The influence of the generation of detail on accurate and inaccurate remembering.

by

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A Thesis submitted to the Faculty of Graduate Studies of

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Abstract

Traditionally, recognition judgments have been thought of as arising from two fundamentally different processes; namely, familiarity and recollection (Jacoby, 1991; Mandler, 1980). According to the dual-process theory (Jacoby, 1991), the differences in these two influences on recognition judgments lies in their degree of automaticity and the extent to which they rely on a heuristic attribution about the source of current processing. Specifically, familiarity is thought to be based on the attribution that the automatic perceptual processing of a stimulus originates from prior exposure, whereas recollection is often seen as resulting from the direct and consciously controlled retrieval of details associated with prior exposure to a stimulus (Jacoby & Dallas, 1981). As a result, familiarity is conceptualized as being a remembering process that is error-prone and inferential, whereas recollection is conceptualized as being a relatively infallible basis of making remembering judgments. The main objective of this thesis is to critically examine the commonly held perspective that recollection is a less error-prone basis for making remembering judgments than a reliance on familiarity. Across three experiments, I examined the factors that influence how people use the recollection of detail in forming recognition memory judgments. Together, the results from the three studies provide evidence that the generation of detail, or recollection, is not an infallible basis to form remembering judgments; instead, in some situations, recollection was found to be based on an error-prone inferential process.

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CHAPTER 1

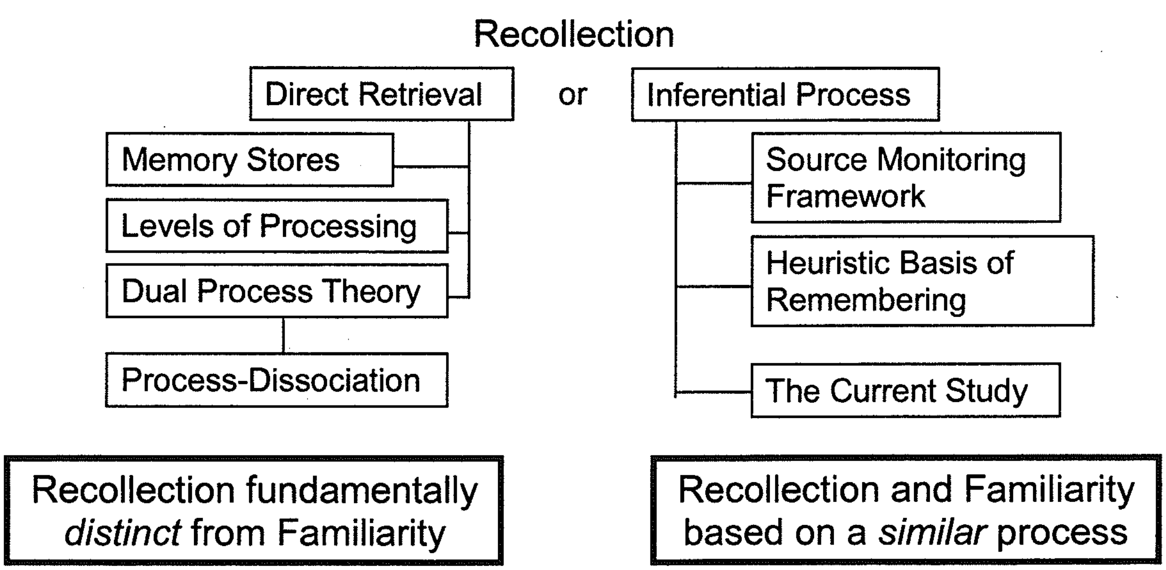
INTRODUCTION

Our ability to effectively behave in our environment is dependant on our ability to correctly recognize the particular situation that we are in. For example, while walking down the street, we may encounter someone that we recognize. In this situation we may initially experience a feeling of familiarity for the person. That is, we may experience the "feeling" that we know the person from some past experience, but be unable to determine from where we know them. In addition to this vague "feeling", we may also recollect details from some prior experience and determine from where we know the person. For example, after initially experiencing the feeling of familiarity for a person we encounter, we may recall chatting with the person after class; therefore, we may recognize them as a friendly person from class, and approach them to say "hi". Alternatively, we may recall seeing the person yelling at the professor after class; therefore, we may recognize them as an obnoxious person from class, and try to avoid talking to them. Together, the initial feeling of familiarity along with the generation of detail, or recollection, guide our memory judgments and behaviour towards particular stimuli.

To examine the accuracy of memory judgments, basic cognitive research has focused on examining peoples' ability to determine whether certain items were previously experienced in some prior context. These studies examine how people accurately make recognition memory judgments. In general, the study of recognition memory in the laboratory involves presenting people with a set of items, such as words, nonwords, word pairs, or numbers during a study phase. At some later time, people are then presented with another set of items containing both items that were previously present and those that were previously absent from the study phase. In these types of experiments, people are required to judge whether each item was encountered during the previous study phase. Memory accuracy is determined by examining participants' correct "old" judgments for previously studied, or *old*, items (hits) and "new" judgments for previously unstudied, or *new*, items (correct rejections). Furthermore, memory inaccuracy is determined by examining participants' incorrect "new" judgments for previously studied items (misses) and "old" judgments for previously unstudied items (false alarms).

Based on the results from such laboratory recognition experiments, a number of hypotheses regarding recognition memory have been proposed. Early hypotheses of recognition memory were based on the notion that memory acted like storage system from which specific events could be retrieved. In contrast, more recent accounts of memory are based on the idea that an inferential process guides remembering judgments and that remembering does not allow for privileged access to some prior experience stored in memory. To begin, early accounts of memory will first be presented followed by a discussion of how more recent accounts of memory take into consideration the inferential nature of remembering. Specifically, the widely accepted dual-process theory (Jacoby, 1991) will be discussed, which proposes that recognition judgments can be based on two fundamentally different processes: familiarity, the automatic and inferential process, and recollection, the controlled and direct process. As a result of the different processes that give rise to familiarity and recollection, familiarity is typically thought of as being a remembering process that is error-prone, whereas recollection is thought of as being a relatively infallible basis of making remembering judgments. In contrast to this commonly held perspective, recent research will be discussed which raise concerns about treating recollection as an error-free basis for making remembering judgments. As an alternative to the traditional view of recollection, a more parsimonious account for how remembering judgments are formed will be discussed that proposes that both familiarity and recollection arise from inferential processes. Finally, three studies will be discussed, which explored the factors that influence how people use the recollection of detail in forming recognition memory judgments. An outline of the conceptual framework behind the current study and how the current study fits into the current literature is provided in Figure 1. Together, the results from the three studies provide evidence that, in some situations, the generation of detail, or recollection, is not an infallible basis to form remembering judgments, and, instead, may be based on an error-prone inferential process.

Figure 1. Schematic representation of the conceptual framework behind the current study.



Memory as Direct Retrieval or as a Reconstructive Process

Most early accounts of memory have treated memory as storage system, which stores information about a past event in a theoretical mental filing cabinet. Following this analogy of memory, the act of remembering has been typically conceptualized as occurring via as a search and retrieval process. For example, Waugh and Norman (1965) expanded on theories originally proposed by James (1890) and Broadbent (1958) which suggested that memory consisted of two storage systems: primary and secondary memory. The information stored in and recalled from primary memory was thought to be information that was consciously being processed as part of the present situation. In contrast, information stored in and recalled from secondary memory was thought to be information that was no longer consciously being processed and was not part of the present situation. Therefore, for information to be stored about a previous event, it must have been transferred from primary memory to secondary memory. Waugh and Norman concluded that with rehearsal, information has a certain probability of entering secondary memory and being successfully recalled at a later time. Furthermore, a number of early memory researchers proposed that rehearsal of information results in a stronger memory trace for that information which results in better remembering for rehearsed information compared to other information that has not been rehearsed (Barnes & Underwood, 1959; McGeoch, 1932; Postman & Stark, 1962, Rundus & Atkinson, 1970). Thus, according to these early researchers, accurate remembering was thought of as resulting from accessing the appropriate memory trace from secondary memory and transferring that information to primary memory. From this perspective, secondary or long-term memory is conceptualized as being a mental structure that stores information about past experiences, and the act of remembering is conceptualized as involving the direct retrieval of the details about prior experience from memory storage. Failures in the use of memory, then, primarily relate to forgetting, which may occur either because information was not sufficiently rehearsed at the time of encoding or because interference from similar memory representations block access to the event one is attempting to remember.

In contrast with the notion that mere rehearsal leads to better transfer of information to long-term memory storage, Craik and Lockhart (1972) proposed that the level of meaningful processing at the time of encoding is important in determining whether information will be recalled at a later time. According to Craik and Lockhart, deeper processing at the time of encoding results in better remembering. That is, encoding the stimulus in a meaningful manner results in a richer, more elaborate memory trace, making the stimulus more likely to be accurately remembered later. Therefore, accurate remembering was thought to be partly dependant on the extensiveness of processing involved at the time of encoding the stimulus. By this view, elaborate encoding enhances the distinctiveness of a representation, insulating the representation for that event from interference from other memory representations stored in memory. In line with early theories of memory, however, Craik and Lockhart maintained the notion that remembering involved directly accessing representations of a previous event or item stored in memory. Thus, the emphasis of the levels of processing framework was on factors that determine successful remembering of prior experiences, thereby treating retrieval failure as the primary source of remembering breakdown.

More recent accounts of memory suggest that remembering does not exclusively reflect direct access to and retrieval of a past experience. Instead, the remembering of any one event is thought to be a reconstruction that can be biased and distorted by irrelevant memory representations and aspects of the current situation (Bartlett, 1932; Johnson, Hashtroudi, & Lindsay, 1993; Leboe & Whittlesea, 2002; Loftus & Palmer, 1974; Roediger & McDermott, 1995). For example, Leboe and Whittlesea (2002) demonstrated that participants' confidence in their recollection for a context word, after being presented with cue word, was biased depending on whether the cue and context words were related. When the cue and context words were related, participants were less confident in their recollection for the context word. Whereas, when the cue and context words were unrelated, participants were more confident in their recollection for the context word. This recollection confidence bias created by presenting either a related or an unrelated cue demonstrates how manipulations to the conditions at recall influence recollection, supporting the reconstructive nature of recollection.

Furthermore, remembering can be thought of as stemming from a subjective experience that derives from attributions about the nature of current processing (Jacoby, 1991; Jacoby & Dallas, 1981; Leboe & Whittlesea, 2002; Whittlesea, 1993; Whittlesea & Leboe, 2000). As such, the conscious experience of remembering occurs when an unconscious attribution is made about current processing originating from some prior experience. Thus, in contrast with early theories of memory, more recent theories suggest that remembering does not always involve direct retrieval of information from storage; rather, remembering is thought to be a process which emerges from an active piecing together of whatever information is made available in the present and a constant evaluation of current processing to determine whether that processing reflects the influence of some prior experience.

One such theory which now takes the inferential basis of remembering into account, the dual-process theory, proposes that people base their recognition memory judgments on two separate processes: *familiarity* and *recollection* (Jacoby, 1991; Mandler, 1980). Even so, when originally discussed by Mandler, both familiarity and recollection were described as resulting from the direct retrieval of some prior experience from memory. According to Mandler, familiarity was thought to arise from the process of "intraitem integration" (p. 255). Intraitem integration was thought to occur as a result of prior experiences with an item. Specifically, this prior experience was thought to activate and organize the concept according to the sensory and perceptual qualities in memory apart from the surrounding context. Therefore, when the concept is retrieved from memory, the more coherent organization of the concept was thought to produce familiarity through facilitated stimulus perception. Similarly, recollection was thought to result from the retrieval of particular contextual details about some past experience (Mandler). Thus, according to Mandler's original dual-process account, both familiarity and recollection stemmed from the direct retrieval of information from memory. The distinction that was made between familiarity and recollection was in the type of information that is retrieved from memory. In contrast to this account, the more recently proposed dual-process theory, initially discussed by Jacoby (1991), distinguishes familiarity and recollection from one another based on the processing that gives rise to these cognitive experiences.

