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To Recognize or Not to Recognize: What Is the Effect on Relearning?

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TO RECOGNIZE OR NOT TO RECOGNIZE: WHAT IS THE EFFECT ON RELEARNING?

By

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ABSTRACT

Repeated experiences are a cornerstone of learning and memory, but to what extent does the benefit of repetition depend upon noticing it? A rich literature exists examining the impact that an original learning experience has on a current experience when recognition of repeated material occurs while a surprisingly limited amount of research has examined the impact on relearning when recognition of repetition fails. Asch (1969) reported that recognition of repetition was necessary to experience a benefit of repeated experiences while the formal memory model Retrieving Effectively from Memory (REM; Shiffrin & Steyvers, 1997), incorporating elements of Asch, assumes that an initial experience establishes a memory trace which is added to during a repetition, but only if the repetition accesses the original trace. If the repetition is not noticed, a second memory trace is created. I discuss research exploring the impact of recognition during a subsequent learning experience when the lists are separated by extreme context changes. In two experiments I attempted a conceptual replication of Asch and show that while recognition may not be necessary to receive a benefit of repeated information, there is a greater benefit during relearning when recognition of repetition occurs.

CHAPTER 1

INTRODUCTION

When relearning information is there a greater benefit to recalling the specific prior learning episode or does original learning impact relearning speed regardless of whether the specific instance is recollected? While studying for a cumulative final at the end of the semester I may need to relearn material from the start of the semester as some (or most) of it has been forgotten. However, recalling a specific example from an earlier class may facilitate faster relearning. Whether it is relearning material from the beginning of the semester or relearning the name of someone we met recently, relearning information is a common part of life.

While the mechanisms underlying the effect of repeated experiences are not entirely understood, it is widely accepted that prior experience informs current experience. Indeed, if repeated experiences had no bearing on later experiences heuristics, schemas, and other methods of adapting to the world would be rendered impotent and would be theoretically uninteresting. Conversely, the effect of prior experience on current experience is repeatedly and robustly demonstrated in a beneficial manner in a variety of paradigms such as the testing (Roediger & Karpicke, 2006), spacing (Wahlheim, Dunlosky & Jacoby, 2011), and savings effects (Nelson, 1978) whereas prior learning can be detrimental in paradigms such as proactive (Lustig, May & Hasher, 2001) and retroactive interference (Wickelgren, 1965). Regardless of the way prior experiences affect current experiences, at the core of all these effects is the assumption that some kind of an original learning experience is now affecting a current learning experience. The ability of prior experiences to inform current experiences makes the effect of repeated experiences theoretically interesting and has resulted in a rich literature aimed at identifying the impact and boundary conditions that repeated experiences have on current experiences.

The literature examining the effect of original learning on a new learning experience has resulted in the largely untested assumption that a current learning experience is affected by an original learning experience even when a repeated experience is not identified as such. However, building on the work of influential thinkers (Bain, 1855; Kohler, 1941), Asch (1969) proposed that recognition of a repetition is an essential mechanism in benefitting from prior learning, without which prior learning, regardless of associative strength, does not aid relearning. To test this proposition participants in Asch (reported in 1969) learned a short list, List 1, of number – letter pairs and then were repeatedly tested, or asked to "anticipate" the target, until they reached a criterion of three consecutive correct recalls of the critical pair (e.g., 24 – E). After a brief retention interval participants learned and were repeatedly tested on a new list, List 2, where only one critical repeated pair carried over between lists until they reached a criterion of one errorless cycle on the entire list or to a maximum of 20 cycles. Participants then completed a recognition test of the repeated pair and, based on their responses, their data were divided into two groups; recognizers and non-recognizers. A purely associanistic approach to relearning would predict that because the repeated pair was learned to criterion just minutes ago it would be both available and accessible to aid relearning. To the contrary, only participants who recognized the repeated pair during study of List 2 benefitted from their original learning when compared to a new pair which only appeared in List 2 (e.g., 26 – F). While there are several possible mechanisms underlying the benefit of repeated experiences, Asch's results show that recognition of repetition may be critical.

Incorporating recognition as a critical component in the benefit received from repeated information the formal memory model Retrieving Effectively From Memory (REM; Shiffrin & Steyvers, 1997) and its predecessor The Search of Associative Memory (SAM; Shiffrin, Ratcliff & Clark, 1990) have been found to support a variety of memory data. The REM models assume that when retrieval of information stored in a memory trace by a current stimulus does not occur another memory trace is created resulting in two less differentiated memory traces. However, when retrieval of information by a current stimulus is successful the original memory trace is updated with additional features resulting in a single more differentiated trace. The more informative single trace is more likely to be sampled and the contents retrieved from memory during a relearning experience than the two less informative traces. Yet, typically used paradigms often guarantee that information from a current learning experience will be added to the existing memory trace from the original learning experience by reinstating the original context of recently learned information at test (e.g., using the same experimenter and/or same location between original learning and relearning), or informing participants of the repeated nature of the material. Both contextual reinstatement and informing participants of repeated material make identifying repeated information extremely likely, even though it is far from inevitable. One such example originates from the savings paradigm, where *savings* is indicated by increasing acquisition speed during relearning.

Originally conducted by Ebbinghaus (1885/1964) and later revised by Nelson (1971, 1978), a prototypical savings experiment required participants to learn a list of paired associates to criterion during session one and then, after a retention interval, learn and be tested on another list during session two. The list studied during session two consisted of half repeated items from the first list and half repaired items where the targets from the first list were matched with different cues from the first list. The savings paradigm was primarily used to assess the impact of relearning for items which were unrecalled but recognized or items which were unrecalled and unrecognized prior to learning the new list necessitating the use of a recall test and a recognition test for List 1 stimuli prior to learning List 2 stimuli (correctly recalled items were studied in the second list but the data were not analyzed). Nelson found that recall of repeated "old" items on the test of List 2 was higher than for repaired "new" items, even though participants failed to recall or recognize the items on the test prior to re-learning.

