline, S., & Groninger, L. D. (1991). The imagery bizarreness effect as a function of sentence complexity and presentation time. *Bulletin of the Psychonomic Society, 29*, 25-27.

Köhnken, G., Milne, R., Memon, A., & Bull, R. (1999). A meta-analysis on the effects of the Cognitive Interview. *Special Issue of Psychology, Crime and the Law, 5*, 3-27.

Koriat, A. (1993). How do we know what we know? The accessibility model of the feeling of knowing. *Psychological Review, 100*, 609-639.

Koriat, A. (1995). Dissociating knowing and the feeling of knowing: Further evidence for the accessibility model. *Journal of Experimental Psychology: General, 124*, 311-333.

Koriat, A. (1997). Monitoring one's own knowledge during study: A cue-utilization approach to judgments of learning. *Journal of Experimental Psychology: General, 126*, 349-370.

Kosslyn, S. M., Behrman, M., & Jeannerrod, M. (1995). The cognitive neuroscience of mental imagery. *Neuropsychologia, 33*, 1335-1344.

Krafka, C., & Penrod, S. (1985). Reinstatement of context in a field experiment on eyewitness identification. *Journal of Personality and Social Psychology, 49*, 58-69.

Lambert, L. D., & Fleury, M. (1994). Age, cognitive style, and traffic signs. *Perceptual and Motor Skills, 78*, 611-624.

Leighbody, G., Alsum, D., Tsao, Y. C., & Evans, C. (1984). Interactive effects of mnemonic aids and instructions for use on recall by fifth grade readers. *Perceptual and Motor Skills, 58*, 757-758.

Lindsay, R. C. L., & Wells, G. L. (1985). Improving eyewitness identifications from lineups: Simultaneous versus sequential lineup presentation. *Journal of Applied Psychology, 66*, 343-350.

Lindsay, R. C., Lea, J. A., Fulford, J. A. (1991). Sequential lineup presentation: Technique matters. *Journal of Applied Psychology, 76*, 741-745.

Locke, J. (1700). Of the association of ideas. In *An Essay Concerning Human Understanding: In Four Books* (4th ed., pp. 221-226). Retrieved February 4, 2005, from http://gateway.proquest.com/openurl?ctx_ver=Z39.88-2003&res_id=xri:eebo&rft_val_fmt=&rft_id=xri:eebo:image:107140

Loftus, E. F. (1979). *Eyewitness Testimony.* Cambridge, MA: Harvard University Press.

Loftus, E. F., & Greene, E. (1980). Warning: Even memory for faces may be contagious. *Law and Human Behavior, 4*, 323-334.

Macken, W. J. (2002). Environmental context and recognition: The role of recollection and familiarity. Journal of Experimental Psychology: Learning, Memory, and Cognition, 28, 153-161.

Malpass, R. S. & Devine, P. G. (1981). Guided memory in eyewitness identification. Journal of Applied Psychology, 66, 343-350.

Mandel, B. J. (1980). Full of life now. In J. Olney (Ed.), Autobiography: Essays theoretical and critical (pp. 49-72). Princeton, NJ: Princeton University Press.

Masson, M. E., & Macleod, C. M. (1992). Reenacting the route to interpretation: Enhanced perceptual identification without prior perception. Journal of Experimental Psychology: General, 121, 145-176.

McKenzie, W. A., & Tiberghien, G. (2004). Context effects in recognition memory: The role of familiarity and recollection. Consciousness and Cognition, 13, 20-38.

Memon, A., & Bull, R. (1991). The cognitive interview: Its origins, empirical support, evaluation and practical implications. Journal of Community and Applied Social Psychology, 1, 291-307.

Memon, A., Gabbert, F., & Hope, L. (2004). The ageing eyewitness. In J. Adler (Ed.), Forensic Psychology: Concepts, debates and practice (Ch. 6). Cullmpton: Willan Publishing.