The Modern Dual-Process Theory

According to more recent versions of the dual-process theory, the distinction made between familiarity and recollection is based on the degree of automaticity versus consciousness of the processing and the attributional basis of the processing. More precisely, feelings of familiarity are thought to arise from the automatic perceptual processing of a stimulus, and recollection is thought to occur from the consciously controlled, effortful retrieval of the past study context from memory (Jacoby & Dallas, 1981). Similar to Mandler's (1980) view, the feeling of familiarity is thought to result from the fluent perception of a particular stimulus. Contrasting Mandler's view, however, the fluent perception that produces feelings of familiarity does not need to be caused by a memory representation for that stimulus. Instead, when a stimulus is experienced as being more fluent than should be expected, for whatever reason, such as the current situation, this unexpectedly fluent perception gives rise to the conscious feeling of familiarity (Jacoby & Dallas; Jacoby & Whitehouse, 1989; Westerman, Lloyd, & Miller, 2002; Whittlesea, 1993; Whittlesea, Jacoby & Girard, 1990). For example, if a person is encountered while walking down the street, the feeling of familiarity may automatically occur, "I know I've seen her somewhere, but I just can't place her". In this instance, although a particular context is not consciously recalled for the recognition judgment, unconsciously, based on the automatic fluent perception of the person, they may still be recognized as being from some past context. In fact, the fluent perception actually may stem from some past experience, such as being in a class with the person. Thus, the automatic fluent perception of the person, which produces the feeling of familiarity, would result in a correct recognition judgment for having seen that person in some prior context. However, the fluent perception of the person may stem from the current situation. As a consequence, the conscious feeling of familiarity may lead to an incorrect recognition judgment. For example, perhaps the person has facial features which are similar to a friend's facial features. Due to this similarity, the person may be processed more fluently than expected without the knowledge that they look similar to a friend. Since this unexpected fluent processing of the person would not be attributed to their similarity to a friend, the fluent processing may lead to the feeling of familiarity. In this example, the fluent perception would result in an incorrect judgment of having seen the person in some prior context. Thus, feelings of familiarity are not necessarily error-free; rather, reliance on the same processing information, reliance on the degree of fluent perception, may lead to either accurate or inaccurate recognition judgments.

Recognition judgments based exclusively on the feeling of familiarity are often experiences as being unconvincing, even as being unsettling. To experience a more convincing sense of remembering, recollection of details must also occur. As described by the dual-process theory, recollection is considered to involve a controlled conscious use of memory. As a result, recollection is proposed to function as an intentional, resource demanding search and retrieval process. Indeed, recollection, as it occurs in the real world, can be experienced as an effortful, conscious, search and retrieval process (e.g., "Was she in Psychology? No, it was Biology! She was the one who sat in the front and constantly fell asleep."). Thus, when recognition judgments are based on recollection, a consciously controlled process appears to be influencing these decisions.

Specifically, recollection seems to be based on intentionally bringing to mind contextual details associated with some past experience with a stimulus.

Familiarity as an Automatic Process and Recollection as a Controlled Process

The notion that familiarity is an automatic process and that recollection is a controlled process is consistent with the general criteria for distinctions between automatic versus controlled processes (Hasher & Zacks, 1979; Posner and Snyder, 1975). In particular, the processing characteristics of familiarity and recollection seem to be consistent with Posner and Snyder's three general criteria of unconscious and conscious processes, respectively. First, automatic or unconscious processes are thought to occur without intention. Thus, according to this criterion, feelings of familiarity would be classified as being unconscious since these feelings seem to occur immediately as a consequence of perception of a stimulus. In contrast, recollection of detail would be classified as being intentional since deliberate effort is thought to be required.

The second criterion Posner and Snyder (1975) require for unconscious processes is that they occur without awareness. Again, familiarity falls within this description since the feeling of familiarity occur without any specific knowledge of why this feeling occurred. That is, feelings of familiarity occur from the automatic and unconscious process involved in perceiving a stimulus. Recollection, on the other hand, seems to be an effortful search process that we are consciously aware of occurring; thus, it would be classified as being a controlled process.

Lastly, according to Posner and Snyder (1975), automatic processes are thought not to be affected by cognitive load. To support this notion, Jacoby (1991) examined the influence of divided attention on familiarity and recollection for situations in which familiarity and recollection were either expected to together facilitate (Experiment 1) or oppose one another (Experiment 2) in guiding recognition judgments. In Experiment 1, Jacoby first presented participants with a study phase containing a series of words that were either presented intact or as an anagram. In the test phase, the participants were required to perform a recognition test under full or divided attention. For the participants who performed the recognition test under divided attention, a listening task was used in which they listened for a target sequence of numbers in a randomly presented list of numbers. For the participants who performed the recognition test under full attention, there was no additional listening task. For the recognition test, participants were required to identify words that were presented as either an intact word or as an anagram in the study phase as being old. For this task, the ability to recognize words that were previously presented as intact words was thought to reflect the influence of familiarity, since familiarity is based on perceptual fluency that is mainly enhanced after prior exposure. Whereas, the ability to recognize words that were previously presented as anagrams was thought to reflect the influence of recollection. Since there was no prior visual exposure to anagram words, perceptual fluency for these words would not have been enhanced. Instead, more elaborate encoding would have occurred for the anagram words after being required to generate the solution to the anagram, which would have improved recollection. Consequently, if recollection is a controlled process, recognition judgments for words that were previously presented as anagrams would be expected to be impaired by dividing attention, compared to recognition judgments for words that were previously presented as intact words. Indeed, Jacoby's results revealed that recognition judgments for words previously presented as anagrams was impaired more so than recognition judgments for words previously presented as intact words. These results provided initial evidence that recollection is a controlled process and familiarity is an automatic process since increasing cognitive load detrimentally affected recognition judgments that were reliant on recollection and did not have as great of a detrimental affect when recognition judgments were reliant on familiarity.

In Experiment 2, Jacoby (1991) created a situation in which familiarity and recollection made opposite contributions to participants' recognition judgments. To do this, Jacoby first presented participants with a list of words that was identical to the study phase of Experiment 1. Following this phase, participants were presented with another study phase in which a different set of words were heard. In the test phase, participants were required to judge a word as being old only if it was heard during the second study phase. Further, if participants remembered reading or solving an anagram for the word in the first study phase, they were required to judge the word as being new. Therefore, if participants incorrectly judged a word from the first study phase as being old, these false recognition judgments were thought to be based on the influence of familiarity specific from recollection. As in Jacoby's first experiment, the old and new recognition judgments were made under full and divided attention. Jacoby found that in the full attention condition, fewer false old judgments were made for words which were presented as anagrams; indicating that recollection was better for words which were previously presented as anagrams. More importantly, divided attention resulted in much higher false old judgments for words that were previously presented as anagrams than in the full attention condition. In contrast, the proportion of false old judgments was only slightly higher for words that were previously read in the divided attention condition than in the full attention condition. Thus, once again, words encoded as anagrams produced greater recollection of detail than words studied intact. Moreover, divided attention had its greatest impact on the accuracy of recognition judgments involving words previously presented as anagrams. Since words previously presented as anagrams were most affected by dividing attention, these results provided further evidence that demonstrates the controlled process that gives rise to recollection. By implication, recognition judgments based on familiarity are reliant on an automatic process, since recognition judgments in response to words that produced less recollection of detail, but more perceptual fluency, were relatively unaffected by dividing participants' attention.

Together, the results from Experiments 1 and 2 suggest that familiarity is a more automatic process than recollection since it was not as detrimentally affected by increasing the cognitive load. However, although dividing attention led to more difficulties for recognition judgments that were more reliant on recollection, these results were not conclusive since there were no conditions that relied solely on familiarity or recollection. Therefore, to examine further the influence of these processes separately, Jacoby (1991, Experiment 3) developed the process-dissociation framework. Using this framework, Jacoby, and others (Jacoby, Toth, & Yonelinas, 1993; Jacoby, Yonelinas, & Jennings, 1997; Jennings & Jacoby, 1993) have been able to demonstrate dissociations between the influence of familiarity and recollection in memory judgments. In these studies, the independent contribution of familiarity and recollection have been examined by comparing situations in which familiarity and recollection combine to influence remembering judgments to situations in which familiarity is used exclusively to influence remembering judgments.

The Process-Dissociation Framework

The process-dissociation framework was developed by Jacoby (1991) to create situations in which familiarity and recollection combine to influence remembering judgments to situation in which familiarity is used exclusively to influence remembering judgments. To achieve this end, Jacoby developed an experimental design in which words were presented to participants in two different word lists. In List 1, the words were presented to the participant either as words to be read or as words to be named by solving an anagram. In List 2, participants heard a series of words. At test, participants were presented with new words, words from List 1 and words from List 2. Their task was either to judge words that were presented in List 1 and List 2 as being old, the *inclusion* judgment, or to judge words that were presented only in List 2 as being old, the *exclusion* judgment. Jacoby inferred that when participants made correct inclusion judgments, these decisions were based on a combined influence of familiarity and recognition. In contrast, when participants made incorrect exclusion judgments (i.e., reported a List 1 word as being present in List 2 by judging the List 1 word as being old), this decision was based solely on familiarity, since recollection of detail about the previous context would have led to a correct rejection of seeing the word in List 2. By comparing the situations in which participants correctly responded "old" to old items when instructed to do so under the inclusion instructions, to the situations when participants incorrectly responded "old" to List 1 items when instructed to do so under the exclusion instructions, estimates of the relative contributions of familiarity and recollection on recognition judgments were able to be computed.

Using this framework, Jacoby (1991) was able to examine the influence of familiarity and recollection separately when making recognition judgments. Jacoby found that familiarity was not at all affected by divided attention at test, via a listening task, and recollection was found to be hindered; therefore, that these familiarity and recollection were concluded to be fundamentally distinct memory processes. These findings spurred a large number of additional studies, the results of which consistently demonstrated that familiarity was based on an automatic process and recollection was based on a controlled process (Jacoby et al., 1997). Specifically, additional research by Jacoby et al. (1993) indicated that only recollection was affected by divided attention at study. Furthermore, Jennings and Jacoby (1993) demonstrated that aging only reduced the influence of recollection on memory decisions, leaving the influence of familiarity unaffected.

This framework has provided an important paradigm to study the independent influences of familiarity and recollection on recognition judgments, since the use of this framework allows for the isolation of the influence of familiarity and the influence of recollection on recognition judgments.

The Inferential Basis of Familiarity

As mentioned, the dissociation between familiarity and recollection has been further examined according to the notion that familiarity is based on an inferential process and recollection is the result of direct retrieval of the context in which a stimulus was encountered (Jacoby, Kelley, & Dywan, 1989). As such, for fluent perception to produce feelings of familiarity, the fluent processing must be attributed to a source in the past (Jacoby & Dallas, 1981). For example, to experience a feeling of familiarity for someone that is encountered while walking down the street, the fluent processing of the person must be attributed to some past source. However, feelings of familiarity may not occur if the fluent perception of the person is attributed to their striking resemblance to a friend. Thus, when people make recognition decisions, stimuli are unconsciously evaluated based on a *fluency heuristic*, and feelings of familiarity occur as an outcome of an unconscious attribution of fluent stimulus processing to a previous encounter (Jacoby & Dallas, 1981).