While great care was taken in the savings paradigm to ensure participants were unaware that a second session would occur, during the second session participants returned to the same lab (possibly with the same experimenter in the same room), received instructions to recall and recognize the pairs learned during session one, and were informed that distinguishing between the items which repeated from List 1 and the new items presented for the first time on List 2 would be beneficial. The contextual reinstatement elements and specific instructions to use information from the original learning experience likely resulted in participants accessing and adding to the memory traces from learning of List 1 rather than creating new traces for the repeated information. Without the contextual reinstatement elements built into the experimental design it is likely that many more participants would fail to recognize the repeated material spontaneously. If these design elements were eliminated would there nonetheless be a benefit of the repetition, especially after long retention intervals where both internal and external context would be increasingly disparate from the context of the original learning experience (Groninger & Groninger, 1980; Nelson, 1978)?

Similar experimental design elements that facilitate or require accessing original learning are found across most of the memory literature and show that, during a current learning experience, when prior learned information is both identifiable and recallable there is an impact, positive in relearning and negative in interference paradigms, on current performance. While the results from this type of research form an important basis for understanding how memory can work, it may not be an exclusive representation of how memory functions. Specifically, when prior learned information is not recalled or accessed during a current relearning experience what is the subsequent impact on relearning?

When retrieving a memory trace from a prior learning experience the REM model proposes a global matching process which primarily uses item and context information to probe memory in different ways depending on the retrieval method; free recall primarily uses context information, recognition primarily use item information with some contextual information, and the simple model of cued recall (as in paired associate learning) uses both context and item information (Criss, Aue & Smith, 2011; Diller, Nobel, & Shiffrin, 2001; Gillund & Shiffrin, 1984). The features of the test stimulus are compared to the features of all traces stored in a specific context (e.g., during an experiment) and greater similarity among features produces more positive evidence. The trace which produces the most positive evidence, if any, is then accessed. Critically, REM proposes a two-step process where the appropriate trace must first be sampled *and* the information from that trace must be successfully accessed in order to produce recall. If either step fails then so does recall and a new memory trace is created. Thus cued-recall paradigms which reinstate the original context are facilitating the use of contextual information which may not always be available resulting in a decreased likelihood of sampling and accessing memory traces from a prior learning experience. While Shiffrin and Steyvers (1997) did not directly test the role recognition played in relearning, they successfully fit a variety of data with the assumption that recognition of repetition is beneficial during repeated experiences.

Despite the influential nature of the REM model, for many the findings of Asch (1969) remain counterintuitive because the repeated information was recently learned, and the repeated material should transfer to a new learning experience. However, converging evidence from several areas supports the counterintuitive notion that recognition may be an important mechanism in benefitting from repeated experiences. Encoding specificity shows that simply because an item is repeated does not mean it will be identified as having been previously learned, especially if the context of the word has changed (i.e., if the target word is presented with a different cue word). Tulving and Thomson (1973) required participants to learn three lists of weakly related word pairs (e.g., *ground* – COLD), with the third list being the critical list. Participants then generated (Experiment 1) or were provided with half and generated half (Experiment 2) of the free association responses for strong extralist cues for each target in list 3 (e.g., *hot*). From the available responses participants then attempted to identify List 3 target words. While a majority of the List 3 target words from the strong extra list cues (e.g., *hot* – COLD) were available participants failed to recognize most of them, despite being able to recall many of the target words on a subsequent cued recall test using the List 3 weakly related cues. While no relearning occurs in the encoding specificity paradigm, the results show that recognition of repeated recently learned information (e.g., COLD) can fail if the original cues (e.g., *ground* – COLD) are not present.

There is limited evidence that when prior learned repeated information is not recognized during study of a subsequent list there is no benefit at test. Wahlheim, Maddox, and Jacoby (2014) manipulated study-phase retrieval, also called *remindings*, to either encourage or discourage participants from "looking back" to prior lists and recognizing spaced repetitions between two lists. Participants discouraged from noticing between-list repetitions, via a within-list monitoring task, experienced fewer remindings and subsequently diminished recall of the repeated items on a subsequent cued-recall test when compared to participants who were encouraged to notice between-list repetitions, via a monitoring task directing them to note repetitions from either list. Wahlheim and colleagues found that participants encouraged to notice between-list repetitions during study of the second list identified more pairs repeated between the first and second list than those discouraged from noticing repetitions which resulted in greater performance on a subsequent cued recall test. Further, when recall was conditionalized for both groups based on recognition of repeated pairs between study lists at test (yes vs. no), recall for unrecognized pairs was the same as items presented a single time (Experiments 2 and 3).

Inside the REM framework information is stored in memory traces probabilistically such that each feature has a chance of being stored resulting in an updated memory trace; however, when a feature is not stored the feature value inside the trace is zero indicating a lack of information. While decreased recall for unrecognized repetitions in Wahlheim and colleagues (2014) could represent a lack of information stored in memory traces for specific stimuli during study of List 1 making some repeated items essentially singly-presented items during study of List 2, it is also possible that when recognition of repetition failed a new trace was formed because the current learning experience did not result in accessing and adding to the existing trace. In accord with Asch (1969), recognition was important in the benefit gained from repeated information such that failing to recognize between-list repetitions resulted in equivalent recall of between-list repetitions and new items.

Recognition of the similarity between original learning and relearning may be an important mechanism in benefitting from repeated experiences. As such, it is important to understand the role of recognition in accessing and benefitting from prior experiences. However, many experimental designs effectively preclude the possibility that participants may not recognize the repeated nature of the material, which has received little attention. Collectively, the literature suggests that recognition of repeated information during relearning can fail resulting in limited or no transfer of learning from an original learning experience. In the current thesis I considered the impact of spontaneous and informed recognition of repeated information implementing the experimental design of Asch (1969) with two important changes: First, I introduced extreme context changes between list learning for all participants allowing recognition of repetition to fail and, second, I used the more meaningful stimuli of word pairs instead of number-letter pairs. Recognition of repetition was assessed after learning of List 2 was completed using a post-study questionnaire to quantify recognition.