Memon, A., Hope, L., Bartlett, J., & Bull, R. (2002). Eyewitness recognition errors: The effects of mugshot viewing and choosing in young and old adults. *Memory and Cognition, 30*, 1219-1227.

Metcalfe, J., Schwartz, B. L., & Joaquim, S. G. (1993). The cue-familiarity heuristic in metacognition. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 19*, 851-864.

Migueles, M., & Garcia-Bajos, E. (1999). Recall, recognition, and confidence patterns in eyewitness testimony. *Applied Cognitive Psychology, 13*, 257-268.

Mori, M., & Graf, P. (1996). Non-verbal local context cues explicit but not implicit memory. *Consciousness and Cognition, 5*, 91-116.

Murnane, K., Phelps, M. P., & Malmberg, K. (1999). Context-dependent recognition memory: The ICE theory. *Journal of Experimental Psychology: General, 128*, 403-415.

Nagelkerke, N. J. D. (1991). A note on a general definition of the coefficient of determination. *Biometrika, 78*, 691-692.

O'Rourke, T. E., Penrod, S. D., Cutler, B. L., & Stuve, T. E. (1989). The external validity of eyewitness identification research. *Law and Human Behavior, 13*, 385-395.

Park, D. C., Smith, A. D., Morrell, R. W., Puglisi, J. T., & Dudley, W. N. (1990). Effects of contextual integration on recall of pictures by older adults. *Journal of Gerontology, 45*, P52-P57.

Penrod, S., & Cutler, B. (1995). Witness confidence and witness accuracy: Assessing their forensic relation. *Psychology, Public Policy, and Law, 1*, 817-845.

Priestley, G., Roberts, S., & Pipe, M. (1999). Returning to the scenes: Reminders and context reinstatement enhance children's recall. *Developmental Psychology, 35*, 1006-1019.

Raven, J. C., Court, J. H., & Raven, J. (1977). *Manual for Raven's Progressive Matrices and Vocabulary Scales*. London, England: Lewis.

Read, J. D. (1994). Understanding bystander misidentifications: The role of familiarity and contextual knowledge. In D. F. Ross, J. D. Read, & M. P. Toglia (Eds.), *Adult eyewitness testimony: Current trends and developments* (pp. 56-79). New York: Cambridge University Press.

Read, J. D. (1995). The availability heuristic in person identification: The sometimes misleading consequences of enhanced contextual information. *Applied Cognitive Psychology, 9*, 91-121.

Read, J. D., & Bruce, D. (1984). On the external validity of questioning effects in eyewitness testimony. *International Review of Applied Psychology, 33*, 33-49.

Read, J. D., Lindsay, D. S., Nicholls, T. (1998). The relation between confidence and accuracy in eyewitness identification studies: Is the conclusion changing? In C. P. Thompson, D. J. Herrmann, J. D. Read, D. Bruce, D. G. Payne, & M. P. Toglia (Eds.), *Eyewitness memory: Theoretical and applied perspectives* (pp. 107-130). Mahwah, NJ: Lawrence Erlbaum Associates.

Rozeboom, W. W. (1969). Compositional structure in recall. *Journal of Verbal Learning and Verbal Behavior, 8*, 622-632.

Russo, R., Ward, G., Geurts, H., & Scheres, A. (1999). When unfamiliarity matters: Changing environmental context between study and test affects recognition memory for unfamiliar stimuli. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 25*, 488-499.

Sanders, G. L. (1984). The effects of context cues on eyewitness identification response. *Journal of Applied Social Psychology, 14*, 386-397.

Schwartz, B. L., & Metcalfe, J. (1992). Cue familiarity but not target retrievability enhances feeling-of-knowing judgments. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 18*, 1074-1083.

Schwartz, D., & Karp, S.A. (1967). Field dependence in a geriatric population. *Perceptual and Motor Skills, 24*, 603-609.

