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## **Don't Remind Me: Part-set Cuing Inhibits Consumers Prospective Memory When Reviewing Home Loan Terms**

Mark Alexander Leboeuf  
*DePaul University*, [mleboeuf@depaul.edu](mailto:mleboeuf@depaul.edu)

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Don't Remind Me: Part-set Cuing Inhibits Consumers Prospective Memory When Reviewing

Home Loan Terms

A Dissertation

Presented in

Partial Fulfillment of the

Requirements for the Degree of

Doctor of Philosophy

By

Mark Alexander LeBoeuf

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Department of Psychology

College of Science and Health

DePaul University

Chicago, Illinois

**Dissertation Committee**

Jessica Choplin, Ph.D., Chairperson

Sandra Virtue, Ph.D.

Joseph Mikels, Ph.D.

Max Helveston, J.D.

Wendy Epstein, J.D.

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## **Biography**

The author was born in Cincinnati, Ohio, March 2, 1986. He graduated from Sycamore High School, received his Bachelor of Arts degree from Miami University in 2009, and a Master of Arts degree from DePaul University in 2013.

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## Abstract

Three experiments examined whether part-set cuing effects might impair consumers' abilities to remember to check loan attributes on a home-loan disclosure form. In part-set cuing effects, memory is typically impaired when a subset of previously learned items are offered as cues to aid subsequent recall. Participants studied a list of loan attributes to check when they subsequently reviewed a home-loan disclosure form. Results indicated that participants cued immediately prior to reviewing the form remembered to check (visually fixated) a lower percentage of non-cued attributes relative to those presented with no cues (Experiments 1 – 3). The magnitude of impairment increased as the cue-set size increased (Experiment 2) but did not vary according to the correspondence between the cue-presentation order and encoding order (Experiment 3). This pattern of results is consistent with retrieval-strength accounts (response competition or retrieval inhibition) and inconsistent with strategy-disruption accounts of part-set cuing effects. These findings demonstrate that even informed borrowers are vulnerable to deceptive tactics when reviewing government mandated home-loan disclosure forms. Implications for understanding consumers' vulnerabilities to fraud and poor decision-making are discussed.

## Don't Remind Me: Part-set Cuing Inhibits Consumers Prospective Memory When Reviewing Home Loan Terms

The benefits, costs, and risks associated with home loans have grown increasingly complex to assess (Carrozzo, 2005) and consumers frequently have difficulty making informed home loan decisions (Willis, 2006). These difficulties leave consumers vulnerable to deception such as being duped into taking out predatory home loans (Hill & Kozup, 2007) and also make it challenging for responsible mortgage brokers, lenders, and financial counselors to help consumers understand loans (Choplin, Stark, & Mikels, 2013). The federal government's primary response to protect home-loan consumers has been to mandate the disclosure of key loan terms on forms such as Housing and Urban Development's HUD-1 form (U.S. Department of Housing and Urban Development Office of Policy Development and Research, 2008) and the recently released Consumer Financial Protection Bureau home loan disclosure form (Kleimann Communication Group, Inc., 2012). These forms are given to consumers both when they apply for a loan and again prior to funding. The assumption is that once consumers have this information presented to them in an easily accessible manner, they will understand offered loans and comparison shop. As a result, consumers will not be vulnerable to predatory lenders who offer overpriced and unaffordable home loans. These forms should also make it easier for responsible brokers, lenders, and financial counselors to advise home-loan consumers. Despite these efforts, predatory lending remains a widespread problem. Some empirical testing has investigated the ability of consumers to glean information from these forms (e.g., Lacko & Pappalardo, 2007) focusing primarily on how the physical layout and terms selected for

disclosure affects comprehension. Neglected in this research, however, is the possibility that contextual factors can also affect the information that consumers glean from these forms.

In particular, the conversations that consumers have with their mortgage brokers and lenders as well as their financial counselors have important effects on the information that home-loan consumers glean from disclosure documents (Stark, Choplin, & LeBoeuf, 2013; LeBoeuf, Choplin, & Stark, 2014). Mortgage brokers and lenders are often present when consumers review the terms of their loan on these forms, providing guidance during the initial steps of the lending process. Though nominally intended to facilitate consumer understanding, myriad examples exist of industry practitioners using these interactions to mislead consumers into taking out loans with unnecessarily high fees, problematic terms, and risky features (Pacelle, 2004; Hill & Kozup, 2007; Willis 2006). For instance, employees of one lender required its loan officers to follow a standardized sales pitch that diverted attention towards favorable loan-attributes and away from problematic attributes. After reviewing this script, the United States Court of Appeals concluded that, “The loan sales presentation was conducted in such a way as to lead a consumer to disregard the high annual percentage rate (APR) when it was ultimately disclosed on the federally-required Truth in Lending Statement” (In re First Alliance Mortgage Company, 471 F. 3d 977, 985 (9<sup>th</sup> Cir. 2005).

Research conducted within our lab has investigated several techniques that predatory mortgage brokers and lenders can use to mislead naïve consumers, including exploiting confirmation biases (Stark et al., 2013), violating conversational norms (LeBoeuf et al., 2014), and giving senseless explanations (Choplin, Stark, & Ahmad, 2011). The research presented here extends this line of research by investigating a technique that predatory mortgage brokers and lenders might use to mislead even “well-informed” consumers or by which well-intentioned

financial counselors may unwittingly undermine home loan decision-making. A well-informed consumer is operationally defined as someone who has a list in mind of the attributes to check when evaluating a loan. The present study examined how part-set cuing effects (see Nickerson, 1984, for review) may impair consumers' prospective memory to remember to check loan attributes that they intended to check.

Part-set cueing effects are a memory phenomenon under which providing individuals with a subset of previously learned items typically disrupts retrieval of the remaining items. In the classic demonstration of this effect, Slamecka (1968) provided participants with a set of items (words) for subsequent recall. Prior to recalling the items, those in the experimental condition received a subset of the previously studied items as cues or hints and were then asked to recall the remaining items. In contrast, those in the control condition were not provided with any cues and were simply instructed to remember as many items from the previously studied set as possible. Surprisingly, those provided with cues at retrieval remembered a lower proportion of non-cued items relative to those provided with no cues.

Roediger (1973) demonstrated the part-set cuing effect by providing participants categories of items to be memorized (e.g., Birds: *Stork, Robin, Thrush, Canary, Parrot, Egret, Wren*). When participants were later tested, those who were given some of the bird names as a memory cue (e.g., *Stork, Robin, Thrush*) exhibited worse recall for the remaining bird names compared to participants who were asked to recall the entire list. This finding runs counter to the intuitive notion that cueing with a subset of previously learned items should facilitate recall via associative retrieval (e.g., Tulving & Pearlstone, 1966; Tulving & Thomson, 1971), but it has been replicated under a range of retrieval conditions, including free recall (e.g., Slamecka, 1968, 1969), recognition (e.g., Todres & Watkins, 1981; Neely, Schmidt, & Roediger, 1983), serial-

recall (e.g., Serra & Nairne, 2000; Basden, Basden, & Stephens, 2002), and long-term memory (e.g., Brown, 1968; Sloman, Bower, & Rohrer, 1991). The part-set cuing effect has also been observed with non-linguistic stimuli (Peynircioglu, 1987), leading to the conclusion that this effect “encompasses more than just memory. It is a more general phenomenon in which partial answers or hints may sometimes serve to block the general thinking or cognitive processes instead of, as intuition would suggest (at least in the realm of memory), facilitate it.” (p. 440).

When lenders lead consumers through home-loan disclosure documents and highlight only a subset of attributes that the consumer knows beforehand to check, it resembles a part-set cuing task where cues are provided immediately prior to retrieval (e.g., Bäuml & Aslan, 2004). The consumer’s prospective memory to check the non-mentioned (and potentially problematic) attributes that they had originally intended to check may then be impaired. The importance of this issue is manifest: failing to consider pertinent information contained in the disclosure form will directly impact the consumer’s ability to make an informed home-loan decision.

Considering the costs associated with suboptimal home-loan decision making at both an individual and societal level, it is critical that we enhance our understanding of factors that could contribute to suboptimal decision-making within this realm.

Accordingly, the primary objectives of the present research are to 1) inform public policy designed to protect consumers by improving our understanding of consumers’ vulnerabilities to fraud and poor decision-making, 2) provide theoretically interesting contributions to the literature on part-set cuing effects, and 3) assess the ability of eye tracking methodology to provide actionable insights on topics pertinent to consumer protections. The following section provides the conceptual framework implemented by the present study to understand this issue.

### **Theories of Part-Set Cuing**



A variety of explanations have been put forth regarding the inhibitory mechanism underlying the part-set cueing effect (for reviews see Nickerson, 1984; Roediger & Neely, 1982). Three widely cited explanations are *response-competition*, which has also been referred to as *retrieval blocking* or *occlusion* (Rundus, 1973), *retrieval-inhibition* (e.g., Bäuml & Aslan, 2004) and *strategy disruption* (Basden & Basden, 1995; Basden, Basden, & Galloway, 1977). Each of these theories is described in greater detail below.

### **Response Competition**

Response competition (Rundus, 1973) proposes that the re-presentation of items increases the representational strength of these items in memory. Stronger items are more likely to be “covertly” retrieved first and thus compete with or block retrieval of relatively weaker items that share a common retrieval cue (Mensink & Raaijmakers, 1988; Raaijmakers & Shiffrin, 1980, 1981). Rundus provided one of the first competition-based accounts of part-set cuing, positing that the likelihood of recalling a particular item is contingent upon the associative strength of that item with a cue relative to the associative strength of other items that are also linked to that cue. One of the central assumptions of Rundus’ model is that individuals encode information from lists in a hierarchical framework; contextual cues are linked to categories, and categorical cues are linked to individual items. When an individual is presented with a recall test after studying a list of items or words, they initiate this process by first recalling categories via contextual associations. The categories then serve as cues to facilitate recall for individual items. For example, the likelihood of recalling a particular car brand, such as *Honda*, in response to a retrieval cue, such as *car brands*, will depend on the associative strength of *Honda* with the category of *car brands* relative to the strength of all other associations that are also linked to that

category, such as *Toyota*, *Chevrolet*, *Porsche*, *Lexus*, or *Mercedes*. If a subset of previously studied items is presented at the point of recall (e.g., *Toyota*, *Chevrolet*, *Honda*), this serves to strengthen the associations between the presented items and shared categorical cue relative to those items that are not present (e.g., *Porsche*, *Lexus*, *Mercedes*) with the categorical cue.

An additional tenant of this model is that retrieval occurs in a fashion tantamount to sampling with replacement, so even if an item has already been retrieved, it may be retrieved again. The act of re-retrieving an item is presumed to have the same effect on memory as active rehearsal because both acts serve to strengthen the item-cue association. Once the association of an item is strengthened with the cue, the likelihood of continually re-sampling that item will increase. After continued attempts to retrieve the non-strengthened items leads instead to the retrieval of strengthened items, the individual is said to have reached their “stopping criterion,” or the point at which they stop trying to recall the non-strengthened items. They then prematurely terminate the retrieval process prior to recalling the remaining items.

In summary, the response competition account of part-set cuing proposes that items presented at the point of recall function as hints or cues and become more prominent in memory, and non-cued items are less likely to be sampled and recalled prior to terminating search or reaching one’s stopping criterion. Thus, increasing the strength of association between a category and an individual item makes that item a stronger competitor that interferes with the retrieval of weaker competitors via covert retrieval of the strong items. Though this perspective aligns with a number of findings within the part-set cuing literature (see Roediger & Neely, 1982) evidence obtained more recently indicates that merely strengthening an item is does not necessarily produce forgetting of the remaining, non-strengthened items. This finding has encouraged the

development of alternative explanations for part-set cuing, the most prominent of which are discussed in the following sections.

### **Retrieval Inhibition**

The *retrieval inhibition* account of part-set cuing (e.g., Bäuml & Aslan, 2004) is premised on prior research related to *retrieval-induced forgetting* (see Anderson, 2003, for review of retrieval-induced forgetting). According to retrieval-induced forgetting, the act of remembering some items from a common category alters the long-term representations of the remaining non-remembered items in memory. That is, in order to remember certain items from a common category, one must not only retrieve the items but also suppress any other competing items. For example, in order to retrieve *apple* in response to the category cue *fruit*, alternate possibilities (*peach, pear, orange, grape, cherry, etc.*) have to be suppressed. The act of suppression is then thought to produce prolonged forgetting of the suppressed items (Anderson, Bjork, & Bjork, 1994).

Evidence in support of this account, and contrary to the retrieval competition account, has been acquired through studies that have contrasted retrieval performance between those who were re-exposed to items for additional learning with those who were instructed to use the items as retrieval cues (e.g., Bäuml & Aslan, 2004). These studies have shown that strengthening via re-exposure for additional learning does not produce forgetting, whereas strengthening via cuing does. Thus, advocates of retrieval-induced forgetting account of part-set cuing have emphasized the necessity of retrieval rather than strengthening.

Based on this research, Bäuml and Aslan (2006) proposed that the mechanism underlying part-set forgetting is “functionally equivalent” to that of retrieval-induced forgetting (p. 34)(see

also Bäuml & Aslan, 2004; Aslan, Bäuml, & Grundgeiger, 2007). The main difference is that retrieval-induced forgetting stems from the overt retrieval of items while part-set cuing forgetting stems from covert retrieval. Support for this perspective stems from evidence indicating that overt retrieval (e.g., intentionally recalling some items) and covert retrieval (e.g., presenting the items as cues) produce similar levels of forgetting for the non-recalled/non-cued items (Bäuml & Aslan, 2004). Thus, the memory representations of the non-cued items are impaired by covert retrieval of the cued items.

### **Response Competition and Retrieval Inhibition**

Though response competition and retrieval inhibition present differing accounts of how the part-set phenomenon impairs memory, these theories share the assumption that strengthening a subset of previously learned material via cuing leads individuals to covertly retrieve the cued items before the non-cued items. Output order interference then causes forgetting of non-strengthened materials. Smith (1971) provided a clear example of the “self-limiting” nature of memory, which implies that the more one remembers, the more difficult it becomes to remember. In his study, Smith asked participants study items from seven semantically distinct categories (see also Roediger, 1978). Each category cue was then sequentially presented to participants who were instructed to recall as many items from each category as possible. The number of items recalled declined with each successive presentation: on average, 70 percent of items were recalled on the first category tested while 45 percent of items were recalled on the seventh category tested. These results illustrated that retrieval becomes more difficult as more items are retrieved, which has led to the belief that initial outputs (i.e., retrieval) interfere with subsequent outputs.

However, in addition to varying the nature of the cueing process, researchers have attempted to differentiate between response competition and retrieval inhibition as explanations of the part-set cuing effect by controlling for output order interference. To achieve this, cues are presented prior to the free recall task instead of during the task. The targets, or non-cued items, are then presented afterwards for retrieval in a random order. Finally, the non-target, or cued items, are presented last. This setup circumvents the possibility of output order biases, as the non-cued items are tested in the absence of and prior to the retrieval of the cued items.

Bäumel and Aslan (2004) sought to directly compare the effects of part-set cuing, part-set relearning, and part-set retrieval on recall performance relative to a control condition in which items were not re-presented. In the part-set cuing condition, participants were instructed to use the items as hints; in the part-set relearning condition, participants were told that they had an additional opportunity to relearn some of the previously studied items, which would improve their retrieval performance on a subsequent recall test; and participants in the part-set retrieval condition were provided with a word's stem (i.e., the first two letters) and instructed to recall the word. To control for output interference, the non-cued or "target" items were always retrieved before the cued or "non-target" items. The authors posited that if part-set cuing is due to output order biases stemming from response competition, the effects of cuing and relearning on retrieval of the target items should be equivalent. However, if part-set cuing is due to an instructional effect, in which directions to use the items as cues causes participants to covertly retrieve the cued items, then part-set cuing should produce levels of forgetting similar to the part-set retrieval condition. Further, if part-set inhibition reflects more than strengthening induced output order biases, then part-set cuing should produce greater decrements in retrieval than part-set relearning.

Their results indicated that part-set cuing and part-set retrieval both inhibited retrieval of the target items. In contrast, part-set relearning did not have an inhibitory effect on retrieval relative to the control condition. The detrimental effects caused by cuing were greater than those caused by strengthening, indicating that part-set inhibition results from long-term suppression of the target items' representations in memory as opposed to retrieval competition (see also Bäuml & Aslan, 2006, for further evidence). Further, the size and the direction of impairment between the part-set cuing condition and part-set retrieval conditions were nearly equivalent. Bäuml and Aslan interpreted this finding as evidence that a similar mechanism underlies part-set forgetting and retrieval-induced forgetting.

Controlling for retrieval order to circumvent the issue of output order biases has been the primary approach for contrasting response competition and retrieval inhibition accounts of part-set cuing. In most real world retrieval situations, though, it is not possible to control for output order. Covertly retrieving an item or strengthening an item through additional exposure will likely result in output order biases, thereby producing forgetting of the non-retrieved/non-strengthened items. Given that a central objective of the present study is to generalize these findings to actual home loan consumers, it is not possible to control for the order in which participants retrieve the previously studied loan attributes. This precludes the possibility of differentiating amongst these accounts. As such, the response competition and retrieval inhibition accounts will henceforth be described as the *retrieval-strengthening account* (Bäuml & Aslan, 2004).

### **Strategy Disruption**

The *strategy disruption hypothesis* (herein referred to as *strategy disruption*) posits that recall performance is contingent upon one's ability to use an organizational framework during

retrieval that is similar to or the same as that used during the original study phase when the items were learned (Basden & Basden, 1995; Basden, Basden, & Galloway, 1977). It is rooted in the concept of transfer appropriate processing (Morris, Bransford, & Franks, 1977), or the idea that retention depends on the correspondence between strategies used at encoding and those implemented at retrieval. Individuals rely on unique strategies for organizing studied materials in memory and then subsequently utilize on these strategies to facilitate later retrieval (Tulving, 1962). Cues disrupt retrieval when they prompt the individual to utilize an organizational framework that differs from the framework developed during learning.