CHAPTER 2

EXPERIMENTS

2.1 Experiment 1

Experiment 1 was two-fold in purpose: 1) Determine if Asch's (1969) results of the role of recognition in benefitting from repeated experiences was conceptually replicable, and 2) a proof of concept to determine if only recognition of repetition produced a benefit when the more meaningful stimuli of word pairs were used, as opposed to the number-letter pairs used in Asch. I employed a variety of context changes, similar to complex context changes found in other work (Isarida & Isarida, 2010), between learning of List 1 and List 2 to reduce the likelihood that participants would recognize the repeated pair on List 2. I predicted a difference in relearning based on recognition such that when recognition of the repetition occurred during study of List 2 participants would learn the repeated pair in fewer cycles than a new pair but when recognition of the repetition failed participants would not learn the repeated pair in fewer cycles than a new pair.

2.1.1 Method

2.1.1.1 Participants. An a priori power analysis using G*Power 3.1 (Faul, Erdfelder, Buchner, & Lang, 2009) indicated 15 participants were needed to detect a large effect found in similar experiments with letter-number pairs. However, participants were oversampled to account for an unknown effect size using word pairs and differential distribution of participants who become aware of the repetition versus not based on a post-study questionnaire. Data were collected from 49 Florida State University undergraduates who received partial course credit for their participation.

2.1.1.2 Materials and Design. Sixty-eight concrete noun word pairs were divided into two study lists, of which two counterbalanced pairs were designated as either a critical repeated or critical new pair for each participant and were balanced for frequency, length, concreteness, and forward associative strength. The 24 word pairs from List 1 were presented in a set order using flash cards where the cues were on one side and the targets on the other side while the 45 word pairs from List 2 were presented in a computer-randomized order unique to each participant with a single pair repeating between List 1 and List 2.

A post-study questionnaire was employed upon completion of List 2 learning where the experimenter verbally assessed if participants were reminded of the critical repeated pair during study of List 2 (See Appendix F). The questionnaire was formatted to determine if participants detected the repeated pair during learning of List 2, rather than realizing the pair was on both lists while completing the questionnaire. The questionnaire began with broad questions (e.g., "Did you notice anything special about any of the pairs in the second list you learned?") and became increasingly specific (e.g., "Do you remember which pair was on List 2 that you recognized from List 1") targeted to determine whether recognition of the repeated pair occurred and, if so, when it occurred. Criteria for inclusion in the recognizer condition was strict with only participants who correctly recalled the repeated pair and indicated noticing this repetition during study of List 2 being identified as a recognizer whereas responses which indicated a participant was not reminded of the repeated pair or that recognition did not occur during study of List 2 resulted in their inclusion in the non-recognizer condition for data analysis. The experiment employed a within-subjects design where pair type (repeated vs. new) was manipulated such that participants received both a critical repeated and critical new pair on List 2.

2.1.1.3 Procedure. All participants learned and were tested individually in the experiment. Participants studied and were repeatedly tested on List 1 word pairs using a set of flashcards with the cue on the front and the target on the back. During study of List 1 participants read the cue word on the front and either recalled the word on the back or said "pass" aloud until a criterion of two consecutive correct recalls of the to-be-repeated critical pair was reached. Upon completion participants were returned to the participant waiting room for a short break. After the break, participants were retrieved by a different experimenter and then learned and were repeatedly tested on another list of word pairs, List 2, where the cue word was presented on the screen and participants said the cue word aloud until they reached a criterion of two consecutive correct recalls of both the critical repeated pair and the critical new pair. The assignment of word pair to repeated or new on List 2 was counterbalanced.

During initial learning participants were met by the experimenter in the participant waiting room and guided to the top landing of the FSU psychology building stairwell (which had no foot traffic because the door on that floor required special access) where they studied the word pairs from List 1 which were printed on flash cards with the cue on the front and the target on the back. During the initial learning presentation participants generated a sentence incorporating the cue and the target word for each pair (e.g., The "DOG" balanced a "SPOON" on its nose). After verbally reporting the sentence aloud participants then walked across the landing. The sentence generation then walk procedure was repeated for each pair in the list. During subsequent learning cycles participants were not required to use or say the sentence aloud; however, many participants said pieces of their sentences aloud during the recall process. For each pair during the learning cycle participants read the cue aloud and, if the target was recalled, said the target aloud; if the target was not remembered they guessed or said "pass."

After providing a response, participants were able to receive feedback by looking at the back of the cue card. While not mandatory, most participants chose to receive feedback for every pair throughout the entire study of List 1, usually comprised of four or fewer cycles through the list (M = 2.7). Participants were permitted as long as necessary to provide each target and continued cycling through the list as many times as necessary to reach a criterion of two consecutive correct recalls of the critical word pair, to a maximum of 12 cycles. When participants reached criterion they were thanked for their participation and returned to the participant waiting room for a ten-minute delay.

After a ten-minute delay a different experimenter met participants in the participant waiting room and brought them to the new context of a lab in the FSU psychology building. During learning of List 2 participants sat in front of a computer and studied a list of word pairs presented for four seconds each. Participants were instructed to learn all items on the list but, unlike List 1, no encoding strategy was provided during study of List 2. Each subsequent cycle through the list participants were presented with only the cue (e.g., "SCHOOL --- ???") and, if the target was recalled (e.g., "PLANT"), they said it aloud; whereas, if the target was not recalled participants were instructed to guess or say "pass." Participants received feedback after every response such that if the target were correctly recalled the next pair was presented automatically whereas if the target was not correctly recalled the correct cue-target pair (e.g., "SCHOOL --- PLANT") displayed on the screen for one second. If an answer was provided the experimenter typed in the answer provided whereas if a participant chose to "pass" the experimenter advanced to the next pair without entering a response. Response time was not limited, such that the experimenter did not advance to the next pair until an answer or "pass" was provided by the participant. The participant continued through the list as many times as necessary to reach a criterion of correctly responding to both the critical repeated and critical new word pairs two times consecutively, or to a maximum of 8 cycles through the list. Upon completion of List 2 the experimenter assessed if participants were reminded of the critical repeated pair during study of List 2 using the verbal post-study questionnaire. Participants were then thanked for their participation and excused.