Searcy, J. H., Bartlett, J. C., Memon, A., & Swanson, K. (2001). Aging and lineup performance at long retention intervals: Effects of metamemory and context reinstatement. *Journal of Applied Psychology, 86*, 207-214.

Shapiro, L. R., Blackford, C., & Chen, C.-F. (2005). Eyewitness memory for a simulated misdemeanor crime: The role of age and temperament in suggestibility. *Applied Cognitive Psychology, 19*, 267-289.

Shapiro, P. N., & Penrod, S. (1986). Meta-analysis of facial identification studies. *Psychological Bulletin, 100*, 139-156.

Shaw, J. S., Garcia, L. A., & McClure, K. A. (1999). A lay perspective on the accuracy of eyewitness testimony. *Journal of Applied Social Psychology, 29*, 52-71.

Smith, A. D., Park, D. C., Earles, J. L. K., Shaw, R. J., & Whiting, W. L. (1998). Age differences in context integration in memory. *Psychology and Aging, 13*, 21-28.

Smith, S. M. (1986). Environmental context-dependent recognition memory using a short-term memory task for input. *Memory and Cognition, 14*, 347-354.

Smith, S. M. (1988). Environmental context-dependent memory. In G. M. Davies & D.M. Thomson (Eds.), *Memory in Context: Context in Memory* (pp. 13-34). New York: John Wiley and Sons.

Smith, S. M. (1994). Theoretical principles of context-dependent memory. In P. E. Morris & M. Gruneberg (Eds.), *Theoretical aspects of memory* (2^{nd} ed., pp. 168-195). London, England: Routledge.

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

Smith, S. M., & Rothkopf, E. Z. (1984). Contextual enrichment and distribution of practice in the classroom. *Cognition and Instruction, 1*, 341-358.

Smith, S. M., & Vela, E. (1992). Environmental context-dependent eyewitness recognition. *Applied Cognitive Psychology, 6*, 125-139.

Smith, S. M., & Vela, E. (2001). Environmental context-dependent memory: A review and meta-analysis. *Psychonomic Bulletin & Review, 8*, 203-220.

Spence, D. P. (1988). Passive remembering. In U. Neisser & E. Winograd (Eds.), *Remembering reconsidered: Ecological and traditional approaches to the study of memory* (pp. 311-325). Cambridge, UK: Cambridge University Press.

Sporer, S. L. (1994). Decision times and eyewitness identification accuracy in simultaneous and sequential lineups. In D. F. Ross, J. D. Read, & M. P. Toglia (Eds.), *Adult eyewitness testimony: Current trends and developments* (pp. 300-327). New York: Cambridge University Press.

Sporer, S. L., Penrod, S., Read, D., & Cutler, B. (1995). Choosing, confidence, and accuracy: A meta-analysis of the confidence-accuracy relation in eyewitness identification studies. *Psychological Bulletin, 118*, 315-327.

Stafford, L., Burggraf, C. S., & Sharkey, W. F. (1987). Conversational memory: The effects of time, recall mode, and memory expectancies on remembrances of natural conversations. *Human Communication Research, 14*, 203-229.

Stafford, L., & Daly, J. A. (1984). Conversational memory: The effects of recall mode and memory expectancies on remembrances of natural conversations. *Human Communication Research, 10*, 379-402.

Steblay, N., Dysart, J., Fulero, S., & Lindsay, R. C. L. (2001). Eyewitness accuracy rates in sequential and simultaneous lineup presentation: A meta-analytic comparison. *Law and Human Behavior, 25*, 459-473.

Sutherland, R., & Hayne, H. (2001). The effect of postevent information on adults' eyewitness reports. *Applied Cognitive Psychology, 15*, 249-263.

Tabachnick, B. G., & Fidell, L. S. (2001). *Using multivariate statistics* (4th ed.). Needham Heights, MA: Allyn & Bacon.