In general, making inferential judgments about the familiarity of a stimulus based on the fluency heuristic results in accurate memory judgments. Specifically, since a prior experience with a stimulus results in quicker, more fluent processing at a later time, basing memory judgments on the speed of processing is, for the most part, an effective strategy. However, since familiarity is based on an inference made about the fluency of the current processing, systematic memory errors can be demonstrated to occur with experimental manipulations of the fluency of the current processing. For example, Jacoby and Whitehouse (1989) demonstrated that enhancing the fluency of a word by unconsciously priming the word with a masked prime results in more old responses both for words that were previously presented and for new words. However, if the prime is presented so that it is consciously perceived, then the effect of enhanced fluency on old judgments no longer occurs. Thus, Jacoby and Whitehouse's results indicate the importance of attribution for fluency to have an effect on recognition judgments. That is, when provided with no other source of the fluency (i.e., when the prime was unconsciously perceived), people will attribute word fluency to a prior presentation of that word in the study phase.

Building on Jacoby and colleagues' finding (e.g., Jacoby & Whitehouse, 1989; Whittlesea et al. 1990) that fluency can be misattributed to prior presentation, Whittlesea (1993) demonstrated that the experience of fluency does not need to arise from perceptual fluency. Rather, Whittlesea demonstrated that conceptual fluency can also result in feelings of familiarity. Specifically, Whittlesea demonstrated that after a rapidly presented word list, participants' judgments of previously seeing a target word can be biased, depending on whether the semantic context that the word is experienced in at test supports fluent processing of that word. For example, when participants were presented with a target word at the end of a predictive sentence ("The stormy seas tossed the BOAT"), judgments of previously seeing the target word were higher compared to when the target word was presented at the end of a nonpredictive sentence (e.g., "He saved up his money and bought a BOAT"). Whittlesea concluded that the conceptual fluency experienced for words that completed predictive sentences was attributed to previously seeing the target word. These results demonstrate the broad influence of the attribution of fluency on feelings of familiarity.

The Inferential Basis of Recollection

The inferential basis of the feelings of familiarity is thought to be defining characteristic of familiarity that dissociates it from recollection. Recollection, on the other hand, is characterized as being an intentional and infallible process. Therefore, recollection is conceptualized as being a controlled direct retrieval process that is fundamentally different from the inferential process that causes feelings of familiarity. According to Jacoby and colleagues (1991; Jacoby et al. 1993; Jacoby et al. 1997; Jennings & Jacoby, 1993), recollection is treated as an intentional use of memory to retrieve some prior context. This characteristic of recollection is an inherent assumption that must be met for the process-dissociation framework to provide valid estimates of familiarity and recollection. Specifically, for the exclusion task, the correct new and old recognition judgments of words presented in the first and second study lists, respectively, are thought to reflect the influence of familiarity and recollection. In contrast, the incorrect old recognition judgments for words presented in the first study list are thought to reflect the influence of familiarity apart from recollection. That is, since participants are only required to respond “old” to words heard during the second study list for this task, recollection of detail should provide people with information about their previous experience with the word. Therefore, when this information is available, correct recognition judgments would be made. However, if this information is not available, then people may incorrectly judge a word as old that was presented in the first study list based on familiarity. Hence, according to Jacoby and colleagues’ perspective, recollection is assumed not to contribute to incorrect memory judgments. Instead, recollection is assumed to reflect discriminative information of the past context, leading to either acceptance of the word because detail associated with seeing the word in List 2 was retrieved, or rejection of the word because detail associated with seeing the word in List 1 was retrieved. As such, according to the dual-process theory, when recollection occurs, it involves direct retrieval of the prior context and supports more accurate recognition judgments than familiarity.

However, recent research suggests that recollection does not occur in the direct retrieval manner assumed by the dual-process theory. To examine the appropriateness of the dual-process theory, Dodson and Johnson (1996) examined three assumptions necessary for the process-dissociation framework to be valid. Specifically, Dodson and Johnson examined whether the influences of familiarity and recollection are consistent across different types of recognition tests. That is, Dodson and Johnson questioned whether the *consistency assumption* was a valid assumption, provided that the inclusion and exclusion tests are different types of recognition tests. Expanding on this criticism, Dodson and Johnson also examined whether the influence of familiarity is automatic. For the process-dissociation framework to be valid, the influence of familiarity must be thought of as being automatic for both correct and incorrect recognition judgments. Furthermore, recollection must be assumed to be an all-or-none process. Specifically, recollection of the past context must occur for correct exclusion judgments and not for incorrect exclusion judgments.

To examine the credibility of these assumptions, in their first experiment Dodson and Johnson examined whether familiarity was an automatic process that was consistently used when making recognition judgments, or if it could be used strategically to make recognition judgments. To address this issue, Dodson and Johnson used the standard process-dissociation framework; however, they manipulated the proportion of words which were heard during the second study phase to be either one-third or two-thirds. In addition, Dodson and Johnson examined recognition judgments under full or divided attention. Their results indicated that familiarity was being used strategically when forming recognition judgments. Specifically, when attention was full for the exclusion task, participants were biased by the proportion of words which were heard. That is, when only one-third of the words were heard, people were less likely to misjudge a word from the first study phase as being heard in the second study phase. However, when two-thirds of the words were heard, people were more likely to misjudge a word from the first study phase as being heard in the second study phase. Therefore, when more words were heard, people were more likely to rely solely on familiarity and misjudge words from the first phase as being heard during the second study phase. Moreover, this pattern was only present for the full attention condition; indicating a strategic and resource-demanding use of familiarity in forming recognition judgments.

Furthermore, in their second experiment, Dodson and Johnson (1996) demonstrated that recollection does not have a consistent influence on recognition judgments. In this experiment, instead of presenting participants with the standard process-dissociation procedure, participants were presented with a slightly altered procedure. Specifically, the first study phase of the procedure remained the same, i.e. participants were presented with words that were either intact or presented as an anagram; however, in the second study phase and during the recognition test, the process-dissociation procedure was altered. Namely, for one half of the participants, words were acoustically presented during the second study phase, but for the other half, words were presented as word fragments during the second study phase. In addition, for the recognition test there were four different recognition instructions that participants were presented with: 1) the standard inclusion instructions, 2) when words were acoustically presented in the second study phase, some of the participants were given the standard exclusion instructions, i.e. they were asked to judge only heard words as being old, the *exclusion(heard+)* instructions, 3) when words were presented as word fragments during the second study phase, some of the participants were asked to judge only words presented as word fragments as being old, the *exclusion(fragment+)* instructions and 4) when words were acoustically presented or presented as word fragments during the second study phase, some of the participants were asked to judge only words presented as anagrams in the first study phase as being old, the *exclusion(anagram+)* instructions. Presenting participants with acoustically presented words or word fragments in the second study phase created a situation in which a comparison could be made between situations when recollection would be more or less similar for the condition when participants were required to respond old to anagrams. Specifically, when participants presented with the exclusion(anagram+) instructions, it would be expected that the recollective experience associated with anagrams would be more similar to the experience associated with word fragments, compared to the recollective experience associated with words which were intact in the first study phase. In contrast, the recollective experience associated with anagrams would be less similar to the recollective experience associated with words which were acoustically presented in the second phase of the experiment. Thus, according to Dodson and Johnson's predictions, and contrasting the consistency assumption of the dual-process framework, recollection should be used differently across situations in which the recollective experiences are more or less similar.

The result from Dodson and Johnson's (1996) second experiment indicated that recollection was not consistent across all four groups. Dodson and Johnson found that, depending on the similarity of the recollective experiences, participants' recognition judgments changed; indicating that the influence of recollection on recognition judgments is not consistent. In particular, when presented with the exclusion(anagram+) instructions, participants' correct anagram recognition judgments were worse when word fragments were presented in the second study phase compared to when words were heard in the second study phase. Furthermore, when presented with word fragments in the second study phase, participants' correct anagram recognition judgments were worse when presented with the exclusion(anagram+) instructions compared to when presented with the inclusion instructions. However, when words were heard during the second study phase, there was no difference in the correct anagram recognition judgments when presented with the exclusion(anagram+) or inclusion instructions. Moreover, incorrect anagram recognition judgments were much higher when provided with the exclusion(fragment+) instructions compared to when provided with the exclusion(heard+) instructions.

Taken together, these results contradict the process-dissociation framework assumption that recollection is an all-or-non process that only leads to correct recognition judgments. Instead, since there was a difference in anagram recognition judgments between the different exclusion instructions and the inclusion instructions, but only when word fragments were presented during the second study phase, recollection appeared to be influencing incorrect recognition judgments. In particular, when there was high similarity between the studied word lists, misrecollection influenced correct and incorrect recognition judgments for the exclusion(anagram+) or exclusion(fragment+) instructions. Since misrecollection influenced incorrect recognition judgments, recollection would not adhere to the assumption that it is an all-or-none process, leading to only correct judgments when recollection occurred or incorrect judgments when recollection did not occur. Therefore, this finding raises problems for the process-dissociation framework since recognition errors are assumed to be influenced solely by familiarity and not by recollection.

Building on this idea that recollection is not an all-or-none process, Gruppuso, Lindsay and Kelley (1997) demonstrated that when using the process-dissociation framework, the similarity between the two study lists drastically affects the influence of familiarity and recollection on recognition judgments. In their first experiment, Gruppuso et al. presented two study lists, but manipulated the similarity in the way the word were presented within-subjects. Specifically, words in the first study phase were presented to the participant and they were required to either make monetary value judgments or word frequency judgments. Half of the participants were required to make monetary value judgments for words presented in the second study phase, and half of the participants were required to make word frequency judgments for words presented in the second study phase. During the test phase, all of the participants were required to respond "old" to words presented during the second phase of the experiment. Thus, for each participant, half of the words from the first study list would have been experienced in a similar manner to the words presented in the second study list. These words from the first study list were expected to be more difficult to discriminate, since recollection of the prior experience with the word would not be diagnostic of the list that the word was from. In contrast, words from the first study list which were experienced differently from the way that the second study list was experienced would be expected to be easy to discriminate, since recollection of the judgment made would be indicative of the word being from the first study list. Interestingly, when the estimates of familiarity and recollection were computed, the estimates indicated inconsistent influences of each basis of recognition. Specifically, the estimate of recollection decreased when the discrimination task was more difficult. However, the estimate of familiarity increased when the discrimination task was more difficult. Thus, familiarity and recollection do not consistently influence recognition decisions. Rather, which process people rely on seems to vary depending on the difficulty of the discrimination.

Expanding on the findings of their first experiment, Gruppuso et al. (1997) demonstrated that full or divided attention at test and study influenced the estimates of familiarity and recollection. In their second experiment, attention was either full or divided at test. When attention was full at test, the results were identical to the results of the first experiment. However, when attention was divided at test, the estimates of familiarity were high across both the easy and difficult tasks, and the estimate of recollection remained low across both the easy and difficult tasks. Gruppuso et al. interpreted the low estimates of recollection across both the easy and hard tasks as indicating peoples' inability to use information about the prior encoding condition to discriminate between word lists. That is, when attention is divided at test, recollection itself is not impaired; however, the use of this information to discriminate word lists is impaired which manifests itself in low recollection estimates. Furthermore, in their third experiment, Gruppuso et al. demonstrated that dividing attention at study, which interfered with the encoding of the task, resulted in different effects on the estimates of familiarity and recollection. Specifically, for the easy task, estimates of familiarity were not affected and estimates of recollection were reduced with divided attention. In contrast, for the difficult task, estimates of familiarity were reduced and estimates of recollection were not affected with divided attention. Thus, these results demonstrate that familiarity and recollection do not consistently influence recognition judgments; rather, the influences of these processes are dependent on the encoding and testing situations. Together, the results from Gruppuso et al.'s studies highlight critical flaws in the assumptions necessary for the process-dissociation framework to provide valid estimates of familiarity and recollection. Mainly, the assumption that familiarity and recollection consistently contribute to recognition, which must hold true for the process-dissociation framework to be accurate, does not seem to be appropriate.