2.1.2 Results and Discussion

All 49 participants reached criterion on List 1 of two consecutive correct recalls of the to-be-repeated pair. Based on the post-study questionnaire 34 participants were identified as recognizing the critical repeated pair during study of List 2 and 15 participants were identified as failing to recognize the critical repeated pair. The prediction that participants who recognized the repeated pair as having been studied on List 1 while learning List 2 would learn the repeated pair in fewer cycles than the new pair was supported by a planned comparison, $t(33) = 4.35$, $p < .001$, $d = .72$ (See Figure 1). Importantly, I also predicted that participants who failed to recognize the repetition would not relearn the repeated pair in fewer cycles than the new pair which was supported by a planned comparison, $t(14) = 1.72$, $p = .11$, $d = .44$, but, surprisingly, these participants had a trend toward learning the repeated pair in fewer cycles than the new pair.

The results of Experiment 1 provide tentative support that recognition of repetition was important in the benefit received from the repeated presentation of a pair between two lists, indicating that the results of Asch (1969) may be conceptually replicable with the more meaningful stimuli of word-pairs. Failure to recognize recently learned repeated information resulted in numerically but not significantly fewer learning cycles of a repeated pair over a new pair during study of List 2. Conversely, when the information was recognized as repeated during a current learning experience criterion was reached in fewer cycles for the repeated pair than a new pair. Asch (1969) proposed that recognition of repetition required at least a two-step process wherein a stimulus must first be identified as repeated based on similarity before associative recall could be successful. A failure of either recognition or associative recall would produce an inability to recall the pair resulting in no benefit of a repeated experience. Under Asch's two-step assumption, requiring the use of an effective encoding strategy during study of List 1 (i.e., sentence generation) and learning to the criterion of two consecutive correct recalls made it likely that if the repeated pair was recognized during study of List 2 associative recall would also be successful. Therefore, if the repeated pair were not recognized during study of List 2 then recall failure should have occurred as participants would be unable to access the original cue-target association. However, the trending performance for non-recognizer participants to learn the repeated pair in fewer cycles than the new pair during study of List 2 did not provide strong support for Asch's assumption that recognition must proceed associative recall to be successful, especially as there was limited power to detect an effect of recognition (α = .36) due to a small sample size (N=15).

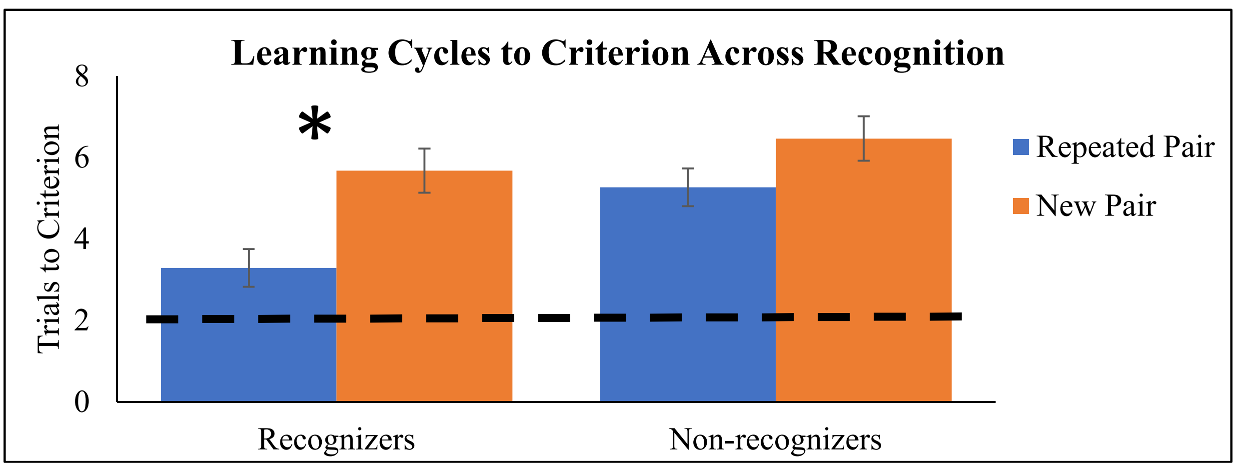

Figure 1. Trials to criterion across recognition in Experiment 1. Graph shows the average number of cycles required for participants to reach a criterion of 2 consecutive recalls for the indicated pair across recognition. The dashed line represents the fewest number of cycles possible to reach criterion. Error bars show standard error of the mean.

Within the REM model successful retrieval requires that a memory trace be sampled and the contents be accessed. Sampling depends on the relative strength of the item compared to all other items in memory whereas accessing content depends on the absolute strength of the item. Strong traces are more likely to be recalled because they are more likely to be sampled and because their contents are more likely to be retrieved. Thus while a single detailed trace is more likely to be sampled and accessed during the global search matching process resulting in a large benefit when relearning information, multiple less differentiated traces may also be beneficial as each has a probability of being sampled and accessed (Sahakyan & Malmberg, 2018). In Experiment 1 participants who successfully sampled and accessed the repeated pair added features to the memory trace from List 1 learning during study of List 2 resulting in fewer cycles to criterion for the repeated than new pair. Conversely, non-recognizer participants failed to sample and access the trace from List 1 resulting in the creation of a second less detailed trace. From the two independent traces created, one during study of each list, participants had a lower probability of retrieving either trace during subsequent learning cycles of List 2, although even if the List 1 trace were sampled and accessed the participants may not have identified it as being from List 1 resulting in a diminished benefit of repeated information. Thus, with additional power the trending performance of the non-recognizers to learn the repeated pair in fewer cycles than the new pair may become significant reflecting non-recognizer participants occasionally accessing and retrieving multiple less detailed traces resulting in a small potential benefit during relearning.