Tiberghien, G. (1986). Contextual effects in face recognition: Some theoretical problems. In H. D. Ellis, M. A. Jeeves, F. Newcombe, & A. W. Young (Eds.), *Aspects of face processing* (pp. 88-105). Dordrecht: Martinus Nijhoff.

Tulving, E. (1974). Cue-dependent forgetting. *American Science, 62*, 74-82.

Tulving, E. (1982). Synergistic ecphory in recall and recognition. *Canadian Journal of Psychology, 36*, 130-147.

Tulving, E. (1983). *Elements of episodic memory.* Oxford, UK: Oxford University Press.

Tulving, E., & Thomson, D. M. (1973). Encoding specificity and retrieval processes in episodic memory. *Psychological Review, 80*, 352-373.

Wells, G. L., & Leippe, M. R. (1981). How do triers of fact infer the accuracy of eyewitness identifications? Using memory for peripheral detail can be misleading. *Journal of Applied Psychology, 66*, 682-687.

Wells, G. L., Small, M., Penrod, S., Malpass, R. S., Fulero, S. M., & Brimacombe, C. A. E. (1998). Eyewitness identification procedures: Recommendations for lineups and photospreads. *Law and Human Behavior, 22*, 603-647.

Wheatcroft, J. M., Wagstaff, G. F., & Kebbell, M. R. (2004). The influence of courtroom questioning style on actual and perceived eyewitness confidence and accuracy. *Legal and Criminological Psychology, 9*, 1-20.

Whittlesea, B. W. A. (1993). Illusions of familiarity. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 19*, 1235-1253.

Whittlesea, B. W. A. (1997). Production, evaluation, and preservation of experiences: Constructing processing in remembering and performance tasks. In D.L. Medin (Ed.), *Psychology of learning and motivation: Advances in research and theory, Vol. 37* (pp. 211-264). San Diego, CA: Academic Press.

Whittlesea, B. W. A. (2002a). On the construction of behavior and subjective experience: The production and evaluation of performance. In J. Bowers & C. Marsolek (Eds.), *Rethinking implicit memory* (pp. 239-260). Oxford, England: Oxford University Press.

Whittlesea, B. W. A. (2002b). Two routes to remembering (and another to remembering not). *Journal of Experimental Psychology: General, 131*, 325-348.

Whittlesea, B. W. A., Jacoby, L. L., & Girard, K. A. (1990). Illusions of immediate memory: Evidence of an attributional basis for feelings of familiarity and perceptual quality. *Journal of Memory and Language, 29*, 716-732.

Wickens, D. (1970). Encoding categories of words: An empirical approach to meaning. *Psychological Review, 77*, 1-15.

Wright, D. B., & Stroud, J. N. (1998). Memory quality and misinformation for peripheral and central objects. *Legal and Criminological Psychology, 3*, 273-286.

Wright, D. B., & Stroud, J. N. (2002). Age differences in lineup identification accuracy: People are better with their own age. *Law and Human Behavior, 26*, 641-654.

Yesavage, J. A., & Rose, T. L. (1984). Semantic elaboration and the method of loci: A new trip for older learners. *Experimental Aging Research, 10*, 155-159.

Appendix A

Central Details	**# of points**
Two girls	2
5 p.m.	1
A *Caucasian, middle-aged man* with *short curly brown hair* then *entered* the room from the *left*	9
blue shirt and *blue jeans*	4
He had a *newspaper,* The *Province,* in his *right* arm.	2
Took the *seat* of Julie's *friend*	2
He started *flipping/reading* the paper but *noticed* the pile of *books*.	3
He *hesitated* and *looked under* the books and found the *laptop*.	4
As he was looking, he *found* a *beige wallet* on the *floor*.	4
He *grabbed* the *wallet,* and *opens* it.	3
He *took 5 $20 bills* and a *red visa/debit card, removed* the *books* and *took laptop*	9
He *folded* the *money* around the *card* and *put* it in his *right jean pocket*	7
Suddenly, he *heard* a *girl's voice* and *left* the room from the *left*	5
Julie's *friend* said she *dropped/left* her *wallet* and *went* in the room from the *right*	5
found her *rent money* and *laptop* were *gone* and *yelled* for *"Julie"*	6
Julie suggested that they *"go* to *security*"	3