Brown and Hall (1979) conducted one of the first studies that relied on the strategy disruption hypothesis to explain their results. In a single study, they varied the influence of item strength and the quantity of cues presented at recall and examined how these factors would affect semantic memory. The experiment involved a free-association task in which participants were asked to provide four words associated with 20 stimulus words (e.g., for the stimulus word *fruit*, possible responses could be *apple*, *orange*, *banana*, or *sweet*). Unbeknownst to participants, after a period of two days they completed a recall test, during which they were asked to remember the responses provided earlier to each of the stimulus words. A subset of these participants was then cued with their earlier responses. Additionally, within the cue conditions, the number of cues present at recall were manipulated, ranging from a single word to three of the four previously generated words. Item strength was also manipulated by selecting responses from different serial positions provided during the initial item generation task, because words generated in lower serial positions (1, 2, 3) were assumed to maintain stronger associations with the target stimulus than words generated in higher serial positions (4, 5, 6).

Cue-strength and number were varied to test the strategy disruption hypothesis against Rundus' (1973) competition at retrieval hypothesis. If the presentation of cues at the point of recall disrupted the strategies participants used for retrieval, then the strength of the cues should not affect overall recall, as the mere presence of a cue should be sufficient to inhibit recall via strategy disruption. In contrast, if recall varied as a function of the cue strength, such that stronger items resulted in greater inhibition, results would align with the competition at retrieval hypothesis. The study yielded a clear part-set cuing effect that was not moderated by the strength of the cues, indicating that cues inhibited memory via strategy disruption.

Since Brown and Hall's seminal study, several key findings have emerged within the part-set cuing literature that provide support for the strategy disruption account. First, part-set cuing produces less impairment when they prompt a retrieval strategy that is consistent with, rather than inconsistent with, an individual's original encoding scheme. For example, Serra and Nairne (2000) conducted three experiments to determine whether cues could facilitate or increase recall performance if they were presented in a way that complemented their presentation scheme during encoding. In Experiment 1, participants studied a list of eight items, followed by a brief distracter period. The original list of items was then re-presented in a different order than that observed during study. Participants were instructed to place four of the originally studied items, which were identified for participants, back into the same position they occupied in the original study list. The only difference across conditions was the location of the cued items when the original study list was re-presented: in one condition the cued terms were located in the same position they occupied during study, while in the other condition these same positions were filled with "+" signs. Results from Experiment 1 indicated that the presence of cues in their original locations led to improved recall for the non-cued items, compared to instances in which these



locations were filled in with + signs. Experiment 2 implemented a similar paradigm and replicated these results.

Experiment 3 examined whether “interitem” associations between cued and non-cued items could improve retrieval performance. Interitem associations are defined as cues that an individual relies on during study to organize retrieval such as semantic associations between words (e.g., *bar-stool*, *ball-bat*, *wheel-bike*, *sun-sand*), spatial information (e.g., how objects in a room are arranged), or temporal information (e.g., the serial order of a list of items). Serra and Nairne hypothesized that if such associations facilitated recall during the previous two experiments, re-presenting items in locations that differed from study should produce retrieval inhibition.

The presence and location of cues were manipulated, yielding three separate conditions. In the first condition, the locations of cued items were indicated by + signs, and the non-cued items were blank. This condition served as the control because information regarding the original cues and their serial positions in the study list were not present. In the second condition, four of the original study items were presented in the same location or serial position they occupied in the study list. The cued items were congruent with an encoding strategy that relied on inter-item associations. In the third condition, the cued items were located randomly in one of the four possible positions that the cued items had occupied on the original study list. The cued items in the third condition were incongruent with an encoding strategy that relied on inter-item associations. In line with their original predictions, retrieval performance was highest in the congruent condition followed by the control, while the incongruent condition exhibited the lowest retrieval performance. It was concluded that cues facilitate recall when they coincide with

an individual's organizational strategy at encoding or the approach used to retrieve the previously learned information at the point of recall.

Basden et al. (2002) furthered this line of research by testing whether part-set facilitation would emerge in tasks other than those involving serial reconstruction, which was the primary focus of Serra and Nairne (2000). Basden et al. noted that the most prominent part-set cuing explanations to date did not account for the possibility that individuals might rely on interitem associations formed during encoding to facilitate later retrieval. To address this possibility, three experiments examined the degree to which interitem associations affect serial and free recall in a part-set cuing task. Recall performance was predicted to improve when cues were presented in the same order that they were studied. Retrieval in the condition where no cues were provided was predicted to be slightly worse, and retrieval in the condition where cues were presented in a random order was predicted to experience the greatest decrements in retrieval performance.

These predictions were tested with an experimental design similar to that of Serra and Nairne (2000). Participants in the consistent condition reviewed a list where cues either occupied the odd serial positions (1, 3, 5, 7) or the even serial positions (2, 4, 6, 8) that they had originally occupied during study. For participants in the inconsistent study condition, the same serial positions were occupied by a scrambled order of words. The dependent measure was the average proportion of non-cued words recalled in each condition. Recall was scored both strictly and leniently: for strict scoring, a response was deemed correct only when a previously non-cued word was recalled in the correct serial position, while a response was deemed correct if the non-cued word was recalled in any serial position for lenient scoring. Experiment 1 showed that serial reconstruction was facilitated in the presence of consistent cues but inhibited in the presence of inconsistent cues when recall was scored either leniently or strictly. Items within each list were

believed to have been associatively linked to one another, such that one item operated as a retrieval cue for the following item, in response to instructions provided to participants to make note of the order in which the items appeared.

A second experiment was conducted to determine whether these effects would also emerge under conditions of free recall, as participants in the first experiment were explicitly instructed to study the order of the items and to recall the items in the order that they had originally appeared. Consistent cues again facilitated recall under free-recall conditions when recall was scored strictly, while recall performance was equivalent across all three conditions when scored leniently. However, unlike Experiment 1, the presence of inconsistent cues did not appear to inhibit retrieval performance. To test the prediction that the spatial location of part-set cues affect retrieval, two cueing conditions—integrated and segregated—were contrasted in Experiment 3. Cues in the integrated condition were interspersed between blanks previously occupied by non-cued items, while cues in the segregated condition were presented in a block above the blanks. Recall was superior in the integrated condition compared to the segregated condition. Based on these findings, Basden et al. concluded that individuals rely on spatial information to cue their recall and, more generally, that interitem associations play a crucial role in how items are encoded and retrieved.

The second finding that provides support for the strategy disruption hypothesis is that the negative effects of cues can be reversed when cues are removed on later recall tests. Bäuml and Aslan (2006) provided direct evidence indicating the transience of strategy disruption in a series of three experiments. In Experiment 1, participants memorized items from a series of lists presented in random order. The strength or degree of interitem associations that participants formed for each list was varied between subjects by creating two separate conditions: a low

associative condition and a high associative condition. In the low associative condition, participants studied each list only once, while in the high associative condition participants studied each list multiple times. The presence or absence of cues at the point of recall was manipulated within subjects. After completing both a cued and non-cued recall task, all participants completed a free-recall task without any cues present. The number of non-cued words recalled after studying each set of word lists was the dependent measure.

Three primary findings emerged from this study. First, part-set cuing inhibition was observed when participants on the first recall test when cues were present at the point of retrieval. Second, retrieval performance on the final free-recall test was approximately equal for the cued and non-cued conditions. This finding indicated that the effects of strategy disruption are temporary and can be reversed when cues are no longer present. Third and of greatest interest, the effects of cuing on recall during the final free-recall task were more prominent for those in the low associative condition, as they recalled fewer items relative to the high associative condition. This aligned with the belief that retrieval-inhibition should produce longer lasting impairment when the initially studied items lack an associative structure. Two follow up studies replicated and extended these results.

Based on these findings, Bäuml and Aslan proposed that the mechanism responsible for retrieval inhibition depended on the context in which the information was originally encoded. If, at the point of encoding, an individual can form interitem associations, then changes to how the item itself is represented in memory are less likely to occur. As a result, the inhibitory effect of cuing at the point of recall is no longer present when cues are removed, presumably because the individual reverts back to their initial recall strategy. Yet in instances where an individual cannot form interitem associations, the inhibitory effect of part-set cuing is more persistent. Thus the

nature of the part-set cuing effect was proposed to be contingent upon the initial encoding context.

In summary, the two primary findings obtained from the strategy disruption literature are that 1) consistent cues produce less impairment than inconsistent cues, and 2) memory impairment stemming from strategy disruption is reversible and transient with a high degree of interitem associations, but persistent and lasting with few interitem associations. Having reviewed the central tenants of the most widely cited explanations for the part-set cuing effect, the following section will focus on everyday applications of part-set cuing. As is apparent from the preceding section, there exists a deep history of theoretical part-set cuing research. Yet only a handful of studies have tested the viability of these theories to explain retrieval in more “real world” settings and situations. The following section will review several applied part-set cuing studies in an effort to evaluate the scope and generality of this effect in real-world remembering situations.

### **Applications of Part-set Cuing**

#### **Brand Memory**

Alba and Chattopadhyay (1986) conducted one of the first studies examining how the presentation of certain products or brands influenced memory for other, non-presented products. The question of interest was whether increasing the salience of one brand in memory serves to inhibit recall for other brands in memory, even when those brands were part of the consumer’s consideration set. The authors reasoned that if one brand were particularly salient, it would continually come to mind when a consumer was attempting to recall other brands from the same product category. For instance, if a consumer had always purchased *Coca-Cola Classic*, they may be less likely to recall other brands of cola (e.g., *Pepsi*, *RC Cola*). Likewise, if a consumer is

exposed to repeated advertisements for a particular brand of car over the course of several weeks and they are in the market for a new car, their ability to recall brands other than the one advertised may suffer. This line of reasoning stemmed from Rundus' (1973) proposal that response competition functions similar to sampling-with-replacement, where previously recalled material could be retrieved again on future attempts and block the retrieval of items that share a common retrieval cue.

The question of whether part-set cuing could account for variations in brand memory was tested with the shampoo product category. Participants were given a single cue before attempting to recall as many products as possible from the product category. In Experiment 1, the variable of salience was manipulated, such that those in the high salience condition thought about the initial cue for a period of one minute before recall, while those in the low salience condition initiated recall immediately after presentation of the single cued brand. The authors hypothesized that interference would be greater for those in the high salience condition compared to those in the low salience condition, leading to lower recall scores for those in the high salience condition compared to those in the low salience condition. The inhibitory mechanism was proposed to emanate from the process of re-sampling the cued brand at the expense of the other, remaining brands.

Results showed that focusing the participant's attention on a single brand for a one-minute time span resulted in the typical part-set cuing effect. Those in the low-salience condition, or those who began recall immediately after the presentation of the cued brand, recalled more shampoo brands than those in the high-salience condition, or those instructed to concentrate their attention on the cued brand for one minute. In discussing potential marketing implications, Alba and Chattopadhyay proposed that increasing salience, even temporarily, could

potentially work to reduce the likelihood of possible competitors from entering into a consumer's choice set, or the brands they are considering for purchase. These findings speak to the generality of the part-set cuing effect for everyday remembering.

### **Social Interactions**

The part-set cuing effect has also been examined in the realm of social interactions to understand how groups remember information. Typically, groups have been shown to outperform individuals on retrieval tasks (Stephenson, Kniveton, & Wagner, 1991). However, Andersson, Hitch, and Meudell (2006) proposed that the primary reason for this discrepancy was that members of a group will each remember unique subsets of presented information and, as a result, more information will be available to retrieve. They argued that it is of greater interest to determine whether groups of people recall a given amount of information based on their ability to pool their resources, as several prior studies (e.g., Andersson, 2001) observed that groups recall less information than would be predicted by information pooling. Further, prior part-set cuing research mainly involved tasks where cues were visually presented at the outset of retrieval, while cues in a social setting would be spoken and distributed across the duration of the interaction. To determine whether that spoken cues would affect retrieval similar to written cues in a collaborative setting, Anderson et al. had participants first memorize a word list followed by a brief distracter task. Participants were then instructed to record words (i.e., cues) that were communicated from an audiotape during the free recall task. This was intended to simulate a situation in which ideas are communicated amongst group members. Cues were presented either initially or throughout the free recall task, and a third control condition in which no cues were presented was also included. The outcome variable was the number of non-cued items recalled.

Two findings emerged from their initial study pertinent to the present study. First, spoken cues inhibited recall in a manner similar to that of written cues. This finding was somewhat surprising because the cues were presented to participants in the same order that they were originally learned. Generally, when cues are spatially congruent with their original presentation order, the presence of cues does not result in inhibition (e.g., Sloman et al., 1991). Second, presentation of cues at the beginning of the free recall task resulted in an inhibitory effect that spanned the duration of the entire presentation sequence. These findings suggest that spoken cues presented over the course of a retrieval task will impact retrieval similar to written cues presented at the outset of a task.

### **Memory for Lists and Locations**

Bovee, Fitz, Yehl, Parrot, and Kelley (2009) studied part-set cuing effects in relation to memory for grocery lists and geographical locations on a college campus. In their first experiment, participants were presented with a common scenario involving grocery shopping, after which they were assigned to one of two possible conditions: an applied condition and a lab analog condition. Those in the applied condition were taken to a local grocery store and provided a blank grocery list and pen. They were led around the store by an experimenter and instructed to record items on the blank list that were pointed out by the experimenter. Once they had recorded the final item, their list was collected and they were provided with either a cued- or non-cued recall test. Those in the lab analog condition watched a video of another person shopping in a grocery store. Similarly, members of this group were instructed to record the items selected by the person in the video, after which they were also provided with either a cued- or non-cued recall test. Their results indicated the traditional part set cuing effect, as a higher percentage of items from the grocery list were remembered when cues were not present at the point of recall.



Boyee et al. attempted to replicate this finding and test the strategy disruption account of part-set cuing in a situation where sequential information was of critical importance to retrieval during a follow up experiment. Prospective students and their parents were asked to recall a sequence of 12 buildings they had visited while touring a college campus upon the culmination of the tour. Participants were provided no indication that they would be asked to complete this task. Half of the participants were provided with a list containing cues that were consistent with the original order the building had been viewed, while the remaining participants were not provided any cues. Cues were found to facilitate retrieval, as those who received consistent cues more accurately reconstructed the order in which the buildings were viewed relative to those in the control condition. This appears to be the only evidence to date to show part-set facilitation in a naturalistic memory setting, indicating that the manner in which cues are presented can affect retrieval performance in unprompted, real-world memory tasks.

### **Chess**

A number of part-set cuing studies have been conducted within the domain of chess. For example, Watkins, Schwartz and Lane (1984) examined how presenting chess players with only part of a previously studied board would affect their recall for the positions of the remaining chess pieces. The study used a basic two-condition design: in the cued condition, half of the chess pieces comprised the cue set and were present when each chess player was attempting to recall the remaining chess pieces; in the non-cued condition, an empty chessboard was presented and the chess player simply reconstructed the board from memory. The outcome measure was the number of pieces correctly assigned to their original position. Their results indicated that cues neither facilitated nor inhibited recall for the remaining chess pieces for either experts or

novices. This finding ran counter to the prevailing view that cues at the point of will impair retrieval of the remaining, non-cued items.

However, as identified by Huffman, Matthews, and Gagne (2001), one shortcoming of this study was that the pieces in the cue set were selected at random and bared little resemblance to the configurations of a typical game. Therefore the chess players could not utilize strategies they would normally use to organize this information, strategies that experts had previously been found to rely on more heavily than novices (Chase & Simon, 1973). This shortcoming led Huffman et al. to conduct a follow up study in which the pieces comprising the cue set were organized in way that resembled an actual chess game. The purpose of this study was to investigate how the effects of part-set cuing varied as a function of expertise under more realistic retrieval conditions. A 2 X 2 factorial design was used, where level of expertise was a between-subjects factor while cuing was manipulated within-subjects. Participants were simply instructed to remember the positions of pieces on a chess board, and that they would later be asked to recall these positions. Similar to Chase and Simon's (1973) study, half of the pieces were then re-presented at the point of recall in the cueing condition, while no pieces were re-presented in the non-cue condition. Results indicated that experts recalled more pieces than novices. However, there was no effect of cuing on recall. The absence of part-set cuing effects study led the authors to conclude that part-set inhibition is less likely to emerge when the memory task is highly familiar to participants. Certain memories may be so ingrained that the presence or absence of cues at the point of retrieval does not provide enough facilitation or inhibition to dramatically alter recall performance.

More recently, Drinkwater, Dagnall, and Parker (2006) conducted a study that examined the moderating effects of cue-set size, or the number of cues re-presented at the point of retrieval.

They also examined whether the effects of cue-set size would vary as a function of expertise. The experiment used a 2 (Experience: experienced, novice) X 3 (Cue-set Size: 0 cue, 6 cues, 12 cues) factorial design. Participants memorized the positions of chess pieces for a period of 30 s, after which they attempted to reconstruct the pieces from memory on a separate blank board. Following a 2 min distracter task, participants again reconstructed the originally studied board, but this time either six or twelve pieces were present as cues. Retrieval performance was determined according to the percentage of pieces located on the correct squares.