2.2 Experiment 2

In Experiment 2 I extended the findings of Experiment 1 by adding an informed condition and increasing the power in the non-recognizer condition. Participants in the informed condition were instructed of the presence, but not the identity, of the repeated pair between Lists 1 and 2. Informing participants of the presence of the repeated pair was expected to facilitate sampling and accessing the List 1 trace for the repeated pair leading to relearning of the repeated in fewer cycles than the new pair. Further, an interaction was expected between the three conditions (informed, uninformed recognizer, uninformed non-recognizer) during relearning such that participants in all three conditions would learn the repeated pair in fewer cycles than the new pair but that the benefit would vary across the conditions in a specific manner. I predicted that all participants would perform the same on the new pairs presented for the first time on List 2 while performance on the repeated pairs would vary by condition. Specifically, I predicted that participants in the informed condition would reach criterion on the repeated pair in the fewest cycles during relearning as they quickly accessed and added to the detailed List 1 memory trace resulting in the greatest difference between cycles to criterion for the repeated and new pairs. I further predicted that participants in the uninformed non-recognizer condition would have the smallest difference between cycles to criterion between the repeated and new pairs during relearning as they may or may not access one of the two independent less detailed traces from either List 1 or List 2. Lastly, I predicted that the difference in cycles to criterion for the repeated over the new pair for participants in the uninformed recognizer condition would be in between the informed and uninformed conditions as they should add features to the List 1 trace but accessing the trace during learning of List 2 may take additional cycles compared to the informed participants before the repetition is identified.

Additionally, Experiment 2 aimed to replicate Experiment 1 with additional power in the non-recognizer condition. Using the effect size for non-recognizers from Experiment 1 (d = .44) it was determined that 34 non-recognizers were necessary to obtain 80% power with a directional test in G*Power 3.1 (Faul *et al.*, 2009). Additional power in the non-recognizer condition may reveal significantly fewer learning cycles to criterion for the repeated than new pair as participants would have a chance of accessing one of several less detailed traces of the repeated pair during study of List 2. However, as participants who spontaneously recognize the repeated pair during study of List 2 access a more detailed memory trace, they should experience an even greater benefit of the repeated information during relearning than those who do not recognize the repeated information. As such, I predict that with additional power in the non-recognizer condition there will be an interaction between recognition and pair type such that recognizers and non-recognizers will learn the repeated pair in fewer cycles than the new pair but recognizing the repeated information will lead to a greater benefit for the recognizers than the non-recognizers.

I assessed these predictions using the same general procedure as in Experiment 1, with two changes made at the start of List 2 learning in an attempt to equalize the number of recognizer and non-recognizer participants. Unlike Asch (1969) where a majority of participants were unable to recognize the repeated pair, a majority of participants in Experiment 1 recognized the critical pair (approximately a 2:1 ratio of recognizers to non-recognizers) resulting in far more participants than needed for the uninformed recognizer condition. The first change from Experiment 1 was that, prior to learning List 2, all participants engaged in a mental context change task of diagraming their childhood home for two minutes (Delaney & Sahakyan, 2007). The second change was that participants received mismatched encoding instructions (List 1: sentence generation, List 2: visual imagery) intended to reduce recognition of the critical repeated pair.

2.2.1 Method

2.2.1.1 Participants. Data was to be collected in the uninformed condition until 34 non-recognizer participants were obtained. Two additional non-recognizers were obtained on the final day of data collection resulting in 36 total non-recognizer participants. Two hundred and ten Florida State University undergraduate students participated for partial course credit. Despite attempts to equalize the ratio of recognizers to non-recognizers from Experiment 1 using a mental context change task and mismatched encoding instructions prior to learning List 2, Experiment 2 had an even higher ratio of recognizers to non-recognizers (3.5 : 1, respectively).

2.2.1.2 Materials and Design. The same list of word pairs from Experiment 1 were used in Experiment 2. The experiment employed a 2 x 3 mixed model design where Pair Type (repeated vs. new) was a within-subjects measure such that all participants received both a critical repeated and critical new pair on List 2 and Condition (informed vs. uninformed recognizers vs. uninformed non-recognizers) was a between subjects measure where some participants were informed of the presence of the repeated pair and some were not, and some recognized the repeated pair in the uninformed condition and some did not. Participants in the uninformed condition were subdivided (recognizer or non-recognizer) based on their response to a post-study questionnaire where only participants who correctly recalled the repeated pair and indicated noticing this repetition during study of List 2 were included in the recognizer condition.

2.2.1.3 Procedure. The procedure for Experiment 2 was similar to Experiment 1, with three exceptions. First, prior to learning List 2 all participants engaged in a mental context change task of diagraming their childhood home for two minutes. Second, participants received encoding mismatch instructions between study lists (List 1: sentence generation, List 2: visual imagery). Third, participants in the informed condition received instructions regarding the presence, but not the identity, of the repeated pair. They were further informed that identifying the prior learned pair during study of List 2 would aid them in learning List 2.

2.2.2 Results

The results are summarized in Figure 2. All 210 participants reached criterion during List 1 of two consecutive correct recalls of the to-be-repeated critical pair. Forty-eight participants were assigned to the informed condition and 162 participants were assigned to the non-recognizer condition. Based on responses to the post-study questionnaire 126 participants were identified as recognizers for correctly recalling the pair that repeated from List 1 to List 2 and indicating the repetition was noticed during study of List 2 while 36 uninformed participants were identified as non-recognizers for failing to recall the pair that repeated between lists or indicating they did not notice the repetition while studying List 2. As a manipulation check, participants in the informed condition also completed the recognition questionnaire with 42 indicating recognition of the repeated pair during study of List 2 and six indicating that they did not recognize the repetition. Due to the limited number of informed non-recognizers no distinction was made between recognizers and non-recognizers in the informed condition for analyses. Directional analyses were used, where appropriate, because Asch (1969) and the Shiffrin and Steyvers (1997) REM model predict either similar or improved performance for repeated pairs over new pairs, which was supported by the results of Experiment 1.