Appendix B

Peripheral Details	**# of points**
Sitting at a *desk* in a(an) *room/office/library*	3
One girl was wearing a *blue shirt* with *white stripe* and a *white hoody.* She had *red hair* that was *tied* up	9
Her friend (Julie) had a *grey shirt* on with *short blonde hair*	5
Julie's *friend* was *working* on a *presentation/assignment* with a *laptop*	4
Julie was *reading* a *magazine/book* and *asked* about the "*movie* the other night" and about *Jim*	6
Her friend responded "*good*" and *asked* "do you think that I should *move* the *graphics* down there?"	4
Julie further *asked* whether her friend was going to the *party* on *Friday*	4
Her friend responded that she had *3 assignments* due *next week* (*Monday, Tuesday,* and *Wednesday*)	7
Julie responded: "But *Matt* is going to be *there*"	3
Her *friend stretched,* asked for the *time,* and asked whether Julie would want to go get a *coffee*	4
Julie said she might get a *tea*	2
Julie asked whether they should *leave* the *laptop* in the *room*	5
Her friend responded that she *won't*, but said "it's your *computer*"	2
Julie decided because they were only going to be gone for a *few* minutes, she put *three books* on *top* of the *laptop* and said "you *can't* even *tell* it's there" (or to *hide* it).	7
They also *left* behind their other *belongings* and *exited* from the *right*	4

Appendix C

1. How many females were there in the video?
2. What time did the female say it was?
3. What was the colour of the culprit's shirt?
4. Why couldn't one of the girls attend the party?
5. What did the students do before they left the study environment?
6. Why did the students leave the room?
7. From which direction did the culprit enter the room [left or right]?
8. What was in the culprit's hand when he entered the room?
9. Other than a few $20 bills, what item(s) was/were stolen?
10. What did the student say the money was for?
11. Why did the girls return to the room?
12. What was the color of the wallet?
13. What did the females do after they discovered the theft?
14. Name one of the female students:

Table 1:

Mean Central and Peripheral Free Recall as a Function of Context Reinstatement and Context Integration (Standard Errors in Parentheses)

		Centrality	
		Central	Peripheral
Same	Integrate	27.48 (1.29)	12.15 (1.12)
	Isolate	30.40 (1.47)	10.95 (0.85)
Different	Integrate	21.81 (1.31)	7.65 (0.63)
	Isolate	22.40 (1.51)	6.21 (0.48)

Table 2:

Mean Central and Peripheral Cued Recall as a Function of Context Reinstatement and Context Integration (Standard Errors in Parentheses)

		Centrality	
		Central	Peripheral
Same	Integrate	6.31 (0.15)	3.79 (0.19)
	Isolate	6.11 (0.17)	3.69 (0.19)
Different	Integrate	6.05 (0.20)	3.29 (0.21)
	Isolate	6.11 (0.16)	3.14 (0.19)

Figure 1:

Percentage Positive Familiarity Judgments as a Function of Context Manipulations and Lineup Type