As expected, experienced players remembered more of the non-cued items on both reconstruction trials relative to novice players. But part-set cues did not disrupt recall for either experienced or novice players. These results aligned with prior research on chess (Watkins et al., 1984; Huffman et al., 2001) that found that re-presenting pieces as cues neither facilitated nor impaired retrieval for the remaining, non-cued pieces. However, unlike Huffman et al., who proposed that familiar retrieval processes are less susceptible to the influence of cues, Drinkwater et al. argued that part-set cuing effects have typically been observed with verbal materials, and that the retrieval of chess pieces might rely on different memorial processes that are less susceptible to part-set cuing. This suggests that the part-set cuing effect may be limited only to certain types of real-world retrieval tasks.

Upon reviewing the applied part-set cuing literature, there appears to be some support that part-set cuing can affect everyday retrieval. Extant theoretical accounts also seem capable of predicting the nature of these effects with some degree of reliability outside of laboratory settings. However, the identification of boundary conditions—and why such boundaries exist—appears somewhat elusive. For example, it remains unclear why domain experience eliminates

part-set cuing effects. More research is needed to clarify the nature of these processes and factors that might affect retrieval in everyday settings.

The present study will examine one such factor—the nature of the retrieval process. As is clear from the preceding sections, the part-set cuing effect has been studied with a variety of stimuli and paradigms. Despite the apparent generality of this effect, all part-set cuing studies to date have examined these processes in “directed retrospective memory” tasks, or tasks in which the retrieval process is initiated in response to an explicit request from an outside source (e.g., an experimenter or instruction screen). While real-world retrieval can occur in this fashion, self-initiated retrieval in “undirected prospective memory” tasks are more common, to tasks in which the retrieval process occurs in the absence of external feedback. Thus, to evaluate the scope of the part-set cuing effect and the viability of existing theoretical accounts to explain part-set cuing effects in everyday memory settings, it is necessary to situate the part-set cuing paradigm within a prospective memory context. The next section will provide an overview of the prospective memory literature. This is followed by a brief discussion regarding why (or why not) part-set cuing effects will emerge in a prospective memory task. The goal of this section is to provide the reader with a general overview of how part-set cuing could affect prospective remembering.

### **Prospective Memory**

Prospective memory relates to the performance of behavioral intentions at a future time, or simply “remembering to remember” (Harris, 1984). An everyday example of a prospective memory task includes remembering to pick up one’s dry cleaning on the way home from work. In contrast, retrospective memory involves the retrieval of previously acquired knowledge (e.g., people, places, words, events). Laboratory-based paradigms used to study these forms of memory have relied on two criteria to differentiate between retrospective and prospective

memory tasks (McDaniel & Einstein, 2000). Retrospective memory tasks typically involve an experimenter who directs participants to initiate the retrieval process, where the act of retrieval is the sole focus of the participant. Retrieval in prospective memory tasks, on the other hand, occurs without a stimulating external agent (i.e., an experimenter), and critical to-be-remembered items are embedded in an ongoing task and serve as situational cues for behavioral intentions. For instance, Einstein and McDaniel (1990) had participants press a key on a keyboard whenever a particular word appeared on screen while engaged in a short-term memory task.

Such paradigms typically assess *event-based* prospective remembering in which an environmental cue prompts memory for a behavioral intention (e.g., remembering to take out the trash (action) occurs after hearing the sound of a garbage truck (cue)). This is in contrast to *time-based* prospective remembering in which a time-related cue indicates the need to perform a certain action (e.g., remembering to call a friend at 3:00 p.m.) (Einstein & McDaniel, 1996). The present study is concerned only with event-based prospective remembering, as home loan consumers will likely rely on events (e.g., visually fixating a particular area of the form, hearing a lender/broker mention a particular loan-attribute) to prompt prospective remembering as opposed to time-based cues when reviewing their loan.

Despite the task-related distinction between prospective and retrospective memory, successful prospective remembering involves both memory components: one must not only remember when an action or intention is to be performed but also what steps are required to complete the action or intention (Einstein, Holland, McDaniel, & Guynn, 1992). Einstein and McDaniel (1996) conceptualized successful prospective memory performance via a two-stage process comprised of “Noticing” and “Search.” During the first stage, the stimulus is recognized or noticed as a result of its significance, accessibility, or familiarity. The act of identifying the

stimulus then prompts a search through memory to provide additional meaning. Successful memory search leads to the recognition of the stimulus as a signal to perform an intended action. The necessary steps or content involved in the action or intention are then recalled from memory.

According to spontaneous retrieval theory (e.g., McDaniel & Einstein, 2007; McDaniel, Guynn, Einstein, & Breneiser, 2004; Einstein & McDaniel, 1990; Einstein et al., 2005), noticing and search occur automatically, as encountering a cue elicits feelings of significance or familiarity that lead the cue to be recognized. Said differently, the to-be-performed action or intention is spontaneously brought to mind when an attended cue interacts with the cue-intention association stored in memory. In contrast, monitoring theory argues that prospective memory can only be successful when an individual actively surveys their environment for the cue (Smith, 2003; Guynn, 2003). Both of these theories have received support within the prospective memory literature, which spurred the creation of multiprocess theory (McDaniel & Einstein, 2000; Einstein et al., 2005). Multiprocess theory purports that prospective memory retrieval can be achieved through either controlled monitoring or automatic processes that spontaneously respond to the occurrence of a target event. Which process supports retrieval is contingent upon task demands (e.g., the difficulty of the ongoing task) as well as individual differences (e.g., working memory) (see McDaniel & Einstein, 2000, for review). The ability of these two theories—spontaneous retrieval and monitoring—to account for the results obtained in the present study is addressed in the supplementary analyses section.

### **Prospective Memory and Part-set Cuing**

Though no research to date has examined the effects of part-set cuing on prospective remembering, it is reasonable to assume that cuing would benefit the prospective component. For example, imagine two people intend to go to the grocery store to purchase four vegetables after

work. One person receives a reminder while at work (i.e., go to grocery store—*carrot*, go to grocery store—*tomato*) while the other person receives no reminder. The former person would presumably have a greater likelihood of bringing to mind the intention relative to the latter because their memory for this intention was strengthened. But if both people retrieve the intention, then the retrieval strength accounts predict the former person would retrieve fewer of the non-cued items (e.g., *potato*, *pepper*) than the latter person. Likewise, if both people retrieve the intention but the cues alters the former person's retrieval strategy, strategy disruption would predict a similar outcome. This implies that the part-set cuing effect will likely reside at the retrospective level of prospective memory.

There are two features of prospective memory tasks that might reduce or nullify part-set cuing effects relative to the typical directed retrospective tasks used in part-set cuing research. First, Bäuml and Aslan (2004) proposed that the effect size of part-set cues on retrieval performance might be considerably smaller when cues are presented before test and there are a large number of cue items. This is because cue items may no longer be retrievable from episodic memory or maintained in working memory. As a result, the covert retrieval of cues at test might occur less frequently, thereby reducing the magnitude of effect. Second, whether individuals implement strategies to overcome realized deficits in their prospective memory if the intention has successfully been retrieved is unclear. For instance, in the prior example, if the person who was provided the reminders knew they had to purchase four items but could only remember two, they could adapt their retrieval strategy in order to compensate for the interference (e.g., call a friend; look up the recipe). The extent to which individuals exhibit metacognitive control when their memories have been impaired in a prospective part-set cuing task has yet to be determined (but see Rhodes & Castel, 2008, for evidence on metacognition and part-set cuing in

retrospective memory tasks). Thus the present study will attempt to bridge this gap in the literature by determining whether part-set cuing effects arise in a prospective memory context.

In the following section, we will look beyond the impact of part-set cuing on remembering. Previous part-set cuing research has focused exclusively on how part-set cues affect remembering and remembering alone. Yet there has been scant research on the downstream, behavioral consequences of part-set cues. The present study intends to bridge this gap by examining how part-set cues affect information search processes that support judgment and decision-making in a home loan context. The following section will provide a general overview of the visual search literature and the role of goals and memory in this process. A recent study on the utility of eye tracking as a tool to inform our understanding of prospective remembering and forgetting is then reviewed. The purpose of this section is to justify the use of eye tracking as novel approach for assessing the effects of part-set cues on prospective memory performance.

## **Visual Attention and Memory**

### **The Effects of Goals and Memory on Visual Search**

Visual search within complex real-world scenes consists of locating a target or targets amongst a number of distracters for selection and further processing. Everyday examples of visual search include searching for a lost television remote, finding the appropriate tool while changing a tire, or looking for last night's leftovers in the fridge. Though several models of visual attention during search tasks have been proposed (e.g., Treisman & Gelade, 1980; Wolfe, 1994; Desimone & Duncan, 1995), all share the assumption that selection during search can be determined by both "bottom-up" or exogenous factors as well as "top-down" or endogenous factors. Exogenous search is influenced mainly by the characteristics of a visual scene and



occurs pre-consciously (Itti, 2000; Itti & Koch, 2000, 2001), as humans are predisposed to rapidly respond to salient contrast, color, or motion (Treisman, 2006). In contrast, endogenous search is influenced by task-knowledge, goals, intentions and beliefs (Mulckhuysen & Theeuwes, 2010). For example, in his now classic study, Yarbus (1967) provided participants with separate tasks (e.g., *remember the cloths worn by the people in the painting; estimate the wealth of the family in the painting*) while viewing a painting for 3 min. Yarbus found that the instructions provided to participants largely determined which features of the scene they focused on during the viewing task, a finding that has since been replicated with pictures (Tatler, Wade, Kwan, Finlay, & Velichkovsky, 2010). In this case, knowledge stored in memory about the task and the target of interest constrained wherein the painting individuals allocated their attention.

Memory facilitates the efficient identification and selection of information pertinent to behavioral goals, modulating which information enters into awareness. Memory functions to increase visual search efficiency by delineating the perceptual features associated with a search target from features associated with non-targets or distracters (Desimone & Duncan, 1995; Hollingworth, Richard, & Luck, 2008). For instance, search for one's favorite pair of pants will be more efficient if they can remember the pants are green, because search would then be limited only to green pants. In addition to memories for the perceptual features of the target(s) of interest, search can also be influenced by memories of how a scene's features and objects are spatially arrayed (Hollingworth & Luck, 2009; Henderson, Malcolm, & Schandl, 2009). For instance, to locate a missing television remote in one's living room, attention would initially be allocated toward locations that have the highest probability of containing the remote (e.g., a couch or coffee table), while locations with a low probability (e.g., the ceiling or kitchen) would initially be unlikely to attract attention. Collectively, this research suggests that memory play an

integral role in guiding the deployment of attention during visual search and selection toward task-relevant information (see Woodman & Chun, 2006, for review). Which attributes individuals consider while reviewing the disclosure form in the present study should thus reflect, in part, the accessibility of these attributes in memory.

### **The Effects of Attention on Memory**

The information gleaned from a visual stimulus primarily depends on where an individual allocates their attention within the stimulus (Henderson, 2008; Findlay & Gilchrist, 2003). Prior eye-tracking research has shown that the likelihood of retrieval increases with visual selection, such that objects fixated are remembered more often than those not fixated. This effect has been observed with a variety of visual stimuli, including television commercials (Thorson & Zao, 1997), pictures (e.g., Loftus, Hoffman, & Loftus, 1999; Loftus, 1972; Maughan, Gutnikov, & Stevens, 2006), and print advertisements (e.g., Krugman, Fox, Fletcher, Flischer, & Rojas, 1994; Rosbergen, Pieters, & Wedel, 1997). These findings indicate that where attention is allocated within a visual stimulus heavily influences what features of a visual stimulus that are encoded and retained in memory. This implies that what individuals remember after reviewing a disclosure form should, in part, be determined by how they previously deployed their attention on the form.

### **Eye movements as a Measure of Prospective Remembering**

West, Carlson, and Cohen (2007) investigated the extent to which prospective remembering (and forgetting) could be explained by how an individual allocated their attention on a visual stimulus. Participants in the study performed a visual search task in which they searched for letters within an array of six letters. They were tasked with determining if the display had a prospective memory cue (an “M” or “D”), a target (one of 18 consonants), or

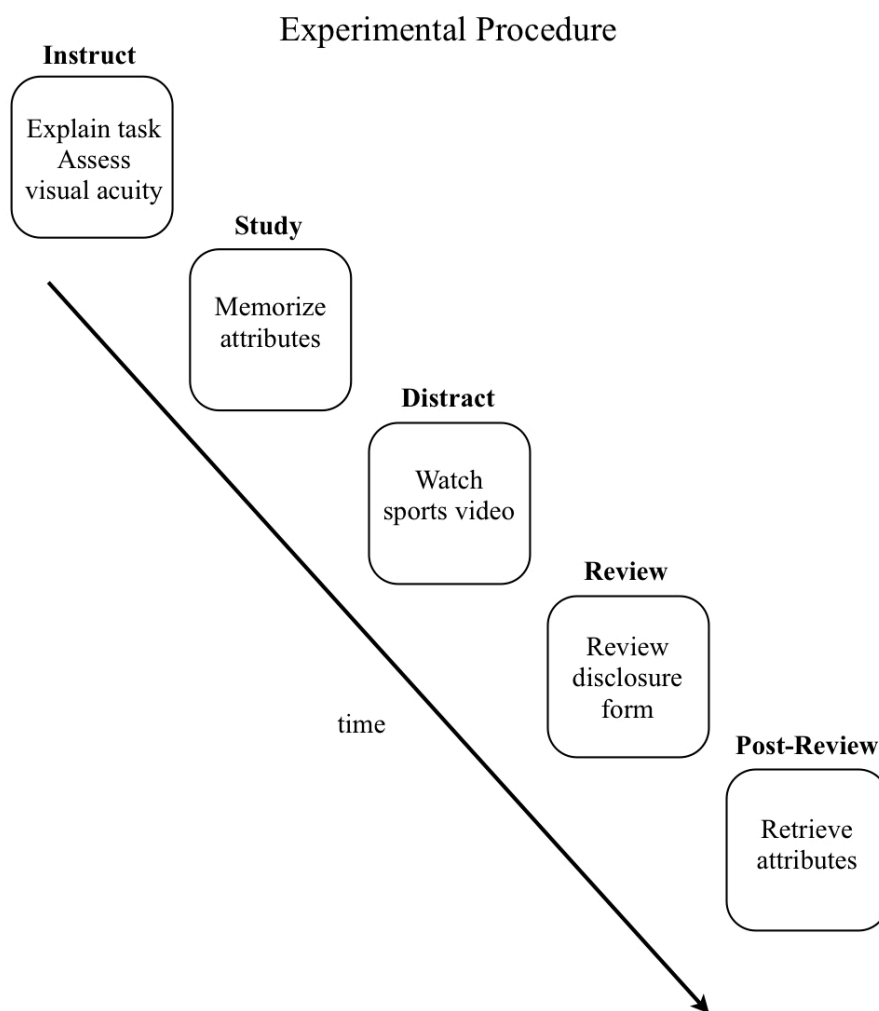
neither a cue nor a target. When participants were presented with target only or prospective cue only trials, the individual target or cue was presented in conjunction with five additional distracter letters. When participants were presented with a target and a prospective cue, participants were instructed to respond only to the prospective cue.

Their findings revealed that variability in prospective memory accuracy, as indicated by the percentage of trials in which the participant indicated the presence of the prospective cue, could not entirely be explained by failures to fixate the target. Approximately 50 percent of prospective misses occurred when participants failed to fixate the prospective cue, a finding that aligned with the central tenants of the automatic associative activation theory of prospective memory (e.g., McDaniel & Einstein, 2007). However, the remaining half of prospective misses occurred when participants registered a fixation on the cue. This finding was consistent with strategic monitoring account of prospective memory (e.g., Smith, 2003; Guynn, 2003), which purports that controlled, non-automatic processes must be activated before encountering the prospective cue for retrieval of the intention to occur. Further, aggregate fixation durations were, on average, longer for successful prospective memory trials than for unsuccessful trials, indicating that a lack of strategic monitoring could also account for prospective memory failures. At a general level, these findings indicate that eye tracking methodology can provide novel insights on the processes involved in prospective remembering.

### **Rationale**

The present study examined whether part-set cuing inhibition can occur when well-informed consumers are reminded to check loan attributes—a subset of the ones they knew that they were supposed to check—immediately prior to reviewing a government mandated disclosure form. Here, a well-informed consumer is operationally defined as someone who has a

list in mind of the attributes to check when evaluating a loan. Across three experiments, both undergraduate students and adults (i.e., non-students who were 26 years of age or older) engaged in a memory-based evaluation task commonly encountered by home loan consumers (see Figure 1 for procedural overview). During the study, participants initially received a brief home-loan education during which they learned and memorized eight loan-attributes. They were instructed to check these attributes because consumers often take them into consideration when evaluating home loans. After a 1 min distracter task, they were instructed to review the terms of a sample home loan presented on the disclosure form, check the costs associated with the memorized attributes, committing this information to memory, and form an overall evaluation of the loan's quality and fairness. Immediately prior to reviewing the loan, the experimenter re-presented or cued some participants—the experimental group—with half of the previously studied attributes. These attributes were framed as “hints” to help participants remember to check *all* of the previously studied attributes and their respective dollar amounts when reviewing the form. The remaining participants—the control group—were also reminded to check the previously studied attributes but were not provided with specific cues. After reviewing the form in its entirety and advancing past the final page of the disclosure form, all participants were asked to recall as many of the attributes and their respective dollar amounts as they could during a post-review free recall task.



*Figure 1.* Schematic of study design and timeline of tasks. The cuing manipulation occurred between the Distract and Review phases in all experiments.

This research sought to inform public policy designed to protect consumers by improving our understanding of consumers' vulnerabilities to fraud and poor decision making. This research also intended to provide theoretically interesting contributions to the literature on part-set cuing effects. To achieve these goals, three modifications were made to the traditional part-set cuing paradigm (e.g., Roediger, Stollon, & Tulving, 1977; Slamecka, 1968, 1969). First, instead of the basic verbal stimuli or familiar semantic categories typically used in part-set cuing

studies, the names of actual loan attributes that consumers needed to remember while reviewing a loan offer were utilized. These attributes comprised the *study set*, or the items participants were instructed to memorize. The attributes were subsumed under a single common category of fees associated with taking out a home loan referred to as “Settlement Charges.”