In addition, other critics of the dual-process theory have raised concerns about the assumption that recollection is based on direct retrieval of details from some past experience; rather, they suggest that recollection seems to be based on an inferential process, just as familiarity is based on attribution and inference (Leboe & Whittlesea, 2002). Specifically, Leboe and Whittlesea demonstrated that recollection of details about the prior context of a word is biased by an inference made about the information that comes to mind at test. To examine this issue, Leboe and Whittlesea presented participants with words that were either typically associated as being interrogative (e.g., HUNGRY?), as being exclamatory (e.g., DANGER!), or as being neutral (e.g., WINDOW). The important manipulation was made in the study phase to the interrogative and exclamatory words. Specifically these words were either presented along with the consistent punctuation mark (e.g., HUNGRY?) or with the inconsistent punctuation mark (e.g., HUNGRY!). At test, participants were required to recall the punctuation mark that was presented along with the word. Interestingly, participants' recall of the previous context was biased by whether the word–punctuation mark pairing was consistent or inconsistent. Specifically, correct decisions and confidence ratings were highest when the pairing was consistent. Thus, it seems that participants' recollection of the context was influenced by an inference made about the pairing based on the ease of generating punctuation consistent with participants' general knowledge.

Complementing Leboe and Whittlesea's (2002) finding that recollection is based on an inferential process, Higham and Vokey (2004) used the remember-know procedure (R-K; Tulving, 1985) to examine the attributional basis of recollection and familiarity. According to the R-K procedure, remember judgments are based on recollection and know judgments are based on familiarity. Again, just as the dual-process theory assumes that recollection is error free, the remember judgments are assumed to be based on accurate recollection. However, Higham and Vokey used the R-K procedure and a variation of the R-K procedure to demonstrate that that illusory recollection occurs. Specifically, Higham and Vokey first presented participants with a study list of words. They then presented participants with a test phase in which a matching prime of the target word was presented for a short or long duration (6-34 ms or 36-64 ms, respectively) before the target word was presented and the participant was asked to make the R-K memory judgment. Higham and Vokey found that when prime durations were increased, both correct and incorrect *remember* judgments increased. Importantly, this finding was found using the conventional R-K procedure as well as the adapted R-K procedure, which required participants were required to rate, on separate 4-point scales, how much each item was "familiar" and "recollected". This increase in remember judgments was thought to occur because the longer duration leads to more target identification, which is misattributed to the target being presented earlier. Thus, just as familiarity judgments are influenced by target duration and identification (Higham & Vokey, 2000), recollection judgments seem to also be based on a similar attribution.

A vast amount of research based on procedures other than the dual-process theory indicates that recollection is based on an inferential process, like familiarity. Specifically, early research by Bartlett (1932) indicates that people do not recall specific details about a past experience; rather, people recall information that is consistent with the "gist" of a past experience, regardless of whether or not that information was previously encountered. Building on this notion, Roediger and McDermott (1995) used the procedure developed by Deese (1959) to demonstrate that people mistakenly recollect seeing a thematically similar word in a previously presented word list. In their first experiment, Roediger and McDermott replicated the results of Deese, demonstrating that critical thematically related words were about as likely to be recalled as being presented in a word list as a word that was actually present. For example, people showed high rates of falsely recollecting seeing the word SLEEP in a study list that contained semantically related words such as BED, REST, and AWAKE. Furthermore, people falsely recognized seeing the critical word at about the same rate that they correctly recognized seeing a previously presented word. Building on these findings from their first experiment, Roediger and McDermott required participants to make remember-know (Tulving, 1985) judgments about seeing the word in the study list. Importantly, false judgments of previously seeing the critical word were frequently judged as being remembered. Thus, since remember judgments are thought to reflect the influence of recollection, these results indicate that people do not directly retrieve details about their past experience. Instead, it seems that people make an inferential judgment about experiencing a particular detail during the past event based on their processing of that information in the present. If this particular detail seems to fit with the past experience or comes to mind easily, people generally assume that the detail was associated with some prior event.

In addition, research on the misinformation effect suggests that peoples' recollection of details can be altered depending on the information provided at a later time (Loftus & Palmer, 1974). Specifically, after witnessing a video of a collision between two cars, participants' judgments of the speed changes depending on the way that the question is phrased (e.g., "How fast were the two cars going when they *hit/smashed* each other?"). Participants provided with the question containing the verb "hit" reported lower speeds compared to participants provided with the question containing the verb "smashed". Originally, the influence of the question on the recall of specific details was thought to result from the new information replacing or *overwriting* the old information (Loftus, 1979). That is, the retrieval of details of a past event was thought to be replaced with new information if that information was not consistent with the original memory. For example, since "smashed" implies higher speeds, people incorporate this information into their memory and infer that the cars must have been traveling at faster speeds. Although this explanation has not been widely accepted (See McCloskey & Zaragoza, 1985, for a critique of the overwriting hypothesis.), the phenomenon of the misinformation effect reveals that the details associated with a previous experience are not directly retrieved from memory. Rather, they seem to be reconstructed based on inferences made at the time of recall.

More recently, Lindsay and Johnson (1989) suggest that these errors may result from errors in source monitoring. Specifically, instead of old memories being overwritten by the new information, Lindsay and Johnson suggest that the new information becomes more salient and thus is more likely to be retrieved at a later time. However, when required to specify the source of the particular memory, people are less likely to use this false information in recalling details about a particular event. Thus, this interpretation highlights the flexible use of information that comes to mind at the time of remembering.

Together, the research discussed in the preceding section has indicated that recollection is not simply a search and retrieval process, as suggested by the dual-process theory. Rather, recollection appears to be influenced by a subjective inference made at the time of test. Therefore, although the dual-process theory identifies two processes of memory that seem to be fundamentally distinct, this impression obscures the realization of the similar inferential process that underlies both feelings of familiarity and recollective experiences. Undoubtedly, compared to familiarity, recollection generally provides a more convincing, richer, and accurate sense of remembering, which suggests that they are distinct processes. However, a reliance on recollected is not an infallible basis for making remembering judgments. On the contrary, recollection appears to rely on attributions about the source of current processing, much like familiarity. Thus, a more coherent account of the remembering process requires a theoretical approach that takes into account the inferential nature of both familiarity and recollection.

The Source Monitoring Framework

The interpretation provided by Lindsay and Johnson (1989) that recollection errors may result from errors in source monitoring instigated research into a more promising framework of remembering, which is able to account for the inferential nature of the entire remembering experience; thus, encompassing both familiarity and recollection. According to the *source monitoring framework*, both familiarity and recollection are based on an inferential process (Johnson et al., 1993). The difference between familiarity and recollection is experienced because of the level of specificity of the memory. That is, remembering is thought to function along a continuum with familiarity occurring when vague detail is brought to mind and recollection occurring when vivid detail is brought to mind (Dodson & Johnson, 1996; Gruppuso et al., 1997). Johnson et al. suggest that people are never able to directly access a past event from memory; instead, remembering occurs through an attribution of ones' mental processes to some past experience. As such, peoples' ability to accurately recall an event is influenced not only by the characteristics of the memory process, but also by a decision making processes (Johnson et al.).

To examine the influence of these two aspects of the process of remembering, source monitoring experiments use a paradigm that is similar to the process-dissociation framework. As with the exclusion condition in the process-dissociation framework, two sets of information are provided to the participant and they are required to determine from which source the information came from. For example, Lindsay and Johnson (1989) presented participants with a picture of a particular scene containing a number of objects. Later, the participants were provided with a verbal description of the scene which either accurately depicted objects that were present in the picture, or suggested that additional objects were also present in the scene. Following reading the accurate or misleading verbal descriptions, participants were asked to recall whether certain objects were present in the picture. Lindsay and Johnson found that people falsely recognized objects which were only mentioned in the verbal description as being presented in the picture, indicating errors in peoples' ability to discriminate the source of the items.

Importantly, the dual-process theory is not well-designed to account for these findings, since the retrieval of some prior detail (i.e., source information) should be direct, and, therefore, should not produce source monitoring errors. To account for these source monitoring errors, Johnson et al. (1993) suggest that an inferential process contributes to the entire remembering experience. Thus, it follows that recollection of detail, such as the source of some recollected detail about a prior event, is also based on an inferential process. In particular, since accurate and effective remembering is based on both the information that comes to mind and a decision making process, familiarity and recollection must occur depending on the influence of both of these aspects. Specifically, since the quality of a particular memory can vary in specificity, this may influence the subjective feeling that is associated with this memory (Johnson et al.). For example, if the memory is vague and non-specific, one may experience a sense of familiarity; however, if the memory is detailed and specific, one may experience a sense of recollection.

Similarly, depending on the judgment criteria or strategy used, different memory experiences may occur (Johnson et al.). That is, a memory may be automatically attributed to some source based on a heuristic or automatic judgment process. For example, if the stimulus is fluently perceived, an item may be judged as being old based on the fluency heuristic. Alternatively, a memory may be analytically attributed to some source based on a systematic evaluation process. For example, even if an item is fluently perceived, an item may be concluded to be new because of the type of the items previously presented (e.g., only non-words were presented initially, and the item is a real word). Importantly, both the quality of the memory and the decision making process do not reflect direct access to some prior memory trace; rather, both aspects are influenced by an attribution of the current processing experience to some prior event.

Heuristic Basis of Remembering

Similar to the perspective provided by the source monitoring framework, Leboe and Whittlesea (2002) also suggest that familiarity and recollection are both based on an inferential process. Central to their proposal is the notion that remembering relies on a decision-making process based on a number of heuristics. That is, memory judgments are thought to occur in the same manner that other decision processes occur under uncertain conditions (Tversky & Kahneman, 1974). Similar to Tversky & Kahneman's heuristic basis of decision-making, Whittlesea and Leboe (2000) suggest that at least three heuristics guide our memory judgments: the resemblance heuristic, the generation heuristic, and the fluency heuristic. The resemblance heuristic is based on the similarity of the current stimulus to the stimuli experienced in the past. Specifically, this heuristic is based on the similarity of the particular stimulus to some general class of stimuli. For example, you may conclude that a person is familiar from a philosophy class because they like to argue, which fits the general description of someone who is in philosophy. In contrast, the generation heuristic is based on the generation of specific details from some past experience. In this case, a person may be experienced as being familiar if one is able to recall specific details from a class, such as where they sat or if they used to talk during class. As described before, the fluency heuristic is based on the speed of processing. Thus, if a person is perceived more fluently than expected, they may be judged as being familiar. The use of these heuristics in forming memory decisions is a central idea of Whittlesea's (1997, 2004; Whittlesea & Leboe, 2000) Selective Construction and Preservation of Experience (SCAPE) framework. According to this framework, remembering is a constructive process which occurs in two stages: the production stage and the evaluation stage. Specifically, when a stimulus is encountered, the processing of this stimulus causes certain information to come to mind. This production of information is then evaluated according to certain memory heuristic(s). If the evaluation of the processing is attributed as originating from the past, then a sense of remembering occurs.