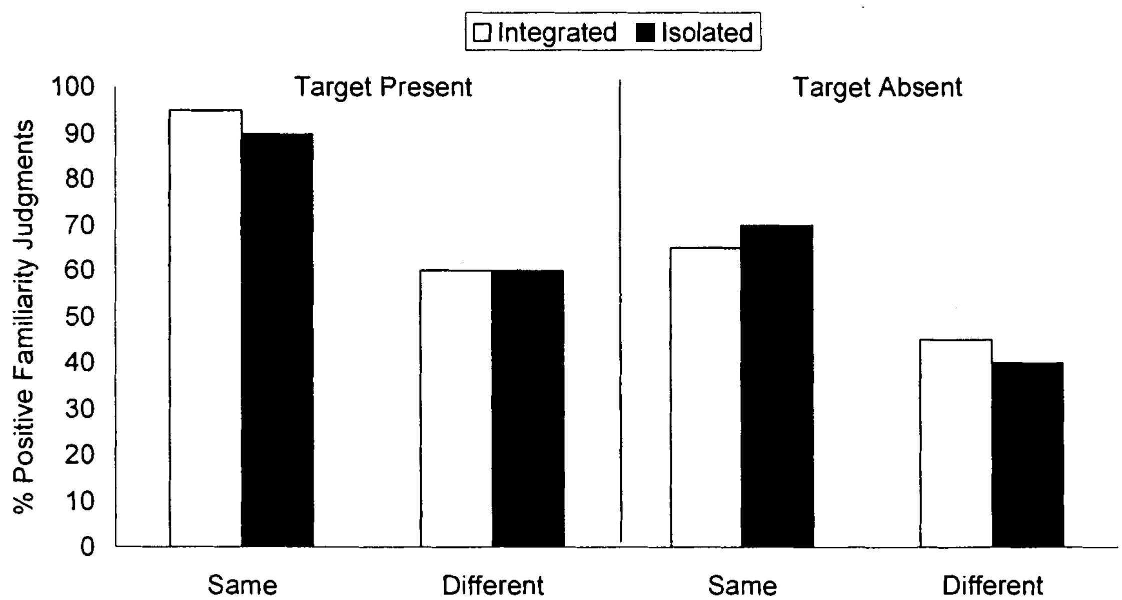


Figure 2:

Percentage Correct Identification as a Function of Context Manipulations and Lineup Type

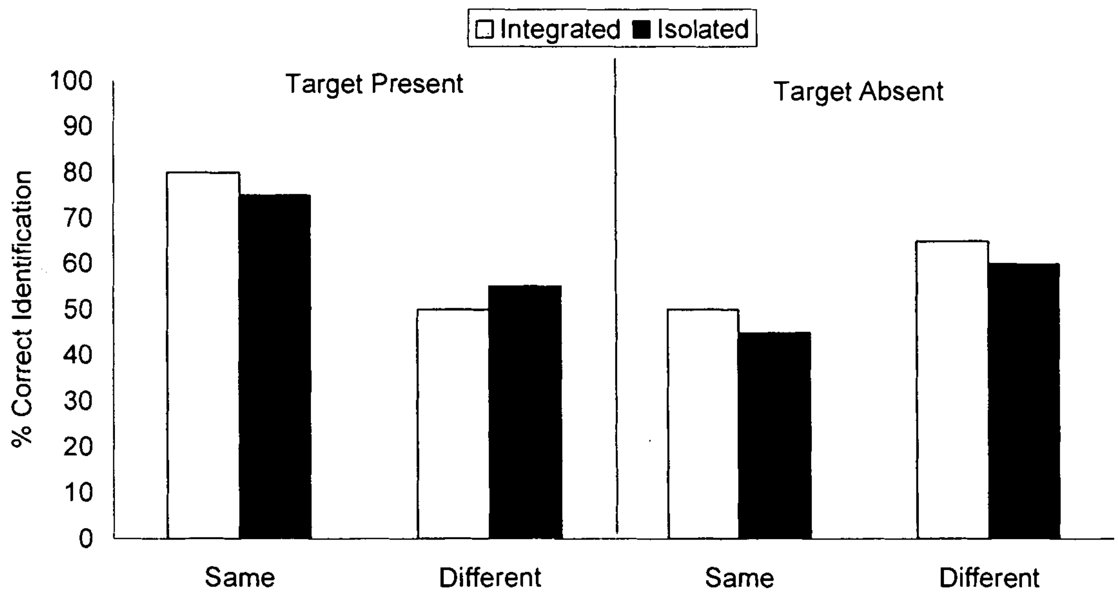


Figure 3:

Percentage Positive identification as a Function of Context Manipulations and Lineup Type

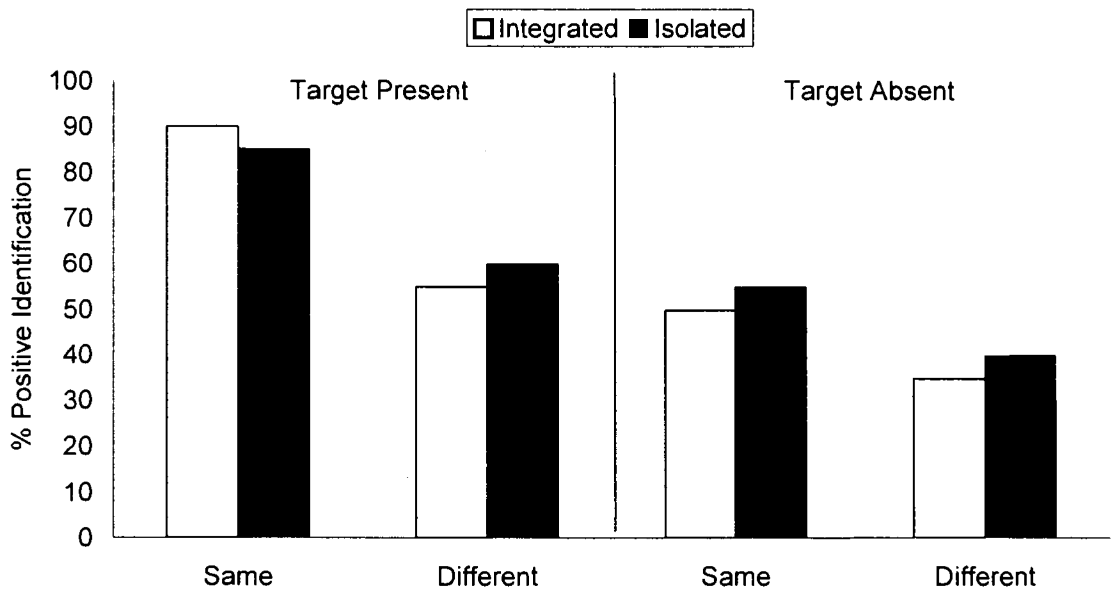


Figure 4:

Mean Confidence Ratings as a Function of Context Reinstatement, Lineup Type, and Identification Accuracy (Error Bar = Standard Errors)