Second, retrieval performance was assessed using two separate measures. While a free recall paradigm that paralleled those used in prior part-set cuing studies was used after participants finished reviewing the disclosure form (c.f., Basden, Basden, & Stephens, 2002), eye-tracking technology was also used to determine whether participants remembered to look at (i.e., check) the loan attributes that they had previously attempted to memorize. The measure of interest derived from this data was the percentage of non-cued attributes that participants remembered to check (i.e., whether those attributes and their respective dollar amounts had been visually fixated) (see Figures 2 & 3).

Third, the effect of cuing on retrieval was assessed in a prospective memory task. Participants in the present study had to remember that they were supposed to check eight attributes upon reaching the “critical page” containing the Settlement Charges (i.e., the prospective component). Additionally, participants had to remember the names of those attributes, and, in some cases, their specific locations within the form as well (i.e., the retrospective component).

<b>L. Settlement Charges</b>				
<b>700. Total Real Estate Broker Fees</b>			Paid From	Paid From
Division of Commission (line 700) as follows:			Borrower's	Seller's
701.			Funds at	Funds at
702.			Settlement	Settlement
703. Commission paid at Settlement				
704.				
<b>800. Items Payable In Connection With Loan</b>				
801. Our origination charge	\$935.00	(from GFE #1)		
802. Your credit or charge (points) for the specific interest rate chose	(\$1,534.00)	(from GFE #2)		
803. Your adjusted origination charges		(from GFE A)	-\$599.00	
804. Appraisal Fee to Max Appraiser		(from GFE #3)	\$300.00	
805. Credit Report		(from GFE #3)		
806. Tax service to		(from GFE #3)		
807. Flood Certification to First American		(from GFE #3)	\$11.00	
<b>900. Items Required By Lender To Be Paid In Advance</b>				
901. Daily interest charges from 5/7/2010 to 5/1/2010 @ 44.8900/day to DK Mortgage Corp.		(from GFE #10)	-\$269.34	
902. Mortgage Insurance Premium		(from GFE #3)		
903. Homeowner's insurance		(from GFE #11)		
<b>1000. Reserves Deposited With Lender</b>				
1001. Initial deposit for your escrow account		(from GFE #9)	\$4,474.62	
1002. Homeowner's insurance months @ per month				
1003. Mortgage insurance months @ per month				
1004. Property taxes 4 months @ \$ \$1,118.66 per month \$4,474.64				
1007. Aggregate Adjustment (\$0.02)				
<b>1100. Title Charges</b>				
1101. Title services and lender's title insurance		(from GFE #4)	\$515.00	
1102. Settlement or closing fee to RST Title	\$265.00			
1103. Owner's title insurance to		(from GFE #5)		
1104. Lender's title insurance to	\$200.00			
1105. Lender's title policy limit	\$417,000.00			
1106. Owner's title policy limit				
1107. Agent's portion of the total title insurance premium to	\$190.00			
1108. Underwriter's portion of the total title insurance premium to Old Republic National Title Insurance Company	\$10.00			
1109. Predatory Lending Endorsement / Service Fee to Regent Title	\$50.00			
<b>1200. Government Recording and Transfer Charges</b>				
1201. Government recording charges		(from GFE #7)	\$84.00	
1202. Deed \$ Mortgage \$84.00 Releases \$				
1203. Transfer taxes		(from GFE #8)		
1204. City/County tax/stamps Deed \$ Mortgage \$				
1205. State tax/stamps Deed \$ Mortgage \$				
<b>1300. Additional Settlement Charges</b>				
1301. Required services that you can shop for		(from GFE #6)		
1302. Survey				
1303. Pest Inspection				
<b>1400. Total Settlement Charges (enter on line 103, Section J and 502, Section K)</b>			<b>\$4,516.28</b>	<b>\$0.00</b>

Figure 2. The critical page with study set attributes encompassed by areas of interest (AOIs).

L. Settlement Charges		
801. Our origination charge \$935.00	(from GFE #1)	
802. Your credit or charge (points) for the specific interest rate chosen (\$1,534.00)	(from GFE #2)	
+++++	\$ ++++++	
+++++	\$ ++++++	
1101. Title services and lender's title insurance	(from GFE #4)	\$515.00
1102. Settlement or closing fee to RST Title \$265.00		
+++++	\$ ++++++	
+++++	\$ ++++++	

Figure 3. Sample post-review stimulus for participants cued with attributes 801, 802, 1101, and 1102. To record their responses, participants clicked on the “+” signs and then typed the name and dollar amount of the attribute that was located on that line. In experiments 2 and 3, no cues were provided in any conditions post-review.



The prospective nature of this task has applied as well as theoretical implications. From an applied perspective, it provides a realistic assessment of an issue pertinent to consumer protections: Are even well-informed consumers who know that they need to check certain attributes vulnerable to part-set cueing disruptions when reviewing their disclosure documents? Prospective remembering is also more consistent with how retrieval—and, of interest here, retrieval failure—typically occurs in everyday settings. For example, it has been estimated that between 50% and 80% of memory errors are, to some extent, prospective in nature (Crovit & Daniel, 1984; Terry, 1988). Thus, this research will add to the small number of part-set cuing studies that have attempted to generalize these effects to more “real-world” remembering situations (e.g., Reysen & Nairne, 2002; Weldon & Bellinger, 1997; Bovee, Fitz, Yehl, Parrot, & Kelley, 2009). From a theoretical perspective, the research presented here will contrast several prominent theories of part-set cuing—response competition (Roediger, 1973; Rundus, 1973) and retrieval inhibition (Anderson, Bjork, & Bjork, 1994; Bäuml & Aslan, 2004, 2006) with strategy disruption (Basden et al., 2002; Basden & Basden, 1995)—to determine whether these theories can be extended to explain retrieval in a prospective memory realm.

Finally, from a methodological perspective, the present study will assess the extent to which eye tracking data can provide actionable insights on topics pertinent to consumer protections. Eye tracking has proven useful in a variety of domains and has been used to study the design of cockpit control panels (Hanson, 2004), to improve upon user interface layouts (Goldberg & Kotval, 1999), to measure information search patterns amongst air traffic controllers (Hauland, 2008), and to understand visual search differences between novice and experienced medical practitioners (Law, Atkins, Kirkpatrick, & Lomax, 2004; Krupinski et al., 2006) and potential sources of bias in medical decision making (Bombardi, Mora, Schaefer,

Mast, & Lehr, 2012). The ability of eye tracking to similarly inform the design and development of disclosure forms, in addition to assessing the potential role that cognitive biases play in reducing the utility of these forms to consumers, has recently received some support (e.g., Stark et al., 2013; Stark, Choplin, LeBoeuf, & Pizor, 2013). This research will provide additional evidence on the utility of eye tracking as a tool for researchers and practitioners to implement during the design and development of future disclosure forms.

### **Overview**

The present study consists of three experiments. Experiment 1 examined the downstream effects of part-set cuing on the search for and selection of pertinent loan information outlined in the HUD-1 disclosure form. The purpose of this experiment was to determine the extent to which part-set cuing affects memory processes that regulate information search. It used a 2 x 2 design, manipulating whether subsets of to-be-checked loan attributes were re-presented both immediately before participants reviewed the disclosure form while their eye movements were tracked and also while recalling loan attributes afterwards. Experiment 2 manipulated cue-set size (i.e., the number of attributes presented before reviewing the disclosure form) (e.g., Marsh, Dolan, Balota, & Roediger, 2004) to determine if the number of attributes re-presented as cues moderates part-set cuing effects on prospective memory. Experiment 3 sought to test the predictions of several part-set cuing explanations to account for the results of experiments 1 and 2. It manipulated the serial order in which the subset of to-be-checked attributes were re-presented to participants before reviewing the disclosure form in a manner similar to Basden et al. (2002).

## Experiment 1

Experiment 1 investigated whether part-set cuing would affect whether participants remember to check loan attributes on a HUD-1 home-loan disclosure form. Retrieval performance was assessed “during review,” or while participants reviewed the form (a prospective memory task) as well as after they had finished reviewing the form in its entirety, or “post-review” (a retrospective memory task). If part-set cuing effects generalize to prospective memory tasks, then the retrieval-strength accounts—response competition (Rundus, 1973) and retrieval inhibition (e.g., Anderson et al., 1994)—would predict that participants who are cued immediately before they review the form will fixate on a lower percentage of non-cued attributes relative to participants who are not cued. Failing to look at the non-cued attributes should also reduce participants’ abilities to recall that information during the post-review free recall task. The strategy-disruption account also predicts that cued participants would fixate on a lower percentage of non-cued attributes, if participants implement a retrieval strategy to prompt retrieval of the attributes during review (and part-set cues disrupt this strategy). However, given the dearth of information during study from which to form a retrieval strategy, it seems somewhat unlikely that participants will be able to form a retrieval strategy. If part-set cuing impairs prospective memory performance in Experiment 1 via response competition, retrieval inhibition, or strategy disruption, the following outcomes are predicted:

H1a: The cue-before-review condition will fixate a lower percentage of non-cued attributes relative to the no-cue-before-review condition while reviewing the disclosure form.

H2a: Retrieval of non-cued attributes will be best in the no-cue-before-review/no-cue-post-review condition and worst in the cue-before-review/cue-post-review condition, with performance of the remaining two conditions (cue-before-review/no-cue-post-review, no-cue-before-review/cued-post-review) falling in the middle during post-review free recall.

There were no theoretical reasons to predict that cued participants would fixate on a higher percentage of non-cued attributes than non-cued participants, but equal fixation rates were possible. Two features of the paradigm used in the present study speak to this plausibility of this outcome. First, prior research indicates that the rate at which items can be retrieved under free recall conditions declines precipitately over time (Rohrer & Wixted, 1994). In the present study, several minutes elapse between cue presentation and when participants encounter the critical page. Furthermore, the information outlined in the disclosure form spans three pages. The study set attributes are located on Page 2, and the post-review free recall task is initiated once participants advance past Page 3. The time participants spent on Page 1 could reduce part-set cuing effects while participants reviewed the form (Ebbinghaus, 1885/1913) or the time participants spent on Page 3 could produce retroactive interference, thereby reducing participants' abilities to recall any of the loan attributes after reviewing the form (e.g., Massaro, 1970). Cuing before participants review the loan thus might have little effect on how participants search for information on the critical page during the review phase or what information they remember afterwards during the post-review phase. In combination, these factors might reduce the accessibility cue attributes in memory during the review and post-review phases, leading to the following predictions:

H1b: The cue-before-review condition will fixate the same percentage of non-cued attributes relative to the no-cue-before-review condition while reviewing the disclosure form.

H2b: Retrieval of non-cued attributes will be equivalent across conditions in the post-review free recall task.

From a theoretical perspective, Experiment 1 will provide evidence on the potential parallels between the mechanism underlying the part-set cuing effect in retrospective memory tasks and prospective memory tasks. This will help in determining whether extant part-set cuing theory can be extended to a prospective memory domain. From an applied perspective, Experiment 1 will not only clarify whether well informed consumers are susceptible to part-set cuing effects but also explore the downstream effects of memory on cognitive processes that support judgment and decision making. These findings will provide insights on how exchanges between consumers and their respective mortgage brokers/lenders can affect the information consumers glean from their home loan disclosure forms.

## **Method**

### **Participants**

A total of 64 participants took part in Experiment 1, including 18 community participants and 46 students (see Table 1 for demographic information in Experiments 1-3). Community participants were recruited because they more closely resemble the population of consumers who typically take out home loans. Student participants were recruited because extant part-set cuing research has been conducted primarily with student samples. Recruiting both types of participants increased the generalizability of these results and also makes the results comparable

to prior part-set cuing literature. Students received course credit while community members received \$20 for participating, and both could earn up to an additional \$8 depending on their recall accuracy during the post-review task. All participants had normal or corrected-to-normal vision and were run individually in sessions lasting approximately 30 minutes.

Table 1

*Demographic Information for Student and Community Participants in Experiments 1 - 3.*

Variable	Experiment 1		Experiment 2		Experiment 3	
	Student	Community	Student	Community	Student	Community
Female (%)	73	44	---	43	66	33
Non-White (%)	47	47	---	54	58	54
Home loan experience (%)	6	24	---	44	0	25
Non-native-English-speaker (%)	15	22	---	0	17	17
Age						
<i>M</i>	19.54	39.70	---	36.52	19.66	38.31
<i>SD</i>	1.36	10.01	---	10.60	1.76	7.92
Years of education*						
<i>M</i>	13.04	15.56	---	15.79	13.04	15.08
<i>SD</i>	1.15	3.01	---	2.18	1.04	2.18

\* 12 years of formal education defined as having a high school diploma or GED

## Design

The experiment consisted of a 2 (cue-before-review: present, absent) x 2 (cue-post-review: present, absent) factorial design. Cuing was manipulated between subjects.

## Apparatus

Participants' eye movements were recorded monocularly at a sampling rate of 1000 Hz using the SR Research EyeLink 1000 infrared eye tracking system. Participants were seated 76.2 centimeters from the computer screen (a 20-inch Sony Trinitron monitor) where each page was

displayed as a digital image at an aspect ratio of 1,024 x 768 pixels. Though head motion was taken into account, a chin rest was used to stabilize the viewer's head. Participants navigated through the form using a keyboard located on a table below the eye-tracking apparatus.

### **Materials and Counterbalancing**

The present study used the HUD-1 disclosure form. This form was developed in 2008 in response to the mortgage crisis and has been used since January 1, 2010. It is a three and a half page form presented to consumers that discloses fees and summarizes the loan's terms. Participants viewed the form's pages on a computer screen. To improve textual resolution, participants first viewed the top-half of a page followed by the bottom-half. Eight loan attributes selected from the Settlement Charges section of the form comprised the study set (See Figure 1). These attributes were selected to reduce the effects of prior knowledge on new learning (e.g., Morris, Tweedy, & Gruneberg, 1985), as consumers who were not familiar with contemporary home loans would not have known of these attributes prior to participating in this study. Additionally, the dollar amounts associated with each attribute were approximately matched to further minimize specific attribute effects.

Materials were counterbalanced across-participants. Presentation sequences were created in which two attributes near the top and two attributes near the bottom of the critical page were re-presented. Attributes were paired together according to their order of appearance. That is, if 801 and 802 were cued, then 803 and 804 were not cued and vice versa. Likewise, if 1101 and 1102 were cued, then 1107 and 1108 were not cued and vice versa. The attributes selected to cue were counterbalanced such that each combination was used equally often. For those cued both before review and during the post-review free recall task, the same attributes were cued each time.

## Procedure

**Instruction phase.** Participants were initially briefed on their role and provided with a general explanation of the function of home loan disclosure forms. Participants then learned how to navigate between pages within the form by reviewing a reading passage unrelated to the experiment.

**Study phase.** An instructional screen informed participants they would be shown a list of loan attributes that borrowers often take into consideration when evaluating home loans, and that these charges would be located on a single page in the form titled “Settlement Charges.” Participants were told to memorize the names of these attributes, to remember to check their respective dollar amounts, and to commit this information to memory while reviewing the loan. Participants were further informed that the order in which the attributes appeared during study paralleled their order appearance on the page. Finally, participants were told that their ability to remember the contents of the loan would be tested once they finished reviewing the form, and that each correct answer provided would yield a \$1 payment. The experimenter first read these instructions aloud to the participant and clarified any points of confusion. Participants were also asked to re-read the instructions to further solidify their understanding of the task.

Eight loan attributes were then presented successively on a computer screen at a 40 s rate in a single study trial. Each attribute was accompanied by a category label (e.g., Settlement Charges—Adjusted Origination Charge) and a brief description (i.e., 2 – 4 sentences). Descriptions were included to help participants understand the relationships between the attributes, why they were charged, and who received payment—information that would typically be communicated during a loan counseling session or outlined in educational materials. An audio recording with flat affect first re-stated the attribute and then described it while present on



screen. To ensure that the amount of time spent encoding each attribute was equal, the presentation duration for each attribute was exactly 40 s; when an attribute was explained in less than 40 s, the remaining seconds were silent. Presentation order was constant across all participants and attributes were presented in a way that emulated their order-of-appearance in the form.

**Distracter task.** Following the study phase, participants watched a 1 min “sports video.” The purpose of this task was twofold. First, it served as a recency control intended to eliminate short-term memory effects. Second, it paralleled the fact that many lenders will often spend time at closing talking about irrelevant topics (Stark et al., 2013). This distracter task was more ecologically realistic than the arithmetic problems or backward counting tasks commonly used in part-set cuing studies (e.g., Marsh, Dolan, Balota, & Roediger, 2004; Bäuml & Aslan, 2004).

**Review phase.** Immediately following the video, participants were randomly assigned to a condition. In the cue-before-review condition, the experimenter told participants they would reiterate some of the attributes outlined earlier, and that they could use this information to help them remember to check *all* of the previously studied attributes and their respective dollar amounts when evaluating the loan. The experimenter then successively stated half ( $N = 4$ ) of the attributes at a 5 s rate, with an inter-attribute interval of approximately 2 s. In the no-cue-before-review condition, participants were simply reminded to check the previously studied attributes and their respective dollar amounts while reviewing the form. All participants then reviewed the form at their own pace and were encouraged to approach the task as if the loan outlined was being offered to them.