Interestingly, recent research by Leboe, Palmer, and Illsley (2004) demonstrates that people can selectively use heuristics as a basis to accept or reject certain words as being presented in a previous phase. Specifically, Leboe et al. found that people only use cues provided by the generation of detail as a basis to accept words if past processing of the target context matches this type of processing. Across a number of experiments, the same general procedure was used. During Phase 1 of the experiment, one third of the words were read once, read three times, or interactively imaged three times with another word. During Phase 2, half of the words from the first phase were presented again. Finally, in Phase 3 the participants' task was to recall which of the words were presented in the second phase of the experiment. The important manipulation was in how words were encoded during Phase 2 of the experiment. Specifically, in one experiment words were interactively imaged, in another experiment words were read alone, and in another experiment words were imaged alone.

The significant result from Leboe et al.'s (2004) experiments was the finding that people selectively use the generation heuristic when making memory decisions, depending on the way that words were encountered in Phase 2. That is, when words were interactively imaged in Phase 2, participants used the generation of detail as a basis for accepting words as being presented in that phase. In contrast, when words were read or imaged alone, the generation of detail was used as a basis for rejecting words as being presented in Phase 2 of the experiment. Importantly, this manner of forming memory judgments is counterintuitive. That is, the type of processing engaged in during Phase 1 had no predictive value for whether words were presented in Phase 2 of the experiment. Therefore, if people were logically forming memory decisions, there should be no difference in the use of the generation of detail across the different experiments.

However, Leboe et al. (2004) suggest that people base their memory decisions on the use of appropriate memory heuristics, instead of on probabilistic information. Specifically, Leboe et al. concluded that people were basing their memory decisions on expectations formed during Phase 2 of the experiment. That is, when words were interactively imaged in Phase 2, the generation of detail for a certain word would be expected to be indicative of that word being presented in Phase 2 of the experiment. Therefore, people should use the generation of detail as a basis to accept items as being presented in Phase 2 of the experiment. In fact, this is what Leboe et al. found, since they found higher judgments of seeing words in Phase 2 if that word was imaged in Phase 1. More interestingly, when words were only encountered briefly in Phase 2 of the experiment, these words would not be expected to promote the detailed remembering later. Instead, they would only be expected to be processed more fluently than words that were only presented in Phase 1. Thus, words that were imaged in Phase 1 would be less likely to be concluded as being presented in Phase 2 because these words would promote the generation of detailed images. Accessing a detailed image during the test phase represents a type of processing that would not be expected based on the type of processing engaged in during presentation of words in Phase 2. Again these were the results that Leboe et al. obtained. Specifically, people seemed to discount words that promoted the generation of detail as being presented in Phase 2 of the experiment. Thus, it seems that people are able to flexibly use different heuristics depending on expectancies made about type of processing that should occur at test, given the type of processing participants' knew they engaged in during the events that they are attempting to remember.

Although this strategic use of memory heuristics seems to be quite sophisticated, it also leads to incorrect memory decisions. Specifically, using the generation of detail to discount words as being presented in Phase 2 led to more errors since equal proportions of words that were read once, three times and imaged three times were presented in Phase 2. Therefore, more words that were imaged in Phase 1 and presented in Phase 2 were falsely judged as not being presented in Phase 2. From these results it seems that irrelevant information from a certain context may be used as a basis for making memory decisions. Using a real world analogy, it seems that if one is able to recall details about a person having been encountered in one context, this information may be used as a basis to conclude that that person was not previously encountered in another context. For example, if you are tying to decide if you recognize a person from a party, but you are able to recall details about attending class with that person, you may be more likely to conclude that that person was not at the party.

The focus of the current thesis is to come to a better understanding as to when the generation of detail is used as a basis to accept or as a basis to reject a stimulus being presented in a particular context. To examine this issue, the same basic paradigm used by Leboe et al. (2004) was used. Building on Leboe et al.'s findings, the current study examines the impact additional factors on the use of the generation of detail when forming recognition judgments.

CHAPTER 2

THE CURRENT STUDY

The current study examined how peoples' recognition judgments are altered depending on their reliance on the generation heuristic. Specifically, I examined situations in which participants use the generation heuristic as a basis to reject or to accept stimuli as being presented in a particular context. Unique to this study is that the focus is on understanding how information about seeing a word in an irrelevant context may be used in forming recognition judgments. To illustrate the issue of interest for the current study, imagine that you encounter a person who looks familiar while walking down the street. Suppose you try to determine whether you know them from a party that you attended, but information about seeing them at school comes to mind. As discussed above, research by Leboe et al. (2004) suggests that if detail comes to mind, and this information is not indicative of the stimulus being present in the target context, this information will be used as a basis to reject the stimulus as being previously seen in the target context. According to this research, the expectation would be that you would be less likely to conclude that the person is from one context, the party, if detail is generated about seeing them in another context, at school. The aim of this thesis is to come to a better understanding of situations where detail generated about a stimulus from another context is used as a basis to accept or reject stimuli as being present in another context.

Three studies are discussed that examine the selective use of the generation of detail as a basis to form recognition decisions. The first study extends previous research by Leboe et al. (2004) and examines how the generation of detail is used to form recognition judgments where there is an equal probability of a vivid image coming to mind at test. Unique to this experiment was that there was either a high or a low proportion of previously imaged words presented in the second phase. When a high proportion of previously imaged words were presented in Phase 2, generating an image at test would be good indicator of that word being in the second phase of the experiment. In contrast, when a low proportion of previously imaged words were presented in Phase 2, generating an image at test would be a good indicator of that word not being in the second phase of the experiment. Thus, as a consequence of the proportion manipulation, the generation of detail could be used to make recognition judgments based on the similarity to the words that were presented in Phase 2. The use of generation of detail as a cue in this manner to form judgments about whether a word was or was not presented in the second phase would indicate the use of a resemblance heuristic in forming recognition judgments (Whittlesea & Leboe, 2000). However, to foreshadow, the results from this experiment indicated that the generation of detail did not influence recognition judgments when generating detail was or was not predictive of having seen words in the critical phase. The second experiment examined how the generation of detail is used to form recognition judgments when a high or a low proportion of words sponsor the generation of a vivid image at test. In contrast to the results from the first study, the results from this second experiment revealed that participants' recognition judgments were biased by the proportion of words that sponsored the generation of a detailed image at test. Critically, participants in this experiment were biased by the proportion of words that sponsored the generation of a detailed image even though this information had no bearing on whether those words were presented in the second phase of the experiment. Finally, the third experiment indicates that the use of the generation of detail to form recognition judgments is only used when participants can expect to recollect some information about items presented during the critical study phase. In that case, when the critical phase consisted of a counterfeit list (Westerman et al., 2002), participants were uninfluenced by the recollection of detailed images when making their recognition judgments.

Experiment 1

Method

Participants

Sixty-four participants (33 female and 31 male, mean age = 19.19) were recruited from Introduction to Psychology classes at the University of Manitoba using the Introduction to Psychology Participant Pool System. Thirty-two participants were randomly placed in each of the Phase 2, .75-Imaged and Phase 2, .25-Imaged conditions. Each participant received course credit in exchange for their participation in this study. All participants were under the age of 30 and spoke English as their native language.

Apparatus and Stimuli

A Dell Dimension 9150 desktop or Latitude D510 notebook computer installed with the E-Prime suite (Schneider, Escheman, & Zuccolotto, 2002a, 2002b) was used to present the target words and record the participants' responses. A set of 160 target words were randomly selected from a database of nine hundred common English nouns ranging between 3 and 12 letters in length were generated for use in Experiment 1. In addition, each target word was randomly assigned three different context words, which were selected from the same database of words that was used for the target words, for when that target word was imaged in the first phase of the experiment. Eight target word lists were created for each of the *Phase 2 proportion imaged* conditions (.75 imaged and .25 imaged) so that, across participants, each target word appeared equally often in each initial encoding (imaged vs. read) and target list (present vs. absent) condition.

Procedure

Participants completed the experiment individually at a computing station. Upon arrival, participants were randomly assigned to either the Phase 2, .75-Imaged or Phase 2, .25-Imaged condition and to one of the eight versions of the experiment generated by the counterbalanced assignment of word targets to the imaged/read initial encoding and target list present/absent conditions. Prior to the start of the experiment, participants were asked to read over and sign a consent from, and to provide their age and gender. Participants then read the general instructions for the experiment and then were asked to seat themselves a comfortable distance in front of the computer screen before beginning. Following the completion of each phase, the program stopped, allowing time for the instructions for the subsequent phase to be read to the participant.

Phase 1: Initial Encoding Phase. Prior to beginning this phase, participants were verbally read instructions. They were informed that they would be presented with a series of trials, each consisting of a target word presented alone or as the right-hand item in a word pair. They were told that when the word is alone, their task was to read the word silently to themselves, and when a word is a member of a pair, their task was to create an image of the concepts identified by the two words in interaction. They were also told that when a pair of words appeared, the right-handed word would form the basis of a later memory test, whereas singly presented words would also form the basis of a later memory test. To facilitate their understanding of "creating an image", participants were provided with the following example: "Suppose the two words were KITE – DOG, the word dog is the target word. With these words, you could create an image of the dog chasing the kite." Once the participant was ready to begin, they were instructed to press the letter "B" to commence the experiment.

Each of the target words was presented three times either as a member of a pair (the 3X-image condition) or in isolation (the 3X-read condition). Target words assigned to the 3X-image condition were presented to the right of three different words during the initial encoding phase. Both words appeared at the center of the computer screen, separated by a dashed line (-). Target words assigned to the 3X-read condition were presented alone at the center of the computer screen. As mentioned above, there were eight versions of each of the Phase 2, .75-Imaged and Phase 2, .25-Imaged conditions. There were 160 target words presented during the Initial Encoding Phase, 80 of those words were imaged three times and the remaining 80 of them were merely read. Each word was presented three times each, which produced 480 trials for the initial encoding phase of the experiment. Words corresponding to both the 3X-image and 3X-read conditions were presented for four seconds immediately followed by presentation of the word or pair of words for the next trial. Each of the three presentations of target words for both the 3X-image and 3X-read conditions occurred in a different random order for each participant. The end of the Initial Encoding Phase was signaled by the words, "End of Phase 1", appearing on the computer screen.

Phase 2: Target List. Prior to this phase, participants were informed that a series of single words would be presented. Participants were told that each word would appear in the center of the screen and their job was to read each word aloud and then to press the spacebar to continue to the next word. Unbeknownst to the participant, for one group of participants, 75% of the words presented in the Target List were previously imaged in the

Initial Encoding Phase (the *Phase 2, .75-Imaged* condition). For another group of participants, only 25% of the words presented in the Target List were previously imaged in the Initial Encoding Phase (the *Phase 2, .25-Imaged* condition). Therefore, unlike Leboe et al.'s (2004) experiment, there was a predictive relationship between whether a word was imaged or read in Phase 1 and the presentation of that word in the Target List. Eighty words from the Initial Encoding Phase appeared in the Target List for all participants. For participants in the *Phase 2, .75-imaged* condition, however, 60 of those words were imaged three times during the first phase, whereas 20 of those words were read three times. For participants in the *Phase 2, .25-imaged* condition, 60 words from the target list were simply read three times during the Initial Encoding Phase, whereas 20 of those words were imaged three times. At the end of the presentation of the target list, the words, "End of Phase 2", appeared on the computer screen.