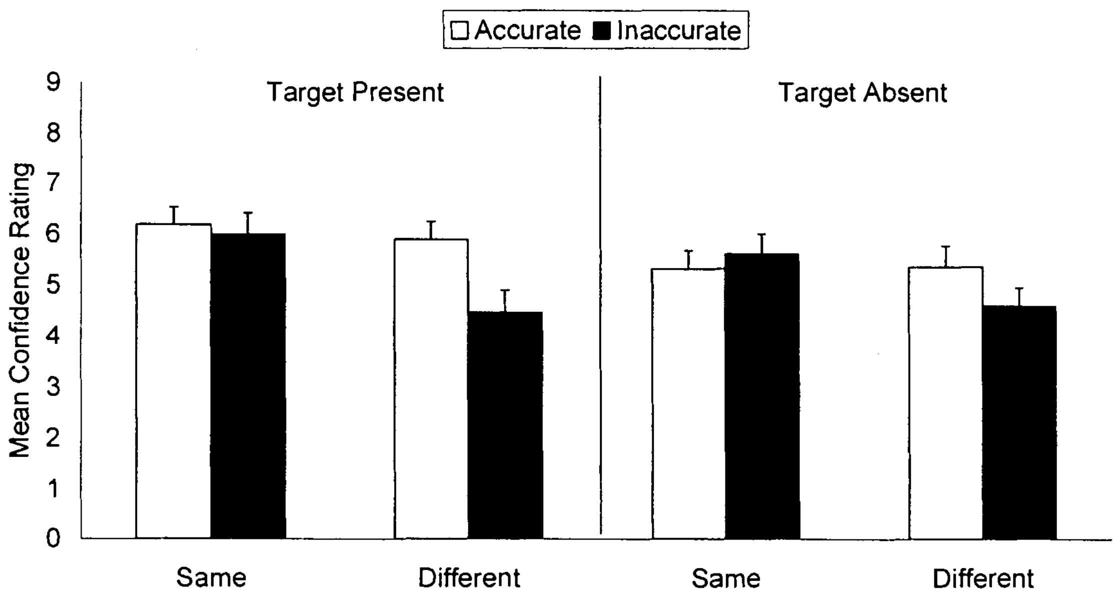
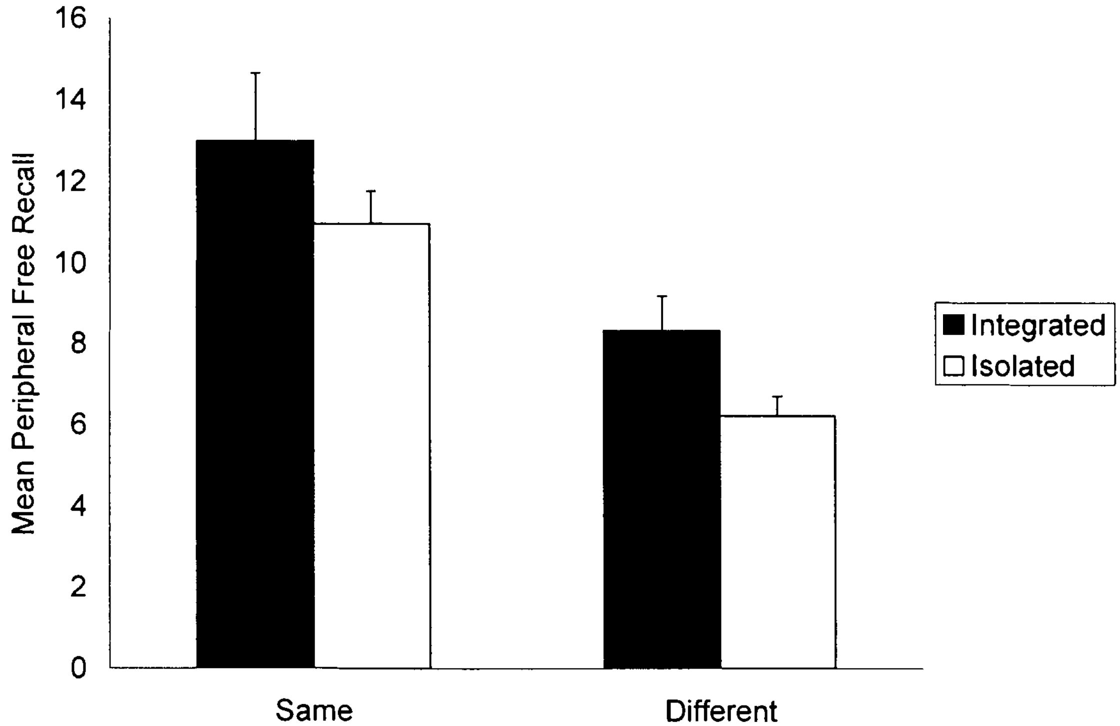


Figure 5:

Mean Peripheral Free Recall as a Function of Context Reinstatement and Context Integration



Note. These are the results of those who successfully performed context integration (*integrated*: $n = 49$; *isolated*: $n = 80$)