Prospective memory performance was assessed during the review phase via sixteen non-overlapping, rectangular Areas of Interest (AOIs) created around each loan attribute and its

respective dollar amount (see Figure 1). A fixation was defined as a set of consecutive gaze coordinates located within 1° of visual field for more than 200 ms, which is a relatively low estimate of fixation duration for a task involving silent reading as well as visual search (Rayner, 1998). The 200 ms cutoff was used to ensure that participants sufficiently attended to and processed the attribute. Fixations less than 1° from the preceding fixation were combined. Successful retrieval of an attribute during review was classified as having fixated both the text of the loan attribute (e.g., The Origination Charge) and the dollar amount linked to the attribute (e.g., \$935.00) at least once. The requirement that both the loan-attribute and dollar amount be fixated was used to ensure that participants not only located the attribute but also remembered to verify the cost associated with it.

**Post-review phase.** Immediately after advancing past the final page of the form, participants were asked to fill in blank spaces that were occupied by the study set attributes and their respective dollar amounts on the critical page within the disclosure form (see Figure 2 for example). The locations of the to-be-recalled attributes/dollar amounts were indicated by a series of underlined “+” signs. Participants clicked on the “+’s” and then typed in the missing information. Attributes on this page that were not described during the study phase were obscured to prevent them from interfering with retrieval. In the cue-before-review conditions, cue attributes and their dollar amounts were displayed in the same locations they had occupied within the form. Participants were instructed to utilize these attributes as an aid for remembering the remaining attributes. Once participants indicated that they could not recall any additional information, they rated the overall quality of the loan, provided a brief explanation for their rating, completed a demographic survey, and were paid according to the number of correctly recalled attributes. They were then debriefed and thanked for their time.

## Results

The dependent measures were the mean percentage of non-cued attributes fixated during review and retrieved during the post-review free recall test. All analyses were first conducted with subject origin (community vs. student) as a between-subjects factor. No significant differences or interactions were observed in this study or in the other studies in this series (e.g., LeBoeuf et al., 2014) between these groups. Thus, the data were merged in the results described below.

### Performance in the Review Phase

The maximum number of non-cued attributes that could be fixated in the no-cue-before-review and cue-before-review conditions was eight and four, respectively. For this analysis, I collapsed across cuing conditions because the post-review recall manipulation occurred after participants had finished reading through the form and therefore had no effect on visual search and selection. Consistent with the retrieval strength accounts (response-competition and retrieval-inhibition) and possibly the strategy-disruption account (if participants implemented a retrieval strategy), the results indicated that participants in the cue-before-review condition remembered to check a lower percentage of non-cued attributes ( $M = 61.3\%$  fixated) relative to no-cue-before-review condition ( $M = 78.1\%$  fixated),  $t(62) = 2.36$ ,  $p = .02$ ;  $d = 0.59$  (see Figure 4 for example).

### No-cue-before-review

L. Settlement Charges		
700. Total Real Estate Broker Fees		
Division of Commission (line 700) as follows:		
701.		
702.		
703. Commission paid at Settlement		
704.		
900. Items Payable in Connection With Loan		
901. Our origination charge \$935.00	(from GFE #1)	
902. Your credit or charge (points) for the specific interest rate chosen (\$1,534.00)	(from GFE #2)	
903. Your adjusted origination charges	(from GFE A)	-\$599.00
904. Appraisal Fee to Max Appraiser	(from GFE #3)	\$300.00
905. Credit Report	(from GFE #3)	
906. Tax service to	(from GFE #3)	
907. Flood Certification to First American	(from GFE #3)	\$11.00
900. Items Required By Lender To Be Paid In Advance		
901. Daily interest charges from 5/7/2010 to 5/1/2010 @ 44.8500/day to DK Mortgage Corp.	(from GFE #10)	-\$259.34
902. Mortgage Insurance Premium	(from GFE #3)	
903. Homeowner's insurance	(from GFE #11)	
1000. Reserves Deposited With Lender		
1001. Initial deposit for your escrow account	(from GFE #9)	\$4,474.62
1002. Homeowner's insurance months @ per month		
1003. Mortgage insurance months @ per month		
1004. Property taxes 4 months @ \$ \$1,118.66 per month \$4,474.64		
1007. Aggregate Adjustment (\$0.02)		
1100. Title Charges		
1101. Title services and lender's title insurance	(from GFE #4)	\$515.00
1102. Settlement or closing fee to RST Title	\$265.00	
1103. Owner's title insurance to	(from GFE #5)	
1104. Lender's title insurance to	\$200.00	
1105. Lender's title policy limit	\$417,000.00	
1106. Owner's title policy limit		
1107. Agent's portion of the total title insurance premium to	\$150.00	
1108. Underwriter's portion of the total title insurance premium to Old Republic National Title Insurance Company	\$10.00	
1109. Predatory Lending Endorsement / Service Fee to Regent Title	\$50.00	
1200. Government Recording and Transfer Charges		
1201. Government recording charges	(from GFE #7)	\$84.00
1202. Deed \$ Mortgage \$84.00 Releases \$		
1203. Transfer taxes	(from GFE #8)	
1204. City/County taxstamps Deed \$ Mortgage \$		
1205. State taxstamps Deed \$ Mortgage \$		
1300. Additional Settlement Charges		
1301. Required services that you can shop for	(from GFE #6)	
1302. Survey		
1303. Pest inspection		
1400. Total Settlement Charges (enter on line 101, Section J and 502, Section K)	\$4,516.21	\$0.00

### Cue-before-review

L. Settlement Charges			
700. Total Real Estate Broker Fees			
Division of Commission (line 700) as follows:			
701.			
702.			
703. Commission paid at Settlement			
704.			
900. Items Payable in Connection With Loan			
901. Our origination charge \$935.00	(from GFE #1)		
902. Your credit or charge (points) for the specific interest rate chosen (\$1,534.00)	(from GFE #2)		
903. Your adjusted origination charges	(from GFE A)	-\$599.00	
904. Appraisal Fee to Max Appraiser	(from GFE #3)	\$300.00	
905. Credit Report	(from GFE #3)		
906. Tax service to	(from GFE #3)		
907. Flood Certification to First American	(from GFE #3)	\$11.00	
900. Items Required By Lender To Be Paid In Advance			
901. Daily interest charges from 5/7/2010 to 5/1/2010 @ 44.8500/day to DK Mortgage Corp.	(from GFE #10)	-\$259.34	
902. Mortgage Insurance Premium	(from GFE #3)		
903. Homeowner's insurance	(from GFE #11)		
1000. Reserves Deposited With Lender			
1001. Initial deposit for your escrow account	(from GFE #9)	\$4,474.62	
1002. Homeowner's insurance months @ per month			
1003. Mortgage insurance months @ per month			
1004. Property taxes 4 months @ \$ \$1,118.66 per month \$4,474.64			
1007. Aggregate Adjustment (\$0.02)			
1100. Title Charges			
1101. Title services and lender's title insurance	(from GFE #4)	\$515.00	
1102. Settlement or closing fee to RST Title	\$265.00		
1103. Owner's title insurance to	(from GFE #5)		
1104. Lender's title insurance to	\$200.00		
1105. Lender's title policy limit	\$417,000.00		
1106. Owner's title policy limit			
1107. Agent's portion of the total title insurance premium to	\$150.00		
1108. Underwriter's portion of the total title insurance premium to Old Republic National Title Insurance Company	\$10.00		
1109. Predatory Lending Endorsement / Service Fee to Regent Title	\$50.00		
1200. Government Recording and Transfer Charges			
1201. Government recording charges	(from GFE #7)	\$84.00	
1202. Deed \$ Mortgage \$84.00 Releases \$			
1203. Transfer taxes	(from GFE #8)		
1204. City/County taxstamps Deed \$ Mortgage \$			
1205. State taxstamps Deed \$ Mortgage \$			
1300. Additional Settlement Charges			
1301. Required services that you can shop for	(from GFE #6)		
1302. Survey			
1303. Pest inspection			
1400. Total Settlement Charges (enter on line 101, Section J and 502, Section K)	\$4,516.21	\$0.00	

Figure 4. Attention “heatmap” for two participants on the critical page in the no-cue-before-review condition and the cue-before-review condition in Experiment 1. Black rectangles indicate locations of study-set attributes. Red and yellow areas received the most attention, and green and non-colored areas received little-to-no attention.

### Performance in the Post-Review Phase

Retrieval performance was measured as the percentage of non-cued attributes and their respective dollar amounts retrieved after participants finished reviewing the disclosure form. We adopted a “lenient” scoring system similar to Basden et al. (2002) in which attributes or dollar amounts reported in an incorrect line were not counted against participants. Credit was given if at least one attribute “keyword” was recalled (see Appendix for list of accepted keywords), and a second point was given if the reported dollar amount associated with that attribute fell between 75% and 125% of its actual value. For example, the Origination Charge was \$935. Thus, a reported value greater than or equal to \$701 or less than equal to \$1168 for the Origination Charge was deemed correct. One point was also given if an attribute’s dollar amount was located on the appropriate line, even if the attribute associated with that value was not reported or was reported incorrectly. No credit was given if the dollar amount was correctly recalled in an incorrect position and the attribute was also not correct. Credit was also not given if both the attribute and its respective dollar amount were correctly recalled but reported on the wrong section (i.e., recalling a term that appeared on the top of the page at the bottom of the page or vice versa). Misspellings or minor errors were not counted against participants.

Due to missing data from one participant, a total of 63 participants were included in this analysis. Near floor performance was observed in all conditions (no-cue-before-review/no-cue-post-review:  $M = 4.6\%$  retrieved; no-cue-before-review/cue-post-review:  $M = 7.8\%$  retrieved; cue-before-review/no-cue-post-review:  $M = 7.0\%$  retrieved; cue-before-review/cue-post-review:  $M = 6.6\%$  retrieved). A 2 X 2 Analysis of Variance (ANOVA) revealed no significant main effects or interactions (cue-before-review:  $F(1, 62) = .03, p = .84$ ; cue-post-review:  $F(1, 62) = .20, p = .65$ ; cue-before-review X cue-post-review interaction:  $F(1, 62) = .32, p = .56$ ).

### **Experiment 1 Discussion**

Experiment 1 showed clear effects of cuing on prospective memory to check loan terms during review. Participants cued prior to evaluating a sample home loan disclosure form remembered to check a lower percentage of non-cued attributes relative to those not cued. These results provide initial evidence that even well-informed consumers who know what to look for when reviewing the terms of a loan are susceptible to misleading tactics implemented by unscrupulous lenders as well as well-intentioned reminders by financial counselors, advisors, and friends. These results replicate the general finding of part-set inhibition in free recall tasks (e.g., Nickerson, 1984). Further, to my knowledge, this is the first attempt to demonstrate the part-set cuing effect in a prospective memory task. This provides initial evidence that prior part-set theory can be extended to account for instances of prospective forgetting.

These results also provide insights on the downstream consequences of part-set cuing on behaviors that support judgment and decision-making. Until now, part-set cuing research has focused primarily on how this phenomenon affects retrieval and retrieval alone. Experiment 1 provides evidence that memory biases resulting from part-set cuing can cause decision makers to miss information that will inevitably lead to errors in judgment. These results resemble the results in an eye tracking study that Bilalic, Mcleod, and Gobet (2010) conducted with expert chess players who were tasked with finding a solution to a chess problem. Those authors found that players tended to direct their attention towards information congruent with their initial solution and away from incongruent information, a tendency that persisted even when the players believed they were actively searching for an alternative solution. Likewise, in the present study, those in the cue-before-review condition checked fewer non-cued attributes while reviewing the form because the cued attributes were activated first and biased subsequent attentional allocation on the critical page.

The part-set cuing effect observed during review was not observed afterwards during the post-review free recall test, most likely due to a floor effect. This failure to find an effect is not entirely unexpected; similarly low performance has been observed in prior part-set cuing studies using “longer” item lists (e.g., Basden et al., 2002, Experiment 2). One possible explanation is that processing information pertinent to evaluating the loan between the critical page and the post-review phase produced interference, thereby impeding retrieval of the previously encountered attributes on the critical page (Massaro, 1970). This might have masked potential differences on this measure. To address the lack of variability between participants and conditions, the post-review recall results from all three experiments will be examined together (see supplementary analyses). However, failing to look at certain attributes is problematic and would clearly affect judgment and decision-making, irrespective of the consumer’s ability to remember the exact dollar amounts associated with the attributes they knew to check.

## **Experiment 2**

Experiment 2 investigated whether part-set cuing effects on prospective memory are moderated by cue-set size by providing participants with one, two, or four cues prior to review. Prior research has typically shown that as the cue-set size increases retrieval of the non-cued items decreases (Lewis, 1971; Rundus, 1973; Slamecka, 1968; Marsh et al., 2004). For example, Roediger (1973) had participants memorize several exemplars from 16 different semantic categories, after which participants completed a free recall task that included the 16 category labels. Participants were provided with zero, one, three, or five exemplars out of a possible six during free recall task. The likelihood of retrieving the remaining, non-cued exemplars decreased as the number of cues present at retrieval increased. Processing or recalling more cues presumably increases the probability that at least one or more of the cues will interfere with the

retrieval of the non-cued items. Thus, it is reasonable to predict that the percentage of attributes fixated during review and recalled post-review will decrease as the number of cues provided before review increases.

H1a: Increasing the number of cues presented before review will reduce the percentage of non-cued attributes fixated during review and recalled post-review.

However, the task of reviewing home-loan disclosure forms involves remembering spatial positions. Recent research related to the influence of part-set cuing on memory for spatial positions of chess pieces (Drinkwater et al., 2006) found no evidence of impairment for participants presented with six or 12 chess pieces as cues relative to a zero cue control group. Analogous findings were observed within two recent experiments investigating part-set cuing effects on spatial memory for objects within pictorial scenes (e.g., a drawing of a room) (Fritz & Morris, 2013). To test the effects of part-set cuing on memory for the spatial locations of loan attributes presented on the form, the participants in Experiment 2, unlike the participants in Experiment 1, were shown each attribute's spatial location on the critical page during the study phase. The results of Drinkwater as well as Fritz and Morris suggest that cue-set size may not moderate the level of part-set impairment experienced by participants if they note the spatial locations of the attributes in the form, and then use this information to facilitate subsequent retrieval while reviewing the form.

H1b: Increasing cue-set size will have no effect on the percentage of non-cued attributes fixated during review and recalled post review.



From an applied perspective it is important to explore this issue, because understanding the role of cue-set size in moderating part-set cuing effects will help to elucidate the boundary conditions of this phenomenon in a home loan context. If a minimal number of cues (e.g., 1 or 2 cues) produces a level of inhibition across all three conditions similar to the levels observed with more cues (i.e., 4 cues), it would suggest that even brief interactions that activate consumers' memories for certain attributes can impede access to other, non-activated attributes. Well-intentioned financial counselors in particular would need to exert great caution when advising their clients if such a pattern were observed.

## **Method**

### **Participants**

The sample consisted of 48 members of the local community. One participant was excluded due to recording errors, leaving 47 participants for analysis.

### **Design**

Experiment 2 used a one-way between-subjects design and manipulated the number of cues—one, two, or four—presented prior to review.

### **Materials**

The materials used in Experiment 2 were the same as those used in Experiment 1.

### **Procedure**

**Instruction phase.** The instructions in Experiment 2 were identical to Experiment 1.

**Study phase.** The study phase was also identical to Experiment 1 except that the location of each attribute on the critical page was highlighted and displayed for 5 s after the 40 s description. To prevent participants from evaluating some study set attributes as more important

than others due to small differences in the dollar amounts associated with each, the critical page during the study phase was blank and did not contain any information other than the location and identity of the study set attributes on the page.

**Review phase.** A single change to the review phase used in Experiment 1 was made in Experiment 2. Specifically, the experimenter not only re-presented participants with the attribute, but also the attribute's location on the critical page. The visual appearance of the page was identical to its appearance during the study phase, and it was again presented on screen for a period of 5 s. In the one-cue condition, a single attribute was cued. In the two-cue condition, pairs of attributes were cued that appeared in corresponding serial positions (e.g., 801 & 802, 803 & 804, 1101 & 1102, or 1107 & 1108), while the presentation sequences in the four-cue condition were counterbalanced such that only lines 801,802,1101, and 1102 were cued or only lines 803,804,1107, and 1108 were cued.

**Post-review phase.** The post-review free recall test was identical to Experiment 1 except cues were not present in any condition. Cues were eliminated to reduce task difficulty.

## Results

### Performance in the Review Phase

A linear trend analysis was conducted to determine whether participants noted fewer non-cued attributes as the number of cues presented before review increased. As is shown in Figure 5, results indicated a marginally significant negative trend regarding the percentage of non-cued attributes fixated,  $F(2, 44) = 3.56, p = .06$ . Those re-presented with only one cue remembered to check the highest percentage of non-cued attributes ( $M = 74.1\%$  fixated), followed by the two-cue condition ( $M = 70.7\%$  fixated), with the four-cue condition ( $M = 56.6\%$  fixated) remembering to check the lowest percentage of non-cued attributes.

### Performance in the Post-Review Phase

A linear trend analysis found that recall of non-cued attributes during the post-review free recall marginally decreased as the cue-set size increased,  $F(1, 45) = 3.11, p = .08$ . Similar to the eye-tracking results, the one-cue condition recalled the highest percentage of non-cued attributes ( $M = 29.4\%$  recalled), while the two-cue ( $M = 14.0\%$  recalled) and four-cue ( $M = 15.6\%$  recalled) conditions recalled a lower percentage of non-cued attributes.