To determine the impact of recognizing the repeated information on relearning a 2 X 3 mixed model ANOVA of cycles to criterion during List 2 was conducted, with Pair Type (repeated vs. new) as a within-subjects factor and Condition (informed vs. uninformed recognizers vs. uninformed non-recognizers) as a between-subjects factor. The main effect of pair type indicated that the repeated pair was learned in fewer cycles than the new pair, $F(1, 207) = 41.20$, $p < .001$, $\eta^2 = .16$. The main effect of condition indicated that cycles to criterion varied between the three groups, $F(2, 207) = 15.41$, $p < .001$, $\eta^2 = .13$. The main effects were qualified by a pair type x condition interaction, as predicted, $F(2, 207) = 3.11$, $p = .05$, $\eta^2 = .02$. It was predicted that the nature of the interaction would be a result of differential performance between the repeated and new pairs where participants in the informed condition would experience the greatest benefit of the repeated pair due to accessing and adding features to the List 1 memory trace, the uninformed non-recognizers would experience the smallest benefit as they may or may not access and add features to one of the two less differentiated memory traces from List 1 or List 2, and the uninformed recognizer condition would be somewhere in between due to accessing and adding features to the List 1 memory trace but potentially requiring addition cycles before the repeated information was recognized spontaneously.

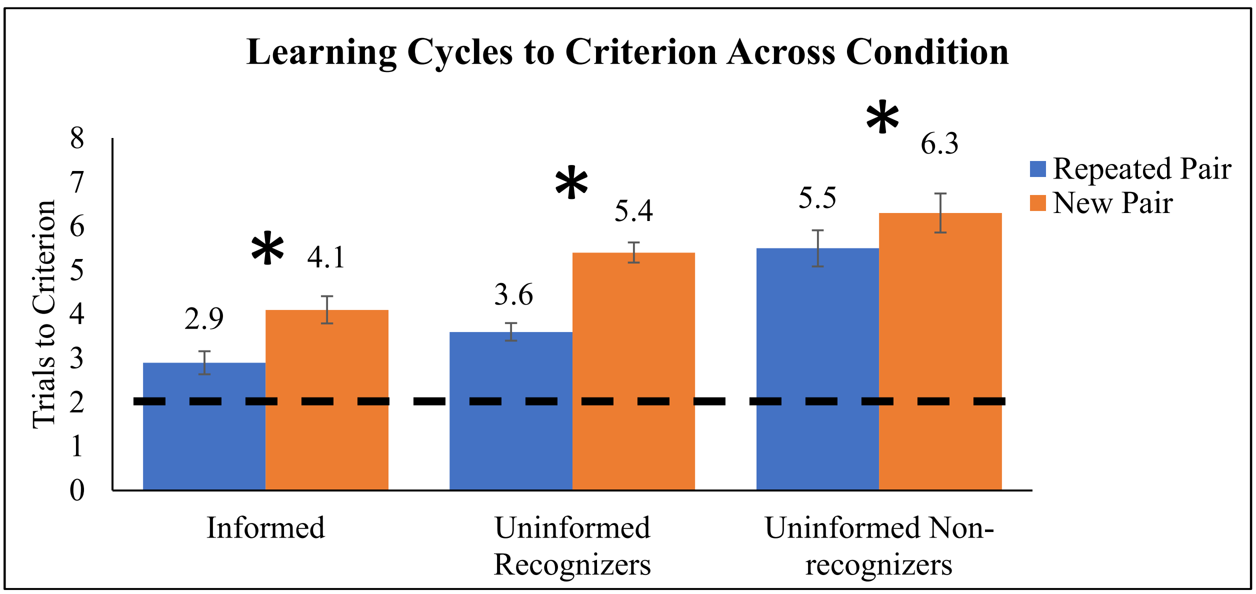

Figure 2. Trials to criterion across condition in Experiment 2. Graph shows the average number of cycles required for participants to reach a criterion of 2 consecutive recalls for the indicated pair across condition. The dashed line represents the fewest number of cycles possible to reach criterion. Error bars show standard error of the mean.

Interaction contrasts revealed that the informed condition did not have a greater difference between cycles to criterion for the repeated than the new pair over the uninformed recognizer condition, $F(1, 207) = 2.30$, $p = .13$, $\eta_p^2 = .01$, but that the uninformed recognizer condition had a greater difference in cycles to criterion than the uninformed non-recognizer condition, $F(1, 207) = 5.27$, $p = .02$, $\eta_p^2 = .03$. A complex interaction contrast comparing the informed and uninformed recognizers to the uninformed non-recognizers revealed trending better performance for the recognizers than the non-recognizers, $F(1, 207) = 2.68$, $p = .10$, $\eta_p^2 = .01$, indicating that recognition of the repeated pair resulted in fewer cycles to criterion than when recognition did not occur.

A mixed model 2 X 2 ANOVA of cycles to criterion during List 2 was conducted for the uninformed conditions with Pair Type (repeated vs. new) as a within-subjects factor and Recognition (yes vs. no) as a between-subjects factor to determine the benefit of spontaneously recognizing the repeated pair during study of List 2. There was a main effect of pair type which indicated that the repeated pair was learned in fewer cycles than the new pair, $F(1, 155) = 29.40$, $p < .001$, $\eta^2 = .16$. There was also a main effect of recognition which indicated that those who recognized the repeated pair reached criterion during List 2 in fewer cycles than those who did not recognize the repeated pair. The main effects were qualified, as predicted, by a pair type x recognition interaction, $F(1, 155) = 5.40$, $p = .02$, $\eta^2 = .03$, indicating that recognition of repetition resulted in fewer relearning cycles of the repeated pair than the new pair during study of List 2. While participants in the recognizer condition had faster learning of the repeated pair than the non-recognizer condition it was possible that increased performance was simply a result of better overall memory for recognizers who also learned the new pair faster than the non-recognizers (recognizers, *M* = 5.4; non-recognizers, *M* = 6.3) which may have resulted in participants being at different parts of the scale (Loftus, 1978).