Phase 3: Test Phase. Prior to this phase, participants were informed that all of the target words from Phase 1 would be presented one at a time at the center of the computer screen. Participants were also told that half of the words from the first phase reappeared in the second phase of the experiment and that their task is to judge whether the target word was presented during Phase 2 of the experiment. They were instructed to press the "." key if they thought a word was presented during Phase 2, and to press the "c" key if they did not think that they saw the word during Phase 2. Once the participant was ready to begin, they pressed the letter "B" for the first target word to appear. After making each remembering judgment, the current target word was replaced by the target word corresponding to the next trial.

Design

The three independent variables that were manipulated in this experiment are the proportion of target words presented in the Target List that were imaged in the Initial Encoding Phase (*Phase 2, .75-Imaged* vs. *Phase 2, .25-Imaged* conditions), the way that the target words were studied during the Initial Encoding Phase (*3X-imaged* vs. *3X-read* words), and whether the target word was presented in the Target List (*present* vs. *absent*). The manipulation of these factors yielded a 2 (X 2 X 2) mixed independent-groups/repeated-measures design, with the proportion of target words in the Target List that were imaged during the Initial Encoding Phase representing a between-participants manipulation. The mode of studying words in the Initial Encoding Phase and whether or not test words were presented during the Target List both represent within-participants manipulations. The dependent variable of interest was the mean proportion of trials in the Test Phase for which participants judged words as being presented in the preceding Target List.

Results

The proportion of trials in the Test Phase for which participants judged the target word as being presented in the Target List was computed for each condition and submitted into a 2 (X 2 X 2) repeated – measures ANOVA. The proportion of words imaged from Phase 1 that were represented in Phase 2 (.75 vs. .25) was treated as a between-participants factor and the Initial Encoding (3X-imaged vs. 3X-read) and the Target List presentation (present vs. absent) were treated as within-participant factors. The mean proportion of trials in which participants judged the target word as being in the

Target List for each condition is presented in Table 1. To complement the recognition responses, d' and C values were computed and are also reported in Table 1. D' was used as a measure to determine participants' ability to discriminate between words that were and were not presented in Phase 2. Higher d' values indicate that participants are better able to discriminate between words that were and were not presented in Phase 2. The participants' response bias was measured using C, which is a measure that is typically used in recognition memory experiments (Neath, 1998). More extreme positive C values indicate a liberal bias, meaning that participants are more inclined to judge a word as having been presented in Phase 2. In contrast, more extreme negative C values indicate a conservative bias, meaning that participants are reluctant to judge a word as having been presented in Phase 2. The d' values from Experiment 1 indicate that participants were able to discriminate between words that were and were not presented in Phase 2 across all conditions. Furthermore, the C values for Experiment 1 indicate that participants were slightly conservative in their responding. In particular, collapsed across the proportion of previously imaged words presented in Phase 2, participants seemed to be slightly more conservative when responding to words that were previously imaged, compared to words that were previously read (.55 vs. .49).

Table 1

Mean proportion of target words participants judged as presented in Phase 2 and mean d' and C values as a function of Phase 1 Encoding (imaged vs. read), the Proportion of Previously Imaged Words presented in Phase 2 (.75 vs. .25), and Target List Presentation (present vs. absent) in Experiment 1. The standard errors of the mean proportions for each condition are displayed in parentheses.

	Proportion of Previously Imaged Words Presented in Phase 2			
	.75		.25	
Phase 1 Encoding	Present	Absent	Present	Absent
Imaged	.53	.14	.56	.14
	(.03)	(.03)	(.03)	(.02)
d'	1.35		1.34	
C	.58		.52	
Read	.56	.17	.58	.15
	(.03)	(.03)	(.02)	(.03)
d'	1.26		1.43	
C	.48		.50	

Note. d' is a measure of participants' ability to discriminate between word that were and were not presented in Phase 2; C is a measure of participants' bias to judge a word as being in Phase 2.

The analysis of participants' responses revealed a significant main effect of Target List Presentation, $F(1, 62) = 412.59$, $MSe = .03$, $p < .001$. Overall, participants were able to distinguish between words that were and words that were not presented in the second phase of the experiment. Participants were 41% more likely to judge words that were presented in Phase 2 as having appeared in that phase than words that were not presented in Phase 2 (.56 vs. .15). In addition, there was a main effect of Initial Encoding,

$F(1, 62) = 6.09$, $MSe = .006$, $p < .05$. Across all conditions, participants were about 3% more likely to judge a previously read word as being in Phase 2 than a previously imaged word (.37 vs. .34). There was no main effect of Proportion of Previously Imaged Words, $F < 1$. There were also no significant interaction effects, $F < 1$ for all cases.

Discussion

The results from this initial study provide interesting findings in comparison to the results obtained by Leboe et al. (2004). When participants were equally likely to experience a word that sponsored the generation of a vivid image at test, as a consequence of imaging half of the words during the Initial Encoding Phase, participants continued to use the generation of a vivid image as a basis to discount seeing a particular word in the second phase of the experiment. However, compared to Leboe et al.'s 2004 results, the results in this study indicate that the magnitude of discounting based on the generation of detail was reduced. Furthermore, participants did not, or were not able to, use the relationship between having previously imaged a word in the first phase and later seeing a word in the second phase to make recognition judgments. Participants were as likely to judge a previously imaged word as having been presented in Phase 2 whether 75% or only 25% of the words presented in Phase 2 were previously imaged. Surprisingly, these results indicate that participants did not make use of the resemblance heuristic when forming recognition judgments.

Although these results indicate that participants did not make use of a highly predictive cue when forming recognition judgments, they are consistent with the results from Kleider and Goldinger's (2006) recent experiment. Similar to the experiment discussed above, Kleider and Goldinger first presented participants with a series of photographs of faces to study. Next, participants were presented with a second series of faces. Finally participants were presented with new faces and faces that were from the first two study phases and were required to judge faces as being old that were presented in the first series of faces. For some groups of participants, a certain percentage of faces in the second phase were presented in front of a predictive cue (a stucco background). When this cue was varied systematically, participants could have easily used the presentation of this cue at test as a basis to from recognition judgments, producing a predictive pattern of false results. Consistent with this notion, when the cue presented at test was highly predictive of having seen a word in the second phase (i.e., 89% or 100% of the faces in the second phase were presented in front of a stucco background), participants were found to base their recognition judgments on the availability of that cue at test. That is, participants were more likely to incorrectly judge a new face or a face from Phase 2 that was presented in front of a white background as being in old. In contrast, participants abandoned the use of this cue when it was only 78% predictive of a face's earlier presentation in the target list. Instead of relying on the background cue when it was only 78% predictive, participants in Kleider and Goldinger's study relied on more specific information about the presentation of a face in the target list and not on generation of a detail that was merely associated with the presentation of a face in the target list. Mainly, when participants abandoned the use of the resemblance heuristic when forming recognition judgments for having seen faces in the second phase, they instead seemed to rely on a more precise recollection for having seen a face in one of the previous study phases. As a consequence of the reliance on more precise recollection, participants' result pattern no longer had high rates of false alarms for the faces that were presented in front of a white background. Instead, the false alarm rates for faces presented in front of a white background was similar to the false alarm rates for faces presented in front of a stucco background, indicating that participants did not use the resemblance heuristic when forming recognition judgments.

Similarly, when forming recognition judgments in the current experiment, participants also seemed to be reluctant to rely on a recollection-based resemblance heuristic when forming recognition judgments. In that case, participants did not rely on the association between having imaged words before and presentation of those words in the target list as a heuristic cue when forming recognition judgments. If participants did use the generation of detail heuristically based on the resemblance heuristics, high false alarm recognition judgments should have been found for previously imaged words when 75% of the words in Phase 2 were previously imaged. Conversely, low false alarm recognition judgments should have been found for previously imaged words when only 25% of the words in Phase 2 were previously imaged.

Nonetheless, since participants were, overall, more likely to judge a previously read word as being in Phase 2, these results could indicate an alternative form of reliance on the resemblance heuristic when forming recognition judgments. Since words in Phase 2 were merely read, participants would not expect that generating a detailed image would indicate that a particular word was in Phase 2. However, since the experience of reading words in Phase 1 more closely resembles the experience associated with half of the words that were presented in Phase 2, participants could have been biased by the similarity of these processing experiences at the time of recall. As the above results indicate, this was the case: participants were more inclined to accept previously read word as being presented in Phase 2, regardless of the proportion of read words actually presented in this phase.

Furthermore, these results are consistent with Leboe et al.'s (2004) finding that people will use the recollection of irrelevant contextual details to reject a word as having been presented in the target context. In combination with Leboe et al.'s findings, it appears that people are quite selective in using the generation of detail when forming recognition judgments for a particular context. Mainly, when the generation of a detail recollection is not indicative of the prior processing of a word in some context, people will use that type of recollection as a basis to reject a word as having been presented in that context. Observing that the generation of a detailed still causes a slight tendency for participants to reject a word as presented in the target list even when a high proportion of previously imaged words appeared in that list also provides clarification of Leboe et al.'s previous results. Specifically, it rules out the possibility that participants rejected previously imaged words in that study because only a relatively small proportion of imaged words appeared in the target list. In Leboe et al.'s design, only 33% of 3X-imaged words appeared in the target list, whereas the remaining 67% of words in that list consisted of previously 1X- and 3X-Read words. The current findings suggest that the proportion of imaged words appearing in the target list have no influence on participants recognition judgments.

Building on these findings, the second experiment examined whether participants would be reliant on the use of processing information when the processing information was not a predictive cue for a word being present in the Target List. Thus, Experiment 2 examines how participants use the recollection of irrelevant details when forming recognition judgments.

Experiment 2

Method

Participants

Forty-three participants (20 female and 23 male, mean age = 20.37) were recruited from the same participant pool that was used in the first experiment. Twenty-one participants were randomly selected to be placed into the .75-Imaged condition and 22 participants were randomly selected to be placed into the .25-Imaged conditions. Each participant received course credit in exchange for their participation in this study. All participants were under the age of 30 and spoke English as their native language.

Apparatus and Stimuli

A Mac G5 computer installed with FutureBASIC II 2.07 was used to present the target words and to record the participants' responses. Target words and context words were selected from the same database of English nouns used in Experiment 1. Each participant received a newly randomized set of target and context words for this experiment.

Procedure

The procedure used in Experiment 2 was very similar to the procedure used in Experiment 1; however, the proportion of words imaged versus read in the Initial

Encoding Phase was manipulated between-participants, while all participants encountered an equal proportion of previously imaged and read words in the Target List.

Upon arrival, participants were randomly placed into either the .75-Imaged or .25-Imaged condition. After receiving the consent form, general instructions, and the instructions for the first phase, participants were instructed to begin the first phase. Each participant received a different randomized set of target and context words presented in Phase 1. For the .75-Imaged condition, 75% of the target words appearing in Phase 1 were presented as the member of a pair three times, whereas only 25% of the target words appearing in Phase 1 were presented alone three times. In contrast, for the .25-Imaged condition, 25% of the target words appearing in Phase 1 were presented as the member of a pair three times, whereas 75% of the target words appearing in Phase 1 were presented alone three times. This resulted in the assignment of 120 words to the 3X-image and 40 words to the 3X-read condition in the .75-Imaged condition. The number of 3X-image and 3X-read words was reversed for the .25-Imaged condition. Thus, the presentation of 160 words, three times each, generated 480 trials for the initial encoding phase of the experiment. Words corresponding to both the imaged and read conditions were presented for four seconds, immediately followed by presentation of the word or pair of words for the next trial. Each of the three presentations of target words for both the 3X-image and 3X-read conditions occurred in a different random order for each participant.