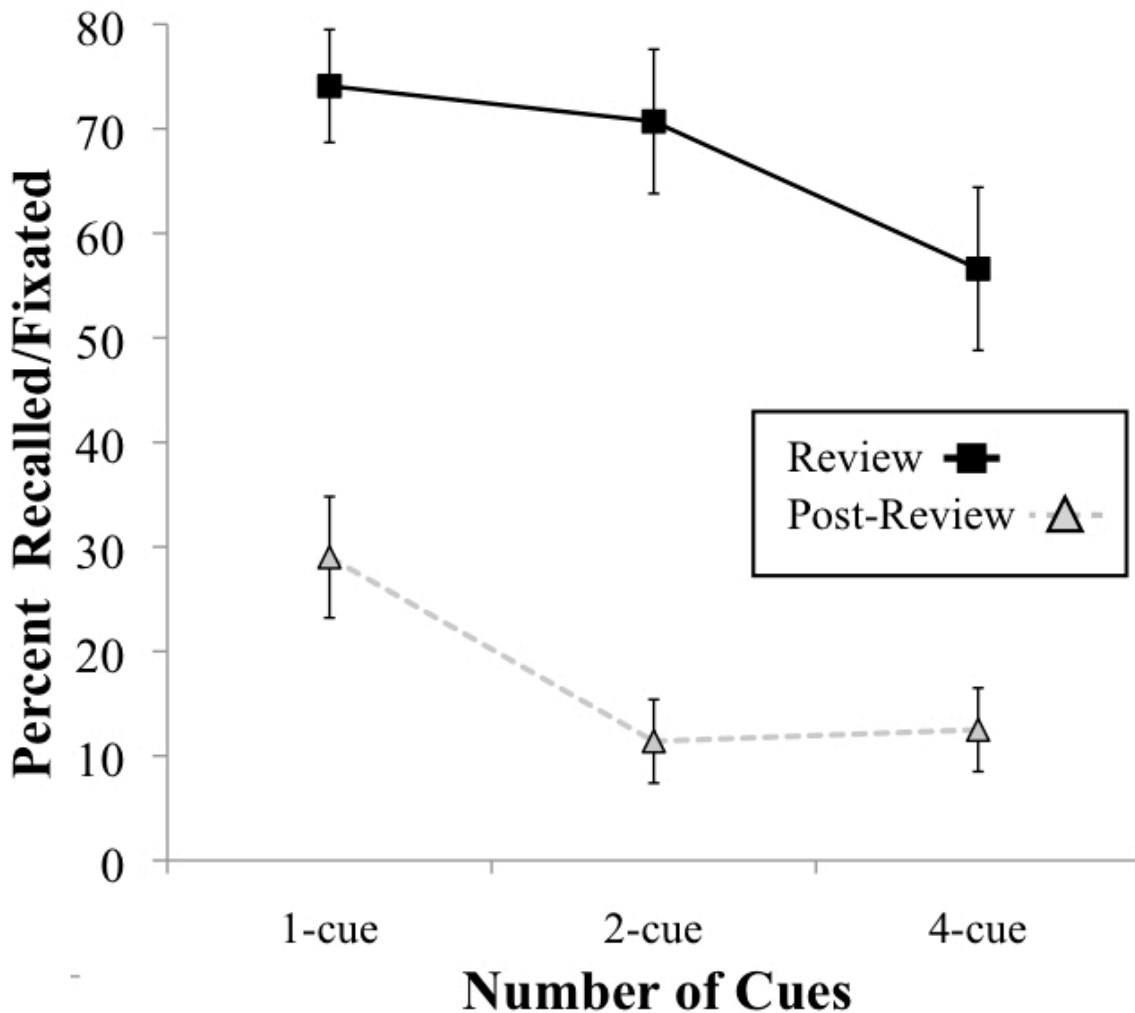


Figure 5. Retrieval performance during review and post-review in Experiment 2 as a function of number of attributes cued prior to review. Error bars represent standard errors.

## **Experiment 2 Discussion**

Experiment 2 demonstrated that reducing the cue-set size decreased part-set cuing effects marginally during the review phase and the post-review phase. These results are consistent with prior research on the relationship between cue-set size and retrieval performance (Rundus, 1973; Blaxton & Neely, 1983; Marsh et al., 2004; Slamecka, 1968, 1972; Watkins, 1975). These results are also consistent with previous results that used conventional verbal part-set cuing stimuli (e.g., Roediger, 1978; Marsh et al., 2004) but run counter to studies that found no relationship between cue-set size and part-set cuing on spatial memory (e.g., Drinkwater et al., 2006; Fritz & Morris, 2013). While the origin of this difference remains unclear, it is possible that participants in the present study relied primarily on verbal cues to guide subsequent retrieval and search, given that cue-set size typically does not affect retrieval in part-set cuing tasks involving spatial memory.

From an applied standpoint, these results show that reminders by mortgage brokers and lenders to review specific terms on a disclosure form can be deceptive. Financial counselors need to be aware of the impact of how they present this information and instruction techniques need to be developed to avoid these pitfalls. Possible strategies for consumers to avoid or reduce part-set cuing effects when trying to remember to check for certain attributes will be addressed in the General Discussion.

## **Experiment 3**

The purpose of Experiment 3 was to test theoretical accounts of the part-set cuing effects on prospective memory found in experiments 1 and 2. Unlike the retrieval-strength accounts (i.e., response-competition (Rundus, 1973) and retrieval-inhibition (e.g., Bäuml & Aslan, 2004), the strategy-disruption account (Basden & Basden, 1995; Basden, Basden, & Stephens, 2002;

Basden & Basden, 1995; Basden et al., 1977) proposes that recall performance is contingent upon an individual's ability to use an organizational framework during retrieval that is similar to or the same as that used during encoding. When cues are consistent with an individual's retrieval strategy they improve retrieval, while inconsistent cues impair retrieval, and cues that provide no retrieval benefit neither facilitate nor impair retrieval. For example, serial retrieval with consistent cues supports an order-based retrieval strategy, while inconsistent cues (i.e., words placed in random, incorrect positions) disrupts this retrieval strategy and interferes with serial recall performance (Basden et al., 2002; Serra & Nairne, 2000). Part-set facilitation has also been observed in spatial-memory tasks with consistent cues (Cole et al., 2013).

Experiment 3 tested these predictions of the strategy-disruption account by manipulating the order in which cue attributes were presented to be either *consistent* or *inconsistent* with their study order. A third no-cue condition was also included to serve as a control. Similar to Experiment 2, all participants were shown each attribute's location on the critical page, and the order in which the attributes were presented was identical to their serial order of appearance within the form. The strategy-disruption account predicts less memory interference (or possibly part-set facilitation) when cues are re-presented in an order that is consistent with the order in which they were encoded relative to a randomized, inconsistent order if participants develop an order-based retrieval strategy. The retrieval-strength accounts, on the other hand, do not predict effects of the order in which cues are presented.

H1a: If participants formulate an order-based retrieval strategy, the percentage of non-cued attributes fixated during review and recalled post-review should be greater in the consistent cue condition relative to the inconsistent cue condition.

H1b: If participants do not formulate an order-based retrieval strategy, then the percentage of non-cued attributes fixated during review and recalled post-review should be equivalent between the consistent and inconsistent cue conditions. Further, retrieval performance in the cue conditions should be lower than the no-cue-before-review condition.

From a theoretical standpoint, Experiment 3 will provide insight on the mechanism underlying the decrements in prospective memory performance observed in experiments 1 and 2 by contrasting the predictions of the retrieval-strength accounts with those of the strategy disruption account. From an applied standpoint, Experiment 3 will address whether financial education courses, materials, or programs can mitigate the downstream effects of part-set cuing. For example, easily accessible HUD-1 “tutorials” intended to familiarize home loan consumers with the Settlement Charges will highlight each attribute within the form and then briefly describe its meaning (see [paragontitle.com](http://paragontitle.com) for example). Consumers often rely on these tutorials to help them to understand the contents of their disclosure forms, and the procedure in Experiment 3 was designed to emulate this format. If the effects observed in the previous two experiments are reduced or reversed as a result of participants formulating interitem associations between the attributes, it would suggest that such tutorials are an effective approach to countering part-set cuing effects in a home loan context. However, if altering the order in which the attributes are re-presented affects the magnitude or direction of part-set cuing effects, or part-set cues impair retrieval in both cuing conditions relative to the no-cue condition, it would suggest that additional educational efforts might be necessary to overcome cognitive factors (i.e., part-set cuing) that bias how consumers process loan information.

## **Method**

### **Participants**

Twenty-four members of the local community and 24 students took part in Experiment 3. The compensation structure was identical to the previous experiments, and all participants were tested individually.

### **Design**

Experiment 3 used a one-way design with three conditions—consistent cue-before-review, inconsistent cue-before-review, and no-cue-before review. In the consistent cue-before-review condition, the attributes were re-presented in the same order that they appeared on the form. In the inconsistent cue-before-review condition, the attributes were re-presented in a random order. In the no-cue-before review, no cues were re-presented. These manipulations occurred between subjects. The attributes participants were cued with alternated between 801, 802, 1101, 1102 and 803, 804, 1107, 1108, parallel to Experiment 2.

### **Materials**

The materials used in Experiment 3 were the same as those used in Experiment 2.

### **Procedure**

The procedure in Experiment 3 was identical to Experiment 2 with the following exceptions. First, additional emphasis was placed on the fact that the order in which the attributes were presented during study was identical to their order of appearance in the form. Second and similar to the four-cue condition in Experiment 2, attributes were displayed in the order consistent with how the attributes were presented on the form; that is, attributes near the top of the page were always presented before attributes near the bottom for those assigned to the

consistent cue-before-review condition. In contrast, within the inconsistent cue-before-review condition, a random number generator was used to determine presentation order. Thus attributes appearing near the bottom of the critical page could be presented before those appearing near the top of the page.

## Results

The results of student and community participants were initially compared. No differences were observed between these groups, so the data for students and community participants were merged together for the following analyses.

### Performance in the Review Phase

In line with the findings of the previous experiments, the percentage of non-cued attributes that participants remembered to check (i.e., fixated) differed significantly between conditions,  $F(2, 45) = 7.29, p = .002; \eta^2 = 0.23$ . The results of a post-hoc LSD test revealed that those cued before review in the consistent ( $M = 50.0\%$  fixated;  $d = 1.3$ ) and inconsistent ( $M = 59.3\%$  fixated;  $d = 1.0$ ) conditions fixated a lower percentage of non-cued attributes relative to the no-cue-before-review condition ( $M = 86.7\%$  fixated) (all  $ps < .01$ ) while the consistent and inconsistent conditions did not differ significantly from one another on this measure ( $p > .05$ ).

### Performance in the Post-Review Phase

Overall, free recall performance was near floor, similar to Experiment 1. As such, free recall of non-cued attributes did not differ significantly between the no-cue ( $M = 9.4\%$  recalled), consistent cue ( $M = 6.2\%$  recalled), and inconsistent cue conditions ( $M = 11.7\%$  recalled),  $F(2,45) = .77, p = .46$ .

## Discussion of Experiment 3



In Experiment 3, the retrieval-strength accounts of part-set cuing impairment (response competition, Rundus, 1973 and retrieval inhibition, Anderson et al., 1994) were contrasted with the strategy-disruption account (Basden & Basden, 1995). Strategy disruption predicts part-set inhibition when cues prompt individuals to use retrieval strategies that are inconsistent with the previously formulated strategy. In addition, strategy disruption predicts part-set facilitation or a reduction in part-set inhibition when cues prompt retrieval strategies that are consistent with the previously formulated strategy (e.g., Serra & Nairne, 2000). Indeed, a recent study on the effects of part-set cuing on spatial memory (Cole et al., 2013) found clear part-set facilitation when participants were provided with consistent cues. Inconsistent with the strategy disruption account, Experiment 3 found that part-set cuing produced a similar detrimental effect on prospective memory to review loan attributes both in the inconsistent and in the consistent presentation conditions relative to a no-cue control condition.

These results align most closely with the retrieval-strength accounts. In accordance with the response-competition account (Rundus, 1973), realizing the intention to check the previously studied attributes might have led cued attributes to be retrieved before the non-cued attributes, producing output order biases that in turn caused forgetting of the non-cued attributes via biased competition. Participants directed their attention towards the currently activated attributes based on prior knowledge (e.g., their locations in the form), and then forgot to check for the remaining non-cued attributes. Alternatively and consistent with the retrieval-inhibition account (Anderson et al., 1994), remembering the intention to check the cued attributes when they were re-presented prior to review might have produced long-term changes in the representations of the intentions to check the non-cued attributes, actively reducing the memory strength of those intentions. This, in turn, caused participants to forget to check those attributes when they reviewed the disclosure

form. Indeed, retrieval inhibition has been shown to persist for upwards of one week after the initial processing event (e.g., Garcia-Bajos, Migueles, & Anderson, 2009; Storm, Bjork, & Bjork, 2012). The temporal delay between when the attributes were re-presented and when they were encountered in the form lasted only several minutes, making this explanation highly plausible.

In defense of the retrieval strategy account, one could argue that participants did not implement a retrieval strategy (although such an argument would seem contrary to the results obtained by Cole et al., 2013, in a task that likely involved similar spatial memory processes to those involved in the present study). Perhaps the initial encoding context was not conducive for the formation of interitem associations. Consistent with this possibility Bäuml & Aslan (2006) have proposed that interitem associations play a “minor role” in retrieval when items are learned through a single study trial in the absence of explicit instructions to encode the items via a particular strategy (although participants were provided a sufficient amount of time to encode and organize the attributes in long-term memory).

It is also possible that participants simply did not think to construct a retrieval plan and, unlike some prior research, they were not instructed to adopt a particular retrieval strategy (e.g., Basden et al., 2002, Experiment 1). Such a manipulation would have been inconsistent with the real-world loan contexts to which the present study’s results are intended to generalize, as actual home loan consumers do not receive these instructions. Retrieval frameworks also rely on myriad sources of information to structure recall (see Basden et al., 2002, for discussion). Order cues appeared to be the most intuitive and efficient sources of information for participants to use to organize the loan-attributes, but participants were free to use any retrieval strategy that they desired. This raises the possibility that the cues might have still disrupted participant’s original

retrieval strategy. Thus, although the results of Experiment 2 are problematic for the strategy-disruption account, they cannot definitively rule out the possibility of strategy disruption.

Independent of the underlying mechanism, these results suggest that current materials intended to familiarize potential borrowers with the HUD-1 disclosure form will not mitigate part-set cuing effects. The procedure of Experiment 3 directly emulated the format of HUD-1 tutorials that consumers will often rely on to familiarize themselves with the contents of the disclosure form. The persistence of part-set cuing inhibition despite having access to this information suggests that additional guidance, such as formal loan counseling sessions, might be necessary to reduce or eliminate biases stemming from part-set cuing.

### **Supplementary Analyses of Results in Experiments 1-3**

The following section focused on issues that are indirectly relevant to the hypotheses under test. These analyses will nonetheless provide valuable insights on several questions pertinent to our understanding of how contextual and individual factors affect the search for and retrieval of information contained in home loan disclosure forms.

#### **The Prospective Component of Prospective Memory in Experiment 1**

The purpose of this analysis was to determine the extent to which detecting a potential prospective memory cue affected retrieval, and, in turn, visual search during review. Participants were aware that all of the study-set attributes located on a page titled “Settlement Charges.” In Experiment 1, it is likely that this information functioned as a prospective memory cue, while the appearance of the critical page itself served a similar purpose in experiments 2 and 3, given that participants in the latter studies were provided this information during study. So how did visually fixating this item at the top of the critical page (versus not fixating it) affect visual search for the previously studied loan attributes?

According to automatic associative action theory of prospective memory, attending to a prospective memory cue (i.e., the Settlement Charges item) should spontaneously trigger the cue-intention association in memory (i.e., to locate the previously studied attributes and check the dollar amounts associated with each) (McDaniel & Einstein, 2007). It is thus reasonable to assume that the Settlement Charges item served as a prospective memory cue. Participants who visually fixated the Settlement Charges item would be expected to exhibit superior memory for all of the previously studied attributes relative to those who do not fixate this item.

To test this possibility, I initially examined how the retrieval of all of the previously studied attributes—both cued and non-cued—differed depending on whether participants fixated the Settlement Charges item. In order to account for the fact that participants who spend more time reviewing a page will, by chance alone, have a greater likelihood of fixating the study-set attributes, the time each participant spent viewing the preceding page was taken into consideration. A rectangular AOI was drawn around the settlement charges item, and those who registered at least one fixation on the AOI were considered to have detected this prospective memory cue. Viewing time on the preceding page was strongly correlated with viewing time on the critical page,  $r(62) = .80, p < .001$ . After controlling for individual differences in viewing time, an Analysis of Covariance (ANCOVA) indicated that those who fixated the Settlement Charges item checked a higher percentage of attributes relative to those who had not fixated this item ( $M = 79.2\%$  fixated,  $M = 57.6\%$  fixated),  $F(2, 61) = 9.62, p = .003; \eta^2 = 0.13$ . This suggests that the Settlement Charges item likely served as a prospective memory cue for participants while reviewing the form.

Next, I examined the effects of cuing on the percentage of non-cued attributes checked by those who fixated this item. This analysis sought to isolate the effects of part-set cuing on the

retrospective component of prospective memory, given that both groups presumably brought to mind the intention to check the previously studied attributes. A total of 38 participants were included in this analysis, and the number of participants fixating the Settlement Charges item was nearly equal in the cue-before-review ( $N = 20$ ) and no-cue-before-review ( $N = 18$ ) conditions. After accounting for viewing time on the previous page, results indicated that participants in the no-cue-before-review condition checked a higher percentage of non-cued attributes relative to those in the cue-before-review condition ( $M = 87.5\%$  fixated,  $M = 68.1\%$  fixated),  $F(2, 35) = 5.13, p = .03; \eta^2 = 0.12$ . This finding provides indirect evidence that part-set cuing effects remain even if the original intention has been retrieved.