To determine whether the greater benefit for the recognizer condition was a result of better memory for the recognizer condition or a greater benefit due to recognizing the repeated pair analyses were run on a subset of the data where performance on the new pair was equated. Performance on the new pair was equated by removing participants from the uninformed recognizer condition who had the fastest relearning of the new pair ten at a time until performance on the new pair was not statistically different between conditions. Twenty participants were removed from the uninformed non-recognizer condition before performance on the new pair was equated. Analyses run on this subset of the data reveal a more significant overall interaction, $F(1, 140) = 9.87$, $p = .002$, $\eta^2 = .02$ indicating that when performance on the new pair was equated participants in the recognizer condition still had a greater difference between learning of the new and repeated pairs than the non-recognizer condition.

Table 1. Maximum learning efficiency across conditions in Experiment 2. Efficiency was determined based on the cycle participants reached a criterion of two consecutive recalls of either the repeated or new pair. Two cycles represented maximum efficiency during relearning as cycle two was the earliest criterion could be reached.

Maximum Learning Efficiency Across Conditions

		Criterion Reached on Cycle 2	
Condition	Criterion Reached	New Pair	Repeated Pair
Informed	Number	18	31
	Percent	37.5	64.6
Uninformed Recognizers	Number	25	64
	Percent	19.5	52.0
Uninformed Non-recognizers	Number	2	4
	Percent	5.9	11.8

Finally, the results of learning efficiency are summarized in Table 1. The most efficient relearning during learning of List 2 was indicated by reaching a criterion of two consecutive correct recalls as quickly as possible (i.e., during cycle two) and less efficient relearning was indicated by reaching criterion in more than two cycles. The informed condition had the highest percent of participants who demonstrated maximum efficiency in relearning the repeated pair (64.6%) while the uninformed recognizer condition had less efficient relearning (52%) and the uninformed non-recognizer condition had much less efficient relearning (11.8%). Interestingly, the maximum efficiency of relearning the new pair was also greatest in the informed condition (37.5%) while uninformed recognizers (19.5%) and uninformed non-recognizers (5.9%) were less efficient. The greatest relearning efficiency of the repeated pair for the informed condition and lowest efficiency for the uninformed non-recognizer with the uninformed recognizer condition in between supports the notion that the type of recognition (informed, spontaneous, or no recognition) results in a differential sampling and access of memory traces during relearning. However, the increased learning efficiency for the informed and uninformed recognizer conditions over the non-recognizer condition on the new pair was surprising.

2.2.3 Discussion

The results of Experiment 2 indicate that recognizers may be more likely to look back to List 1 learning than non-recognizers, improving their subsequent recall over items presented a single time (Jacoby, 1974; Wahlheim *et al.*, 2014). Therefore, it was important to focus on the differences between reaching criterion on the repeated pair over the new pair within a condition. When performance on the new pair was equated recognizers had a greater difference between learning the repeated and new pairs than the non-recognizers suggesting the recognizers received a greater benefit from noticing the repetition, supportive of the assumption in the REM model (Shiffrin & Steyvers, 1997) that recognition of repetition results in accessing and adding features to a more differentiated trace.

While it was initially surprising that the informed condition did not have a greater difference in learning than either of the uninformed conditions faster relearning of the repeated *and* the new pairs would have made a greater difference difficult. Informed participants reached criterion on the repeated (M = 2.9) and the new (M = 4.1) pairs in fewer cycles than the uninformed recognizers (M = 3.6 and M = 5.4, respectively) who reached criterion more quickly than the uninformed non-recognizers (M = 5.5 and M = 6.3, respectively). Learning of the new pair approached floor in the informed condition (M = 4.1), effectively compressing learning cycles to criterion, so that showing a larger difference between repeated and new pairs when compared to the uninformed conditions may not have been possible. The faster relearning of the new pair for those who recognized the repeated pair from List 1 may have been due to a greater depth of retrieval for List 2 pairs.

Jacoby, Shimizu, Daniels and Rhodes (2005) had participants learn two lists of words with either deep (pleasantness ratings) or shallow (whether an O or U was present) encoding. A subsequent recognition test for each depth of encoding list where targets and foils were intermixed was then followed by a combined recognition test of the foils from both encoding lists intermixed with new foils. Jacoby and colleagues found that foils from the pure deeply encoded list were recognized at a higher rate than those from the shallowly encoded list during the combined recognition test. They proposed that while participants were attempting to recognize targets from the previous list during the initial recognition test they reinstated the encoding task (deep or shallow) from that list and applied it to the foils. Similarly, in Experiment 2 participants in the informed condition, or after recognition occurred in the uninformed recognizer condition, may have reinstated the sentence generation encoding task during study of List 2 while attempting to identify the repeated pair from List 1, or identify additional List 1 repeated pairs in the uninformed recognizer condition. While the specific condition is unknown, participants frequently made remarks such as “I need more time to create a sentence” or, “I don’t know how to make a sentence from those words” suggesting that they were reinstating the List 1 encoding task. Deeper initial encoding for the new pairs may have been further compounded if, after deeply processing the new items, participants then completed the encoding instructions for List 2, potentially applying both sentence generation and visual imagery to the new pairs, resulting in improved performance for the new pairs. However, when recognition of repetition for the repeated pair failed participants likely did not attempt the sentence generation task from List 1 and relied only on the visual imagery encoding task from List 2 when learning the new pairs.