With respect to the words presented in the Target List, an equal number of previously imaged and previously read words were presented in Phase 2 to be read aloud. There were a total of 80 target words presented in the second phase. As a consequence of the proportion manipulation applied to the first phase, 40 (or 1/3) of the previously imaged words and all 40 of the read words were presented in Phase 2 for the .75-Imaged condition. The reverse was true for the .25-Imaged condition. In the Test Phase, participants were presented with all the target words from Phase 1 and asked to judge whether each word was in Phase 2.

Design

The three independent variables that were manipulated in this experiment are the proportion of target words imaged in the Initial Encoding Phase (*.75-Imaged* vs. *.25-Imaged* conditions), the way that the target words were studied during the Initial Encoding Phase (*3X-imaged* vs. *3X-read* words), and whether the target word was presented in the Target List (*present* vs. *absent*). The manipulation of these factors yielded a 2 (X 2) mixed independent-groups/repeated-measures design, with the proportion of target words imaged during the Initial Encoding Phase (.25-Imged vs. .75-Imaged) representing a between-participants manipulation. The mode of studying words in the Initial Encoding Phase (Imaged vs. Read) represented the within-participants manipulation. The dependent variable of interest was the mean proportion of trials in the Test Phase for which participants judged words as being presented in the preceding Target List. In particular, the focus was on participants' likelihood of judging words that appeared in the Target List as having been presented in that list. Because all of the previously imaged words in the .25-Imaged condition and all of the previously read words in the .75-Imaged condition appeared in the Target List, the primary analyses were not based on participants' likelihood of judging words not presented in the Target List.

There were no previously imaged words meeting this condition in the .25-Imaged condition and there were no previously read words meeting this condition in the .75-Imaged condition.

Results

The proportion of trials in the Test Phase for which participants judged words that were presented in the Target List was computed for each condition and submitted into a 2 (X 2) repeated – measures ANOVA. The proportion of words imaged in Phase 1 (.75 vs. .25) was treated as a between-participants factor and the Initial Encoding (3X-imaged vs. 3X-read) was treated as a within-participants factor. The mean proportion of trials in which participants judged the target word as being in the Target List for each condition is presented in Table 2.

Table 2

Mean proportion of target words participants judged as presented in Phase 2 as a function of Phase 1 Encoding (imaged vs. read), the Proportion Imaged (.75 vs. .25) and Target List Presentation (present vs. absent) in Experiment 2. The standard errors of the mean proportions for each condition are displayed in parentheses.

	Proportion Imaged			
	.75		.25	
Phase 1 Encoding	Present	Absent	Present	Absent
Imaged	.49 (.04)	.20 (.02)	.31 (.03)	
Read	.34 (.02)		.56 (.03)	.25 (.02)

As mentioned above, for the .75-Imaged condition all read words were presented in Phase 2, and for the .25-Imaged condition all imaged words were presented in Phase 2. Therefore, it was not appropriate to test participants ability to discriminate between words present versus absent from the Target List by collapsing across the two proportion imaged conditions. A separate analysis was performed on the .75-Imaged and .25-Imaged condition, testing for a main effect of Target List presentation for the previously imaged and read words, respectively. This analysis revealed a significant main effect of Target List presentation for the imaged words in the .75-Imaged condition, $F(1, 20) = 134.08$, $MSe = 63.93$, $p < .001$, and for the read words in the .25-Imaged condition, $F(1, 21) = 171.29$, $MSe = 61.80$, $p < .001$. For the .75-Imaged condition, participants were 29% more likely to judge imaged words that were presented in Phase 2 as having been presented in that phase, compared to words that were not presented in Phase 2 (.49 vs. .20). Likewise, for the .25-Imaged condition, participants were 31% more likely to judge read words that were presented in Phase 2 as having been presented in that phase, compared to words that were not presented in Phase 2 (.56 vs. .25).

In addition, an analysis revealed that the main effect of the proportion of words imaged in Phase 1 was not significant, $F(1, 41) = .411$, $MSe = 270.95$, $p > .05$. However, the main effect of Initial Encoding was significant, $F(1, 41) = 7.64$, $MSe = 62.38$, $p < .05$, in that participants were 5% more like to judge previously read words as having been present in Phase 2 when compared to previously imaged words (.45 vs. .40), which is consistent with the results of Experiment 1. More importantly, the interaction between the proportion of words imaged in Phase 1 and Initial Encoding was significant, $F(1, 41) = 137.09$, $MSe = 62.38$, $p < .001$. A simple contrast between the imaged and read words for the .25-Imaged condition revealed a significant effect of the Initial Encoding condition, $F(1, 21) = 102.02$, $MSe = 65.56$, $p < .001$, indicating that participants were significantly more likely judge a previously read word as having appeared in the Target List. More intriguing, a simple comparison between the imaged and read words for the .75-Imaged condition also revealed a significant effect of the Initial Encoding condition, $F(1, 20) = 41.30$, $MSe = 59.03$, $p < .001$, indicating that participants were significantly *more* likely judge previously imaged words as having been presented in the Target List. For the .75-Imaged condition, participants were 15% more likely to judge that a previously imaged word was in Phase 2 (.49 vs. .34); whereas for the .25-Imaged condition, participants were 25% less likely to judge that a previously imaged word was in Phase 2 (.31 vs. .56).

Discussion

Taken in combination, the results from this study indicate that participants selectively use the generation of a detailed recollection as a basis to accept or reject items as having appeared in the Target List, depending on whether such detailed recollections are commonplace or unexpected. Interestingly, participants who were required to interactively image 75% of the words in Phase 1 were more likely to use the generation of an image from the first phase as a basis to accept words as being presented in Phase 2. In contrast, participants who were required to interactively image 25% of the words in Phase 1 were more likely to use the generation of an image as a basis to reject words as being presented in Phase 2. When participants were required to generate an image for 75% of the words in Phase 1, they were more likely to correctly judge words that were imaged in Phase 1 as having been present in Phase 2, compared to words that were read in Phase 1.

Opposite to this finding, participants who were required to generate an image for only 25% of the words in Phase 1 were less likely to correctly judge words that were imaged in Phase 1 as being present in Phase 2, compared to words that were read in Phase 1. The proportion of words that were imaged in Phase 1 was not predictive of whether that word was presented in Phase 2; therefore, it seems that participants adjusted their use of the generation of an image at test depending on the proportion of items that sponsored that type of recollection within the experimental context as a whole. Specifically, when the generation of an image was commonplace within the context of the experiment (i.e., when most of the words were imaged in Phase 1), recollection of an image at test was used as a basis to *accept* items as having been presented in Phase 2. In contrast, when the generation of an image was relatively unexpected within the experimental context (i.e., when very few of the words were imaged in Phase 1), this information was used as a basis to *reject* items as having been presented in Phase 2.

From these results, it seems that participants formed expectations about the likelihood of producing an image upon presentation of words during the test phase and used those expectations as a factor when making their remembering judgments. Recollection of interactive images at test provided participants with evidence of the type of experience they had with words during the first phase of the experiment, but was irrelevant as a basis for judging whether a word was encountered in the second phase; nonetheless, people used this information as a basis to reject or accept a word as being in the second phase of the experiment. Generally speaking, these results suggest that when presentation of a stimulus sponsors the unexpected recollection of some detail, people will be biased to conclude that the stimulus was encountered only within that context. In contrast, when presentation of stimulus sponsors a type of recollection that is highly common, this same type of bias will not occur and people may actually be more likely to assume that they also have encountered that stimulus in some entirely different context.

Recall the real-world example provided above in which you encounter a person that seems familiar and you attempt to determine whether they were at a recent party that you attended. However, instead of information from the party coming to mind, information associated with school comes to mind. Suppose that most of the people you know promote the recollection of details associated with being in the context of school. By extrapolating the results from Experiment 2 to this situation, encountering a person that sponsors the recollection of details from school may be used as a basis to conclude that one has also encountered that person at a recent party. However, in another situation, that is, if only a few people that you know promote the recollection of details associated with being at school, encountering a person that sponsors the recollection of these details may be used as a basis to conclude that they were not also encountered at the party.

As illustrated by the above example, the surprising implication of Experiment 2 is that, similar to Leboe et al.'s (2004) findings, accessing a detailed recollection of having encountered a stimulus in some context does not only support the conclusion that the stimulus has been encountered in that context. It can also form the basis of deciding whether or not a stimulus was also encountered in some other context. The third experiment extends these findings and examines a limit to the use of the generation of a detailed recollection about having encountered a stimulus one context in influencing judgments about whether one encountered that stimulus in some different context.

Experiment 3

Method

Participants

Sixty-four participants (30 female and 34 male, mean age = 19.33) were recruited from the same participant pool as was used in Experiments 1 and 2. Thirty-two participants were randomly placed in each of the .75-Imaged and .25-Imaged conditions. Each participant received course credit in exchange for their participation in this study. All participants were under the age of 30 and spoke English as their native language.

Apparatus and Stimuli

The same apparatus and stimuli that were used in the preceding two experiments were used again in Experiment 3.

Procedure

The procedure followed closely to the procedures used in the previous two experiments; however, the participants were presented with a counterfeit list during the Target List presentation.

Upon arrival, participants were assigned to either the .75-Imaged or .25-Imaged condition and to one of the four versions of the experiment generated by the counterbalanced assignment of word targets to the imaged/read initial encoding conditions. After receiving a consent form, general instructions, and instructions for the first phase, participants were instructed to begin the first phase. Each participant received a different randomized set of target and context words presented in Phase 1.The first phase of Experiment 1 was identical to the first phase of Experiment 2; thus, participants were presented with target words that were imaged for 75% of the trials, or participants were presented with target words that were imaged for 25% of the trials.

After completion of the first phase, participants were informed that they would be receiving a series of single word presentations. They were also told that these words would appear rapidly, and that they would probably have trouble reading the words; however, they would be able to perceive each of the words presented "unconsciously". In reality, participants were presented with a counterfeit list of items, consisting of 80 presentations of: a fixation point (+) for 1 second, a pre-mask (XXXXXXXXXX) for 250 ms, a series of random symbols (e.g., *&&#**#&*#) for 20 ms, and a post-mask (XXXXXXXXXX) for 250 ms. This procedure was adapted from the procedure developed by Westerman et al. (2002) as a method for providing participants with a basis for making remembering judgments with reference to a list of items that were not actually presented. In this procedure, participants are led to believe they have unconscious memory for a list of items that was presented too quickly for them to be able to consciously remember during a later test phase. As with the other two experiments, in the Test Phase participants were presented with all the target words from Phase 1 and asked to judge which of the words were presented in the second phase. Since no words were actually presented during the second phase of the experiment, any judgments of having seen a word in Phase 2 would indicate false recognition judgments.

Design

The two independent variables that were manipulated in this experiment were the proportion of target words that were imaged in the Initial Encoding Phase (*.75-Imaged* vs. *.25-Imaged* conditions) and the way that target words were studied in the Initial Encoding Phase (*3X-image* vs. *3X-read*). Since no words were actually presented in the Target List, whether or not the word was presented in the Target List was not one of the manipulated variables. The manipulation of these two factors yielded a 2 (X 2) mixed-design, with the proportion of words imaged in the Initial Encoding Phase representing a between-participants manipulation and the way that words were studied during that phase representing a within-participants manipulation. The dependent variable of interest was the mean proportion of trials in the Test Phase for which participants judged words as being presented in the preceding Target List.

Results

The proportion of trials in the Test Phase for which participants judged words that were presented in the Target List was computed for each condition and submitted into a 2 (X 2) ANOVA. The proportion of words imaged in Phase 1 (.75 vs. .25) was treated as a between-participants factor and the Initial Encoding (3X-imaged vs. 3X-read) was treated as a within-participant factor. The mean proportion of trails in which participants judged the target word as being in the Target List for each condition is presented in Table 3.