### **A Potential Mechanism of Prospective Retrieval in Experiment 1**

A central debate within the prospective memory literature relates to the mechanism responsible for prospective memory retrieval. Spontaneous retrieval theory (McDaniel & Einstein, 2007) argues that an intention can automatically be retrieved without the intention having to remain in consciousness. In contrast, monitoring theory (e.g., Smith, 2003) argues that prospective memory can only be successful when an individual actively monitors their environment for the cue. West et al. (2007) provided support for both of these theories in their study on prospective memory during visual search. Consistent with spontaneous retrieval theory, successful prospective remembering was less likely to occur in their study when participants failed to fixate the prospective memory cue. On the other hand and consistent with monitoring theory, total fixation durations were longer for successful prospective remembering relative to prospective memory failures when the prospective cue was fixated. The authors interpreted the latter finding as evidence that the participant's monitoring processes were not active when they encountered the prospective memory cue.

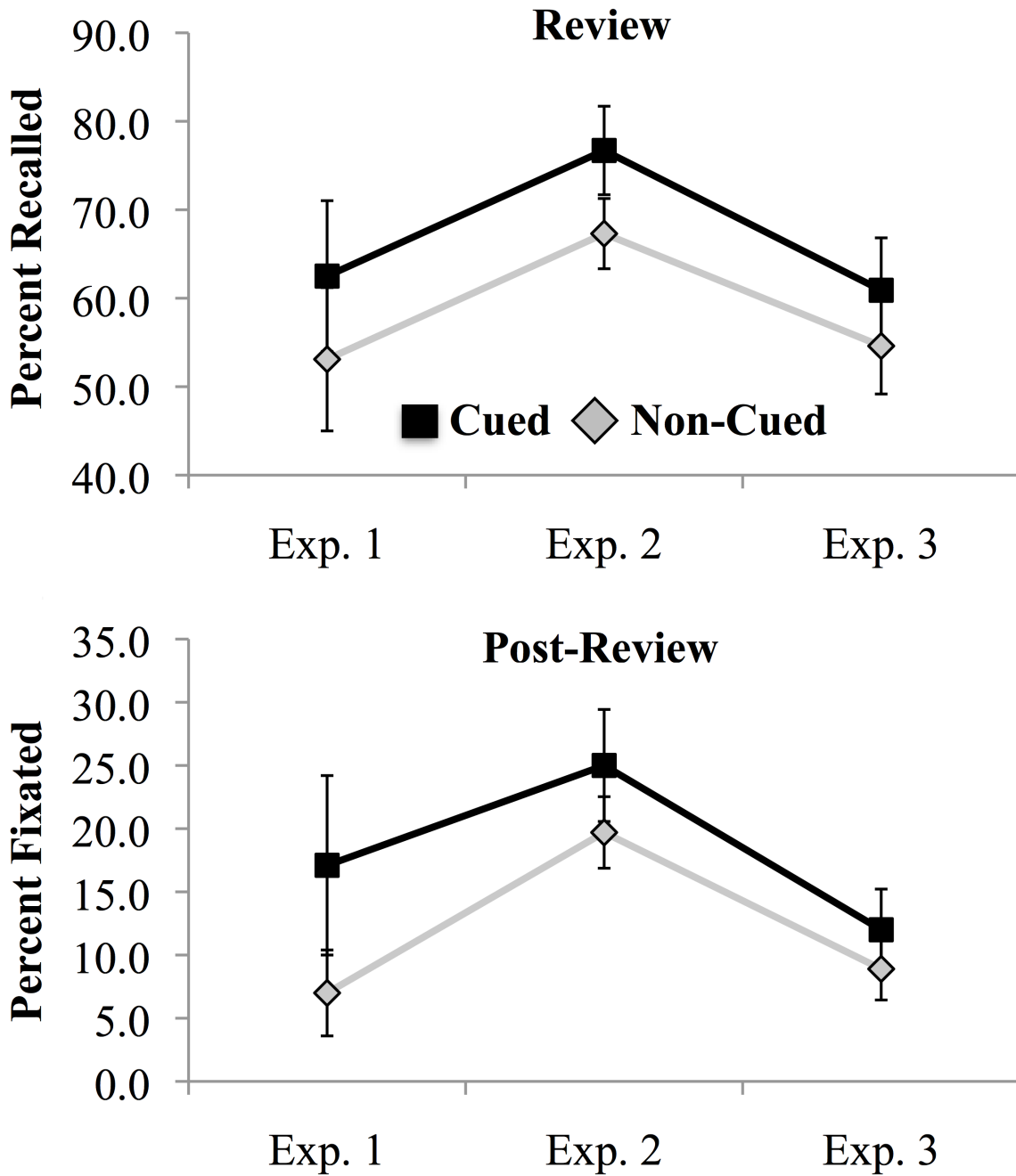
The results from the prior analysis suggest that merely fixating a potential prospective memory cue (i.e., the Settlement Charges item) improved retrieval performance. This finding is most consistent with spontaneous retrieval theory. However, amongst those who fixated the cue, it is possible that longer total fixation durations are associated with improved retrieval performance, similar to the finding obtained by West et al. Such an outcome would be consistent with the predictions of monitoring theory. To assess the potential role that monitoring played in prospective memory performance during the review phase in Experiment 1, I analyzed the partial correlation (controlling for page 1 viewing time) between total fixation duration and the overall percentage of attributes fixated, as well as between total fixation duration and the percentage of non-cued attributes fixated, amongst those who fixated the Settlement Charges item. Total fixation duration was the sum of all fixations (in seconds) that a participant registered on this item.

Results indicated that neither the overall percentage of attributes fixated  $r(35) = -.03, p = .83$ , nor the percentage of non-cued attributes fixated,  $r(35) = .04, p = .77$ , were related to the amount of time participants viewed the Settlement Charges item. These analyses were then replicated separately within the cue-before-review and no-cue-before-review conditions. Condition did not affect the nature of these relationships (all  $ps > .05$ ). Collectively, these findings align with the predictions of spontaneous retrieval theory and provide support for the existence of spontaneous retrieval processes (McDaniel & Einstein, 2007).

### **Retrieval of Cued Attributes in Experiments 1-3 During Review and Post-Review**

Although the primary interest of the present study was to examine part-set cuing effects on retrieval of non-cued attributes, two additional analyses were conducted to understand how cuing enhances retrieval performance. For the eye-tracking data collected during the review

phase, participants across all three experiments who received any number of cues before review were included in these analyses. The same participants were used when analyzing the post-review recall data, except for those in Experiment 1 presented with cues at recall. These participants were excluded to ensure uniformity of retrieval conditions across the experiments. A 2 (attribute: cued or non-cued) X 3 (experiment: 1, 2, 3) mixed-model ANOVA was used to analyze these results. Attribute was a within-subjects factor while experiment was a between-subjects factor. As is displayed in Figure 6, there was a main effect of attribute, such that cued attributes were checked more often during the review phase  $F(2, 108) = 5.45, p = .02; \eta^2 = 0.04$  and recalled marginally more frequently during the post-review phase  $F(2, 91) = 3.52, p = .06$  than non-cued attributes. The attribute-experiment interactions were not significant in either analysis. These findings align with the notion that reprocessing material improves later recall (Anderson et al., 1994; Anderson & Spellman, 1995; Shaw et al., 1995; Ciranni & Shimamura, 1999; Bäuml & Hartinger, 2002). It suggests that leading consumers through their disclosure forms can positively impact later retrieval of the attributes identified during these exchanges. However, the small positive effect of cuing on the retrieval of cued attributes is offset by the robust negative effects of cuing on retrieval of non-cued attributes.



*Figure 6.* Retrieval of cued and non-cued attributes during review and post-review in Experiments 1 – 3 for those provided with cues before review. Errors bars represent standard errors.



### **Fixation Percentage as a Valid Indicator of Retention in Experiments 1-3**

This analysis sought to determine whether fixation percentage was a valid indicator of what participants retained in memory after reviewing the disclosure form. Though the relationship between eye-tracking measures and retrieval has been established in other areas of research (e.g., Advertising—Rosbergen et al., 1997; Krugman et al., 1994), few studies to date have considered this relationship with respect to information outlined in a disclosure form. Further, the vast majority of studies that have considered the relationship between eye movements and later recall have relied on granular, continuous measures of eye movements, such as the number of fixations or dwell time associated with a particular stimulus (e.g., Maughan et al., 2006; Rosbergen et al., 1997; Krugman et al., 1994). The present study, in contrast, relied on a binary measure, considering only whether an attribute had been fixated. The decision to use this measure stemmed mainly from differences in text length for each of the attributes. Attributes with more text (e.g., the credit charge or (points) for the specific interest rate chosen) will obviously receive more fixations/longer dwell times than those with less (e.g., the origination charge). Thus fixation percentage, while perhaps being less sensitive than dwell time or fixation count, is easier to interpret, as it is less likely to be affected by text length.

In order to determine whether fixation percentage produced meaningful differences after participants finished reviewing the form, the correlation between the percentage of non-cued attributes fixated during the review phase and the percentage of non-cued attributes correctly recalled during the post-review phase across experiments 1-3 was examined. Additionally, the correlation between the percentages of cued attributes fixated/recalled was also considered for

participants who were cued prior to review. Participants who were cued post-review in Experiment 1 were again excluded from these analyses.

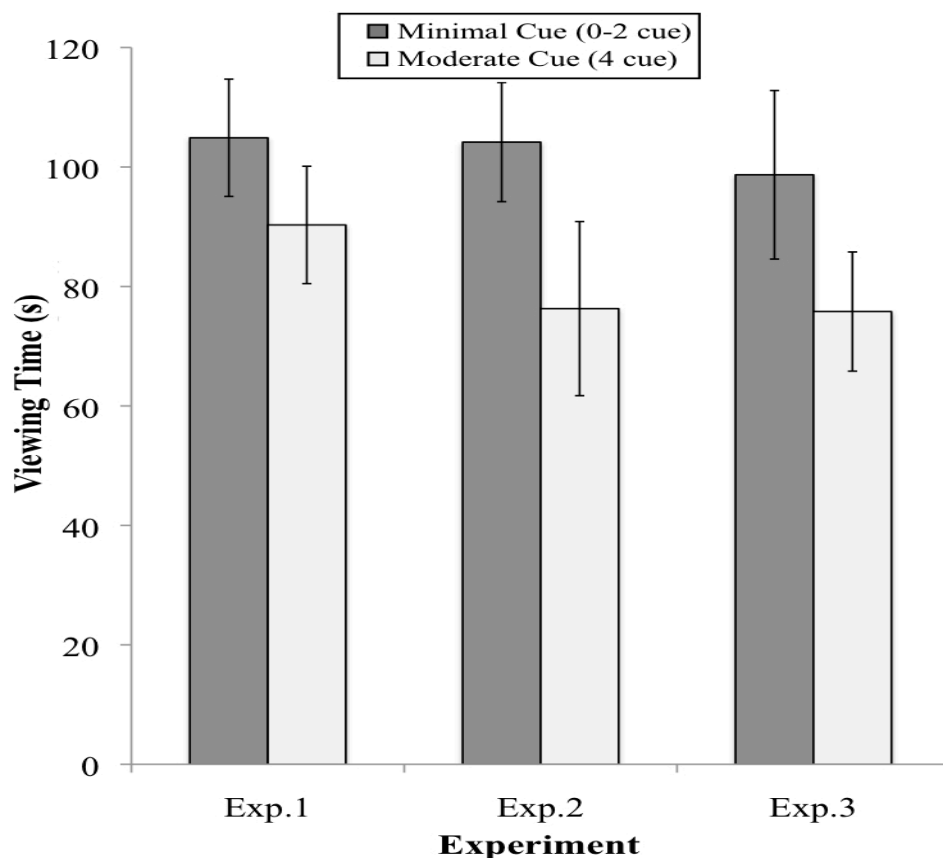
A significant positive relationship was obtained in both analyses. Participants who fixated more non-cued attributes while reviewing the form remembered a higher percentage of these attributes afterwards,  $r(124) = .18, p = .03$ . Likewise, participants who fixated more cued attributes while reviewing the form remembered a higher percentage of these attributes afterwards,  $r(92) = .19, p = .05$ . These findings demonstrate that fixation percentage is a valid measure of what individuals retained in memory after viewing the disclosure form.

### **Viewing Time on the Critical Page in Experiments 1-3**

The following analysis examined how the provision of cues affected the total amount of time participants spent viewing the critical page. Viewing time has previously been used to assess the influence of goals on an individual's propensity to visually engage with a stimulus, such as an advertisement (Rayner, Miller, & Rotello, 2008). Whether participants believed they had successfully achieved their initial goal of checking the eight attributes should, in part, determine the amount of time they spent searching for information on the critical page. Recall that participants' goals were to remember to check the eight Settlement Charges and costs associated with each upon reaching the critical page, and form an overall evaluation of the loan. If participants were aware that part-set cues had compromised their memories for some of the loan attributes, they could systematically process all of the attributes contained on the critical page to overcome this deficit. However, prior research indicates that people are generally not cognizant of the diminishing effects of part-set cues on retrieval (Rhodes & Castel, 2008). Therefore, if those cued with a "moderate" number of cues (i.e., four cues;  $N = 79$ ) prior to review spend less time viewing the critical page than those provided with a "minimal" number of

cues (i.e., zero – two cues;  $N = 80$ ), it would suggest that moderately cued participants might have (falsely) believed they had achieved their initial goal, causing them to terminate search before checking all of the attributes they had intended to check.

A 2 (cue condition: minimal, moderate) X 3 (experiment: 1, 2, 3) ANOVA was conducted with viewing time as the dependent measure. All factors were analyzed between-subjects. This analysis revealed a significant main effect of cue condition, such that those receiving minimal cues prior to review consistently spent more time reviewing the critical page's contents relative to those cued with a moderate number of cues,  $F(5, 153) = 5.27, p = .02; \eta^2 = 0.03$  (see Figure 7). Neither the main effect of experiment nor the experiment-cue condition interaction was significant. These results align with prior meta-cognition research on part-set cuing (e.g., Rhodes & Castel, 2008) and suggest that participants were not cognizant that the earlier provision of attributes as cues affected their memories for the non-cued attributes during review.



*Figure 7.* Mean viewing time (seconds) on the critical page in experiments 1-3. Error bars represent standard error.

### **Demographic Variables in Experiments 1-3**

Subprime and predatory lenders have historically targeted non-native English speakers (NNES), consumers with few years of formal education, members of minority groups, or those who possess limited financial literacy (Carr & Kolluri, 2001). The following regression analyses examined the ability of these four factors—experience with home loans (1 = yes), years of formal education (continuous), ethnicity (1 = non-White), and native language (1 = NNES)—to predict the percentage of non-cued attributes fixated and recalled during the review and post-review phases, respectively, as well as loan ratings in Experiments 1-3. A fifth variable, “cue

group,” was also included to delineate those cued with a minimal number of attributes (zero, one, or two) from those cued with a moderate number of attributes (four). Only community participants were included in these analyses, as student participants were homogenous in regard to the predictors. For post-review recall analyses, participants in Experiment 1 who were presented with cues during this phase were not included so that retrieval conditions were constant across experiments.

As is shown in Table 2, NNES participants noted fewer non-cued attributes relative to native English speakers during the review phase ( $B = -.21, t(80) = -2.06, p = .04$ ). Additionally, those with more years of formal education ( $B = 0.02, t(69) = 1.95, p = .05$ ) and native English speakers ( $B = 0.14, t(69) = 1.84, p = .06$ ) recalled a higher percentage of non-cued attributes during the post-review phase. Somewhat surprising was the finding that prior experience with home loans had little effect on retrieval during review and post-review as well as on loan ratings after controlling for the remaining factors. However, non-White participants rated the loan more positively than White participants, ( $B = .95, t(80) = 2.52, p = .01$ ). Participants should have rated the loan poorly because it contained an adjustable interest rate at a time when fixed-rate loans were available at very low rates and adjustable-rate loans are more risky than fixed rate loans. Implications of these findings are addressed in the general discussion section.

Table 2

*Summary of Linear Regression Analyses for Variables Predicting Loan Ratings, as well as Retrieval During Review and Post-Review for Non-cued Attributes by Community Participants in Experiments 1-3.*

Variable	Loan Rating ( <i>N</i> = 86)			P. Non-cued Fixated ( <i>N</i> = 86)			P. Non-cued Recalled ( <i>N</i> = 75)		
	<i>B</i>	<i>SE B</i>	$\beta$	<i>B</i>	<i>SE B</i>	$\beta$	<i>B</i>	<i>SE B</i>	$\beta$
Education	-0.06	0.08	-0.08	-0.02	0.01	-0.17	0.02	0.01	0.26*
Race	0.95	0.37	0.28*	-0.05	0.06	-0.08	-0.01	0.04	-0.02
NNES	-0.31	0.70	-0.04	-0.21	0.10	-0.21*	-0.14	0.08	-0.21
Home Loan Exp.	-0.35	0.39	-0.10	-0.01	0.06	0.01	0.21	0.04	-0.05
Cue $\leq$ 2	0.05	0.36	0.01	0.15	0.05	0.27**	-0.06	0.04	-0.16
<i>R</i> <sup>2</sup>		0.14			0.19			0.16	
<i>F</i>		2.73*			3.82**			2.69*	

\* $P \leq .05$  \*\* $P \leq .01$

### General Discussion

The present study investigated whether mortgage brokers, lenders, and financial counselors may be part-set cuing home-loan customers as they review disclosure forms, causing them to forget to check attributes they know beforehand to check. A modified part-set cuing paradigm was used in which the experimenter cued some participants with a subset of previously studied loan attributes immediately before they reviewed the terms of a sample home loan on a HUD-1 disclosure form. Eye tracking and a free recall task assessed the effects of cuing on memory for these attributes while participants reviewed the form as well as after they had finished reviewing the form.