Table 3

Mean proportion of target words participants judged as presented in Phase 2 as a function of Phase 1 Encoding (imaged vs. read) and Proportion Imaged (.75 vs. .25) in Experiment 3. The standard errors of the mean proportions for each condition are displayed in parentheses.

	Proportion Imaged	
Phase 1 Encoding	.75	.25
Imaged	.45 (.04)	.46 (.03)
Read	.43 (.03)	.47 (.03)

An analysis revealed that there was no main effect of the proportion of words imaged in Phase 1, $F(1, 62) = .432$, $MSe = .06$, $p > .05$. Furthermore, the method of Initial Encoding did not influence participants' recognition judgments, $F(1, 62) = .162$, $MSe = .02$, $p > .05$. In addition, the interaction between these two factors was not found to be significant, $F(1, 62) = .638$, $MSe = .02$, $p > .05$

Discussion

The results from the third experiment reveal the participants' false recognition judgments were unaffected by the proportion of words imaged in Phase 1 and whether the word was imaged or read in the Initial Encoding Phase. In contrast to the findings of the previous two experiments, these findings indicating that when participants can expect to recollect no details about their experiences with the target list, the recollection of detailed images had no influence on recognition judgments. The finding from the third experiment provides an important limit to the effects found in the first two experiments. Mainly, participants will only be biased by detailed recollections that occur when presented with a recognition item when the target context is capable of sponsoring some form of detailed recollection. In the preceding two experiments, words presented in the target list were merely read. However, participants' conscious experience with them at least provided some expectation that their experiences with those words could sponsor a detailed recollection. In situations when little or no information comes to mind about an experience in the relevant context (i.e. as a consequence of being presented with a counterfeit list), participants rely on a simple fluency heuristic when making recognition judgments.

For example, Westerman et al. (2002) found that when participants were presented with a counterfeit list, incorrect judgments for having seen words previously were enhanced for words that were presented following a repeated masked prime. However, these incorrect recognition judgments were only increased after participants were presented with a visual counterfeit list and not after participants were presented with an auditory counterfeit list; indicating that participants flexible use the fluency heuristic in situations when the perceptual fluency of a recognition item is assumed to be enhanced as a result of some prior experience. Similar to Westerman et al.'s study, participants in the current study would have been expected to base their recognition judgments on perceptual fluency since the counterfeit list was presented visually. However, since all the words in the Test Phase were presented three times during the Initial Encoding Phase as imaged or read words, and the number of prior exposures mainly influences perceptual fluency, the use of the fluency heuristic in this situation would not have lead to higher judgments of "presented in Phase 2" for previously imaged versus read words. Furthermore, as a consequence of the counterfeit list presentation, participants are reliant on the fluency heuristic and are unable to use the generation heuristic when forming judgments for having seen words in Phase 2. This exclusive reliance on the fluency heuristic results in no difference in recognition judgments for previously imaged and previously read words.

CHAPTER 3

GENERAL DISCUSSION

Together, the above three experiments provide a more refined understanding of how the generation heuristic is used when forming remembering decisions. The first experiment demonstrated that the generation of detail was not used when it is predictive of having seen a word in the critical phase. In contrast, the results from the second experiment revealed that the generation of detail is used differently when a low or a high proportion of words are imaged in an irrelevant context. Consistent with previous research by Leboe et al. (2004), participants were found to use the generation of detail as a basis to reject a word as being in a particular context when a low proportion of words sponsored the generation of detail at test. In contrast to this finding, participants were found to use the generation of detail to accept a word as being in a particular context when a high proportion of words sponsored the generation of detail at test. Finally, the third experiment provides a limitation to the use of the generation of detail when forming remembering decisions. Mainly, the generation of detail did not influence recognition judgments when no information came to mind about the target context.

The most substantial finding from the results of the three experiments is that the generation of detail is not used exclusively to make correct remembering judgments. Instead, the generation of detail was found to impair or enhance correct remembering decisions, depending on the proportion of words that sponsored the generation of detail at test and the experience that people had during the target context. In the first experiment, when the generation of detail was experienced for half of the words at test, the generation of detail did not bias recognition judgments. Importantly, no generation of detail bias occurred even for situations when the generation was or was not highly predictive for having seen words during the target context. However, the second experiment demonstrated that biases based on the generation of detail can be induced by altering the proportion of words that are experienced as sponsoring the generation of detail at test. When a low proportion of words were experienced as sponsoring the generation of detail at test, participants used the generation of detail to reject words as having been presented in the target context. In contrast, when a high proportion of words were experienced as sponsoring the generation of detail at test, participants used the generation of detail to accept words as having been presented in the target context. Most intriguing about these results is that the proportion of words imaged was never actually associated with words having been presented in the target context. On the contrary, across both high and low proportion imaged conditions, read and imaged words were equally likely to be presented in the target context. Nonetheless, participants were biased by the proportion of words that sponsored the generation of detail at test. As a consequence of this bias, participants' correct recognition judgments for imaged words were impaired when a low proportion of words sponsored the generation of detail and participants' correct recognition judgments were enhanced when a high proportion of words sponsored the generation of detail.

In addition, the results from these experiments reveal the importance of match in forming recognition judgments. According to principle of transfer-appropriate processing (TAP; Morris, Bransford, & Franks, 1977), remembering tasks are influenced by the degree of match between conditions at study and test. Remembering performance is improved when test conditions more closely match conditions during study. Similarly, Whittlesea and Leboe (2000) and others (Kleider & Goldinger, 2006) have discussed the use of the resemblance heuristic when forming recognition judgments. Consistent with both TAP and the use of the resemblance heuristic when forming recognition judgments, the first two experiments demonstrated that participants were more likely to judge previously read words as being in the target context, compared to previously imaged words. In the first two experiments, participants' recognition judgments were enhanced for words that were previously read. Although enhanced recognition judgments for previously read words increased correct recognition judgments, which provides support for the principle of TAP, these results also meant that incorrect recognition judgments were increased. Since participants were influenced by the match between the type of processing performed at study and test and this influence lead to enhanced correct and incorrect recognition judgments, participants appeared to be utilizing the resemblance heuristic when forming recognition judgments.

The importance of match between processing performed during the target context and the processing experience at test was clearly demonstrated in Leboe et al.'s (2004) second experiment. In Leboe et al.'s second experiment participants were required to create interactive images for words presented in that phase. Consistent with TAP and the use of the resemblance heuristic, judgments for having seen words in the target context were enhanced for words that were previously imaged. Thus, both the results from Leboe et al. experiments and the above Experiments 1 and 2 results reveal participants' recognition judgments are consistently influenced by the degree of processing match between study and test conditions.

Furthermore, the results from the second experiment demonstrate an alternative manner in which recognition judgments can be biased. Instead of the match between study and test conditions solely biasing recognition judgments, the proportion of words that sponsored the generation of detail at test was also found to influence recognition judgments. Although the proportion of words that sponsored the generation of detail at test influence remembering judgments in a manner that is not objectively rational, from the participants' subjective perspective, it could be argued, that they are using the recollected information in the best way possible to guide their remembering judgments. Specifically, participants may have been forming different attributions about the recollected information based on expectations that are formed during the recognition test. That is, based on their experiences with generating a detailed image across the different phases of the experiment, participants may have formed unconscious expectations about the type of information that comes to mind during the test phase. When presented with a test word that causes a detailed image to come to mind, and few words are experienced this way, this information would be experienced as being subjectively surprising. Since the way that words were experienced in the second phase would be not expected to produce a detailed image and this information, comparatively, is unique, participants may easily, but mistakenly, unconsciously attribute the source of the generated detail to the first phase. Thus, when unexpected details come to mind, and these details are related to some irrelevant context, participants may be convinced to judge that they remembered experiencing the word only in the irrelevant context.

In contrast, when presented with a test word that causes a detailed image to come to mind, and many words are experienced this way, this information would be experienced as being subjectively expected. Even though the way that words were experienced in the second phase would not be expected to produce this detailed image, participants would not be surprised by a detailed image coming to mind at the time of test, since many of the words would be experienced in the same way. Therefore, although the generation of detail is unexpected, given the context that is relevant for the remembering task, the generation of a detailed image at test would not be experienced as being unique. As a result, participants may not be convinced to conclude that the word was not in the second phase based on this information. Instead, this information may combine with the feeling of familiarity and be used as a basis to conclude that the word was in the second phase of the experiment.

Importantly, the interaction found between the use of recollection to make remembering judgments and participant's subjective expectations of being able to produce detailed recollections at the time of the remembering test is analogous to the interaction between fluency and subjective expectations. The finding that fluency is influenced by subjective expectations has been used to further demonstrate the dynamic nature of the heuristics used when forming remembering judgments based on the fluency heuristic. Specifically, although fluency has consistently show to influence recognition judgments, when people are provided with a source of the fluency the influence of objective fluency on recognition judgments has been shown to be reduced (Jacoby & Whitehouse, 1989; Whittlesea, 1993; Whittlesea, & Leboe, 2003). Thus, it appears that uncertainty in the source of the fluency of the item is necessary for the objective fluency to influence remembering judgments. Furthermore, attributions and expectations that are formed by the participant have been found to mediate the influence of fluency on recognition judgments (Westerman et al., 2002; Whittlesea & Williams, 2001). For example, Westerman et al. demonstrated that intuitive expectations created by participants mediate the influence of fluency on recognition judgments. In their experiments, participants' recognition judgments were only shown to be influenced by fluency when the modality that the words were presented in during the study phase (auditory vs. visual) matched the test phase (visual only). The important finding from these experiments is that the increasing the objective fluency of an item by presenting a subliminal prime did not necessarily result in an increased likelihood of judging that item as old. Instead, objective fluency was only attributed to previously seeing the word when the modality in the study list matched the test phase. Thus, these results reveal that objective fluency is attributed to a past experience when the fluency is surprising, but also consistent with the type of processing engaged in during the previous study phase.

Similar to the role that subjective expectations play on influencing feelings of familiarity, the results from the second experiment demonstrated that the subjective experience that accompanies the generation of detail can also be used to bias recognition judgments. When generating a detailed image at test is experienced as being subjectively experienced as being surprising, participants are more inclined to use this information to conclude that target words were not in another context. In contrast when the generation of detail is subjectively experienced as being commonplace, participants are less inclined to use this information to conclude that target words were not in another context.

Finally, although the third experiment provided no significant results, this finding provides an important limit to the biases created by the use of the generation heuristic. Since participants recognition judgments were not influenced by proportion of words that sponsored the generation of detail at test, participants are not incidentally influenced by the proportion of words that sponsor the generation of detail at test. Rather, participants' are only influenced by the proportion of words that sponsor the generation of detail when information about the target context comes to mind.

In contrast to conventional conceptualizations of recollection, the above experiments provide demonstrations of the heuristic use of the generation of detail, suggesting a similar underlying process that influences familiarity and recognition. Just as familiarity is influenced by TAP, attributions and subjective expectations, the above experiments, in combination with Leboe et al.'s (2004) study, provide evidence for similar influences on recollection. Although the information that is provided by the feeling of familiarity and recollection are quite different, the results of the current study provide evidence to contend the notion that these processes should be treated as inherently separate processes. Instead, the results provided above suggest that similar errors and biases that arise from the use of the feeling of familiarity when forming recognition judgments may occur when forming recognition judgments based on recollection. Thus, instead of recognition and familiarity being treated as distinct and separate memory processes that are influenced by separate memory systems, it seems more appropriate treat each process as providing different types information that arises from the same set of basic memory principles.

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