Experiment 1 manipulated whether cues were present or absent before participants reviewed the form as well as afterward during a post-review free recall task. Results showed that participants re-presented with several loan attributes prior to reviewing the disclosure form

visually fixated a lower percentage of non-cued attributes relative to participants who were not cued. Experiment 2 extended these findings by showing that as the cue-set size increased, the percentage of non-cued attributes noted during review decreased. Experiment 3 found that presenting cue attributes in an order that was consistent with their order during study and in the form did not mitigate part-set cuing effects during review relative to an inconsistent presentation order. Retrieval performance during the post-review free recall test for non-cued attributes was near floor in Experiments 1 and 3 in all conditions, while retrieval performance in Experiment 2 was significantly better in the one-cue condition relative to the two- and four-cue conditions.

These findings extend prior findings within our laboratory (e.g., Stark et al., 2013; LeBoeuf et al., 2014) indicating that mortgage brokers and lenders can exploit cognitive biases and limitations such as confirmation biases and violations of conversational norms to reduce the ability of disclosures to convey information to the consumer. The results here suggest that even relatively well-informed borrowers who are financially literate and know what loan attributes they should check beforehand are likely to be vulnerable to deceptive tactics when reviewing government mandated loan disclosure forms, if they are reminded to review a subset of those attributes (an event that naïve observers would likely think innocuous). These results also provide further evidence on the shortcomings of disclosure forms to protect consumers from predatory lending. The pervasive biasing influence of such cognitive factors on how consumers interact with these forms highlights the need for future research on strategies to overcome these cognitive barriers as well as considering alternative strategies to protect consumers.

However, several features of the current study limit the extent to which these findings can be extended to separate populations and contexts. One limitation relates to attributes used in the study set. These attributes were selected to reduce the effects of prior knowledge on new learning

(e.g., Morris et al., 1985), as consumers who were not familiar with contemporary home loans would not have known of these attributes prior to participation in this study. While providing greater experimental control, the use of these attributes limits the generalizability of these findings. Many consumers are familiar with some attributes that are more important to check when evaluating a home loan (e.g., interest rate and monthly payment) Although Stark et al. (2013) found that confirmation biases made consumers vulnerable to missing these more important attributes suggesting that they are unlikely to be immune from part-set cuing effects, the effect sizes of part-set cuing on these better known attributes could very well be smaller than the effect sizes observed here.

A second limitation concerns the criteria used to delineate those with home loan experience from those without such experience. Home loan experience was defined as having either previously taken out a loan or assisted a family member or friend during the lending process. No evidence was found that home loan experience reduced the effects of part-set cuing on search during review or retrieval post-review. However, greater familiarity with the disclosure form and the locations on the disclosure form where important loan attributes are presented may be more likely to reduce the effects of part-set cuing. Previous studies on memory for the locations of chess pieces on a chessboard found that experience with the game mitigated part-set cuing inhibition (Watkins et al., 1984; Huffman et al., 2001; Chase & Simon, 1973; Drinkwater et al., 2006). According to Ericsson and Smith (1991), chess serves as an excellent model for how experience influences the organizational strategies and structures individuals use to remember information, because a player's overall rating is a reliable measure of their skill level. In contrast, the measure of expertise used in the present study was general and imprecise. How involved participants were in the lending process, the recency of this experience, and



whether or not the loan that the saw was disclosed on the disclosure form used in this experiment (the HUD-1 form used here went into use in 2010) was not taken into consideration. General financial literacy or knowledge related to home-loans was also not measured. Thus the role of experience in moderating the part-set cuing effect within a home loan context is a topic that requires further research.

### **Policy Implications for Consumer-Protection**

Along with the results of other studies that have been conducted in our laboratory (Stark et al., 2013; LeBoeuf et al., 2014), the current results demonstrate that reliance on home-loan disclosures alone as the sole strategy for protecting consumers from overpriced and unaffordable home loans is not sufficient. As has been proposed elsewhere, financial counseling will likely be required as well. In Stark, Choplin, and LeBoeuf (2013), it was argued that an effective way to ensure that consumers comprehend their loan's risks and costs is through "mortgage counseling interventions." Such interventions would initially provide consumers with an explanation of the terms of the loan for which they had applied. In addition, an independent mortgage counselor would advise consumers on whether they thought the loan was overpriced, unaffordable, risky, or inappropriate for the consumer relative to their qualifications and financial goals. The current findings suggest that even relatively sophisticated consumers who know ahead of time to check certain loan terms may also be vulnerable underscores the need for financial counseling.

Furthermore, this research suggests that financial counselors should review loan attributes in a systematic fashion to prevent part-set cuing effects. Attributes that are discussed frequently or for extended periods of time by the counselor will likely be more accessible in the consumer's memory. This could produce forgetting of the less-accessible attributes when the consumer subsequently reviews the loan disclosure forms, because the more accessible attributes

might interfere with the retrieval of less accessible attributes. Thus, counselors would be advised to allocate an equivalent amount of attention to all of the attributes discussed with the consumer.

### **Potential Strategies For Overcoming Part-set Cuing Inhibition**

The results of the present study provide a clear message: part-set cuing inhibition can negatively impact real-world outcomes. A key question that remains, then, is whether strategies can be developed to avert or reduce the ill effects of part-set cuing in prospective memory tasks. One possible approach is to use implementation intentions. An implementation intention was described by McDaniel, Howard, and Butler (2008, p. 717) as a “planning technique that involves specifying a situation for initiating an intended action and linking these specific cues to the intention”. Prior research has demonstrated that forming an implementation intention can enhance one’s likelihood of successfully retrieving and executing the intention (Gollwitzer & Brandstatter, 1997; Orbell, Hodgkins, & Sheeran, 1997; Liu & Park, 2004; McDaniel et al., 2008). For example, Sheeran and Orbell (1999) conducted a study on how implementation intentions affected participant’s prospective memory for taking a Vitamin C tablet over a three-week period of time. Those who created a specific plan of where and when they would take the tablet each day took the tablet more frequently relative to those who simply created a general intention. It is possible that similar techniques could help home-loan consumers avoid the ill effects of part-set cuing. Future research might investigate the usefulness of implementation intentions for reducing part-set cuing effects when consumers review home-loan disclosure forms and on other prospective-memory tasks.

Part-set cuing effects could also be addressed through the use of external memory aids. External aids (e.g., checklists, memos) are used more frequently than internal aids (e.g., mnemonics, retrieval strategies) (Harris, 1984; Harris, 1992) and have been found to improve

everyday retrieval in those with memory impairments (Sohlberg et al., 2007). Consumers might be able to similarly improve their retrieval of critical loan attributes by creating an external inventory of these attributes prior to reviewing their disclosure form. Such an approach to retrieval would also likely be immune to the ill effects of part-set cuing.

The present study also demonstrates that socio-demographic characteristics play a role in determining the information that individuals glean from disclosure forms and how this information is used when evaluating the quality or fairness of a loan. Over the past decade, a number of legal cases have surfaced that highlight the problems of failing to furnish disclosures and communicate loan terms to NNES consumers in their native language. For example, in 2003, a lender orally promised several Hispanic-speaking consumers in Spanish that they would consolidate two separate mortgages at a fixed rate of 7.8% (*Vasquez-Lopez v. Beneficial Oregon*, 2003). However, the lender had the consumers sign the final loan documents, which were written in English, for an additional mortgage loan with a rate of 12.9% (see also *Munoz v. International Home Capital Corporation*, 2004; *Gonzalez v. Ameriquest Mortgage Corporation*, 2004).

After adjusting for experimental condition, years of formal education, prior home loan experience, and ethnicity, results indicated that NNES participants checked a lower percentage of non-cued attributes relative to native English speakers. This finding is consistent with prior research regarding the increased susceptibility of NNES borrowers to predatory lending tactics (Neil, 2006), and it highlights the need for legislation ensuring that loan documents and loan-related oral communications are provided to NNES consumers in their native language. Currently, federal law does not require that lenders and brokers provide disclosures in a foreign language (Truth In Lending Act, 1968).

The demographic analyses also revealed that non-White participants provided more favorable ratings for the loan relative to White participants. Participants should have rated the loan poorly, given its relatively high adjustable interest rate. The finding that non-Whites viewed the loan more favorably than Whites echoes prior observations that minorities, such as African Americans, consistently exhibit low levels of financial literacy (Mandell, 2008). Predatory lenders have historically targeted members of minority groups, and the results obtained here demonstrate the continuing need to focus efforts intended to bolster financial literacy and awareness on minority groups.

### **Application of Findings to Other Prospective Memory Tasks**

These findings expand upon prior part-set cuing research involving directed retrospective retrieval tasks (e.g., Roediger et al., 1977; Slamecka, 1968, 1969) by providing initial evidence that the part-set cuing phenomenon extends to prospective memory. Extant research on part-set memory has largely neglected this memory domain, despite its implications for the performance of many everyday tasks. By establishing a link between forgetting in retrospective memory tasks and prospective memory tasks, these results speak to the generality of the part-set cuing phenomenon and add to the relatively small number of applied part-set cuing studies (e.g., Reysen & Nairne, 2002; Welldon & Bellinger, 1997; Pei & Tuttle, 1999; Bovee et al., 2009). Future research should extend the research presented here by investigating whether part-set cuing interferes with other prospective memory tasks such as purchase intentions, dietary planning, medication adherence, as well as many other daily tasks that require prospective memory.

These results also suggest that existing theories of part-set cuing can explain forgetting in prospective memory tasks. When considering part-set cuing theory, these findings align best with either the response competition (Rundus, 1973) or retrieval-inhibition (e.g., Anderson et al.,

1994) accounts of part-set cuing. Little supporting evidence was obtained for the occurrence of strategy disruption (Basden et al., 1977; Basden & Basden, 1995), though the current experiments did not control for the cognitive strategies participants implemented during the review or post review phases. The observed forgetting of non-cued attributes could thus potentially be attributed to a combination of response competition, retrieval inhibition, and strategy disruption. However, it should be noted that the goals of the present study were to understand the part-set cuing phenomenon in a real-world memory context that has clear implications for the well-being of home-loan consumers, as well as to provide evidence of the effects of part-set cuing on prospective memory. Future research should attempt to clarify how these effects emerge in prospective memory tasks to further the development of an inclusive account of part-set cuing effects in both prospective and retrospective memory tasks.

Although the data are consistent with the hypothesis that strengthening a subset of learned material leads to forgetting of non-strengthened material, whether through response competition or retrieval inhibition, alternative interpretations remain. One interpretation for the observed differences in the visual search data is that cuing participants lead to *satisfaction of search* (SOS). SOS, as it typically defined in the medical literature, occurs when the detection of one abnormality causes an individual to miss a separate abnormality (see Berbaum, Franken, Caldwell, & Schartz, 2009, for review). Fleck, Samei, and Mitroff (2010) recently demonstrated this phenomenon in a non-medical context with airport baggage screeners. The authors found that as the frequency of “high-salience” targets increased (e.g., a water bottle) relative to the frequency of “low-salience” targets (e.g., a box cutter), participants failed to detect the low-salience targets more often.

Cuing may have had a similar effect on visual search within the disclosure form. Cued attributes should have been more salient in memory than non-cued attributes. Detecting these attributes may have prompted participants to be “satisfied” with the information that they had gleaned from the critical page, which in turn caused them to give up search too early. The viewing time results from all three experiments lend support to this interpretation, as those cued with a moderate number of attributes viewed the critical page for shorter durations relative to those cued with a minimal number of attributes. However, eye-tracking research within the radiological literature has yet to provide support for the notion that SOS errors are caused by curtailed visual search (e.g., Berbaum et al., 2009), making this interpretation somewhat less plausible.

The question, then, is how part-set cuing affects an individual’s decision regarding when to terminate search in displays that contain a number of potential search targets. As mentioned earlier, it is possible that retrieval- or competition-related impairments led participants to falsely believe they had successfully checked all of the attributes they knew to check. At the moment, though, this proposal is based primarily on meta-cognitive part-set cuing research (e.g., Rhodes & Castel, 2008). Future research examining the relationship between the part-set cuing phenomenon and visual search duration in multitarget displays could provide valuable insights on the role of memory salience in the decision making process regarding when to terminate search.

Additionally, to understand the scope of this effect in prospective memory tasks, future research should examine how varying the temporal delay between when the material is cued/retrieved and when it must be remembered. Retrieval-induced forgetting has been shown to last for up to a week after the retrieval event (e.g., Garcia-Bajos et al., 2009). In a recent review,

Storm and Levy (2012) noted that the “exact temporal boundary conditions of retrieval-induced forgetting have yet to be determined” (p. 838). Given that retrieval-induced forgetting is considered to be functionally equivalent to part-set cuing inhibition (e.g., Anderson & Neely, 1996; Bäuml & Aslan, 2006), forgetting stemming from part-set cuing might affect prospective memory long after the original intention was formulated. Future research might vary the time between intention formation and the realization of the intention to gain a better idea of the scope of part-set cuing effects in prospective memory tasks.

### **Using Eye Tracking Technology to Inform Loan Counseling and Form Design**

The data afforded by eye tracking can provide actionable insights on two topics pertinent to consumer protections: loan counseling and form design. Loan counseling refers to information received in a one-on-one setting, and it is premised on the belief that exposing consumers to additional information can encourage “better” financial decision making (Collins & O’Rourke, 2010; Stark & Choplin, 2010). Presumably, one way loan counseling improves home-loan decision-making is by helping consumers differentiate between loan attributes according to their importance. In line with Haider and Frensch’s (1999) information-reduction hypothesis, loan counseling should increase the likelihood that consumers remember to check important attributes, such that consumers selectively allocate more attention (i.e., greater fixation probabilities) towards important attributes and less attention (i.e., lower fixation probabilities) to less-important attributes when reviewing a loan disclosure form relative to those who have received no prior counseling. Additional learning would also be expected to mitigate the downstream effects of part-set cuing impairment, such that consumers would remember to check for the most important attributes regardless of changes in their accessibility in memory. However, at the moment, this remains an open question for future research.

Eye tracking also has the potential to inform the development and design of improved disclosure forms. For example, in a series of two experiments Stark, Choplin, LeBoeuf and Pizor (2013) examined the decision by the Consumer Financial Protection Bureau (CFPB) to relegate the Annual Percentage Rate (A.P.R.) to the third page of their new disclosure form. The decision was based on research indicating that most consumers could not define the meaning of the A.P.R. However, this is problematic given that the A.P.R. is the only loan attribute that combines the interest rate, fees, and most major loan costs into a figure consumers can easily compare across different loan options. These experiments contrasted the existing form with a modified version of the new CFPB form where the A.P.R. was presented on the first page inside a price tag icon that read “APR: Price of the Loan” and “Lower is better for you.” Results from Experiment 1 indicated that only 44% of participants correctly identified the lower cost of two loans with the existing form. That is, 56% of participants judged the loan with the lower interest rate and higher A.P.R. to be cheaper, despite containing extraordinarily high fees. In contrast, 74% of participants correctly identified the lower cost loan with the modified form. In Experiment 2, participants’ eye movements were tracked while they reviewed either the existing or modified version of the form. Results from this experiment indicated that 19% of participants failed to fixate the A.P.R. when it was located on the third page, while no participants failed to fixate this information when it was presented prominently on the first page. If consumers frequently forgot to check for important provisions contained on loan disclosure documents, as was shown in Experiment 2, eye-tracking could be used to guide the design of alterations intended to make these provisions more visible.

From a methodological perspective, this research suggests that eye-tracking technology can help protect consumers from predatory lending practices, improve the usability and value of



disclosure forms, and nudge consumers towards better financial decisions by careful placement of loan terms in locations on disclosure forms where they will have positive impacts on decision-making (Thaler & Sunstein, 2008). It can, for example, help design forms that minimize the number of fixations that precede the discovery of highly important attributes. Furthermore, eye-tracking technology can similarly be used to improve the usability of many other forms that present important information to people, such as medical consent forms.

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## Appendix

## Inventory of Correct Free Recall Responses

A correct response, as it is defined here, matched one of the following descriptions.

**Line 801 (The origination charge)** – *Origination Charge; Origination fee; Origination cost; Origination payment;*

**Line 802 (Your credit or charge (points) for the specific interest rate chosen)** – *Credit for the specific interest rate chosen; Charge for the specific interest rate chosen; Points for the specific interest rate chosen; Interest rate credit; Interest rate charge; Interest rate points; Credit points; Charge points; Points.*

**Line 803 (Your adjusted origination charges)** – *Adjusted origination charge; Adjusted origination fee; Adjusted origination cost; Adjusted origination payment; Adjusted origination.*

**Line 804 (Appraisal Fee to Max Appraiser)** – *Appraisal fee to max appraiser; Appraisal fee to appraiser; Appraisal fee; Appraisal cost; Appraisal payment; Appraisal charge; Appraisal;*

**Line 1101 (Title services and lender's title insurance)** – *Title services and lender's title insurance; Title service insurance; Lender's title insurance; Services insurance; Title insurance.*

**Line 1102 (Settlement or closing fee to RST Title)** – *Settlement or closing fee; Settlement fee; Closing fee.*

**Line 1107 (Agent's portion of the total title insurance premium)** – *Agent's portion of the total title insurance premium; Agent's portion of the title insurance; Agent's portion of the title premium; Agent's portion of total insurance premium; Agent's charge; Agent's fee; Agent's cost; Agent's portion.*

**Line 1108 (Underwriter's portion of the total title insurance premium)** – *Underwriter's portion of the total title insurance premium; Underwriter's portion of the title insurance;*

*Underwriter's portion of the title premium; Underwriter's portion of total insurance premium;  
Underwriter's charge; Underwriter's fee; Underwriter's cost; Underwriter's portion.*