An interpretation of the current results inside the REM framework is that informed recognition of the repeated pair led to the fastest identification of the repeated pair which facilitated sampling and adding features to the List 1 memory trace resulting in a highly differentiated memory trace and the most efficient relearning. Further, deeper encoding of the new pairs as a result of using both sentence generation, reinstated from List 1 learning, and visual imagery, instructed encoding method for List 2, resulted in additional features stored during initial learning and thus a more differentiated trace which was more likely to be accessed during subsequent cycles through the list. Spontaneous recognition also resulted in identification of the repeated pair which aided in sampling and adding features to the List 1 memory trace, but this learning was less efficient as, for many participants, additional cycles were required before reaching criterion suggesting that identifying and accessing the repeated pair spontaneously did not occur automatically. Pre-recognition cycles may have resulted in the creation of an independent and less differentiated memory trace for the repeated pair during study of List 2 which, while potentially beneficial, was not as likely to be accessed as the more differentiated memory trace from List 1 after recognition occurred. Spontaneous recognizers would also have experienced the same benefit for new pairs as those in the informed condition, but the benefit would not start until after recognition of the repeated pair occurred resulting in a smaller benefit for the new pairs. Lastly, when recognition failed an independent and less differentiated memory trace was formed during List 2 resulting in two memory traces which both had a chance of being accessed leading to a small, but significant, benefit of repeated information and the least efficiency in relearning. Finally, uninformed recognizers would have the slowest learning of the new pairs as it is unlikely that they would reinstate the encoding task from List 1 and thus update fewer features in the memory trace during initial learning. Recognition may be an important mechanism in benefitting from repeated information as the speed of identifying and accessing repeated information varies according to the strength of available memory traces.

CHAPTER 3

GENERAL DISCUSSION

The experiments reported aimed to reveal the beneficial effect of recognition when the link between original and relearning was hidden by extreme context changes. Specifically, I predicted that recognizing repeated material would result in fewer cycles to criterion for the repeated pair than the new pair during relearning than when recognition of the repeated pair did not occur. Experiment 1 revealed that, as predicted, the beneficial effect of fewer cycles to criterion for a repeated pair over a new pair depended on recognition such that when recognition occurred there was a benefit and when recognition failed there was not a benefit of identifying the pair that repeated between lists, replicating the preliminary findings reported in Asch (1969). However, while Experiment 1 showed that Asch (1969) was conceptually replicable with word pairs, the power to detect an effect of repetition was low which was insufficient to detect faster learning of the repeated pair over the new pair. Experiment 2 revealed that all three conditions learned the repeated pair faster than the new pair, but, when equating cycles to criterion for the new pair, the difference was greater for participants who recognized the repeated pair than those who did not. The interaction between recognizers and non-recognizers was primarily driven by the greater difference in relearning of the repeated and new pair for the uninformed recognizer condition over the uninformed non-recognizer condition. The difference for the informed condition was not greater than either of the other conditions, likely as a result of greater efficiency in learning the new pair during List 2 that made experiencing a greater difference difficult.

Most memory experiments facilitate the link between original learning and relearning using either context reinstatement or informing participants of the repeated information making it likely that participants would reinstate the original learning context (Smith & Vela, 2001, for a review). However, the context of originally learned information is not always available during relearning and without reinstatement the memory trace of repeated information from the original learning experience may not be sampled, or may take longer to sample, resulting in a diminished or nullified benefit of repeated information during relearning. Previous research has shown that divided attention (Sahakyan & Malmberg, 2018) and instructions to identify within-list, rather than between-list, repetitions (Wahlheim *et al.*, 2014) can inhibit accessing and adding features to the memory trace of repeated information. Experiments 1 and 2 introduced a variety of context changes between learning of List 1 and List 2 to disguise the connection between learning of the two lists. When the connection between List 1 and List 2 was less obvious participants showed a diminished effect of repeated information when recognition of the repetition failed compared to when recognition was successful suggesting that context change may also be capable of disrupting memory trace accumulation inside the original learning memory trace.

However, despite efforts to contextually separate learning of List 1 and List 2 there was a high rate of recognizing the repeated pair. It is possible that the contextual changes were insufficient to disguise the presence of the repeated pair and the limited number of participants who failed to recognize the repeated pair were representative of participant selection effects such that non-recognizers were simply those with the poorest learning. On the contrary, when acquisition speed of the new pair was equated across the uninformed conditions in Experiment 2 there was a greater difference between learning of the repeated and new pairs for the participants who recognized the repeated pair over those who did not, replicating previous findings

(Sahakyan & Malmberg, 2018). The impact of “looking back” may be a result of individual differences where some people are more likely to be reminded of past events than others (Jacoby & Wahlheim, 2013). It is possible that those who failed to recognize the repeated pair were those who were more likely to compartmentalize their learning during a specific episode where a ten minute break was sufficient to change contexts resulting in a failure for them to access the memory trace from List 1 learning. Unpublished pilot data showed that without the contextual changes between Lists 1 and 2 all participants recognized the repeated pair, suggesting that the contextual changes had an effect on at least a subset of the participants. Additional research investigating the types of contextual change necessary for additional participants to fail to recognize the repeated pair may further elucidate the influence of individual differences in the likelihood of transferring learning from one experience to another.

A potential criticism of recognition failure during relearning in earlier reports (e.g., Wahlheim *et al.*, 2014) could be that some repeated items were not encoded during initial learning and thus could not have been recognized during learning of a subsequent list. Successful retrieval of a memory trace requires both sampling and accessing the contents of the memory trace using a combination of item and context information to probe memory traces. A failure of either sampling or accessing the contents of a trace result in an inability to retrieve the memory trace even though it may be stored in memory. However, according to the SAM and REM models features in a memory trace are stored probabilistically during encoding, where features have a certain chance of not being stored or of being stored incorrectly. Utilizing a poor encoding strategy, insufficient study time, distraction during study and task demands may all result in diminished or a lack of item and context information stored in a memory trace.

In Wahlheim and colleagues (2014) a single study cycle may have been insufficient to store item information inside a memory trace for several of the to-be-repeated pairs but no learning assessment was completed prior to moving on to the next task. Thus, it is possible that there were item selection effects for the to-be-repeated items such that the repeated items which were not recognized were simply those items that were not encoded during initial learning. However, Wahlheim and colleagues do not distinguish between unrecognized items and unencoded items making it is unsurprising then that items which may not have been encoded during the learning of List 1 would have equivalent performance as items only presented once on List 2 on a final recognition test as they were essentially singly presented items. In the current experiments, participants first studied the list of words using an effective encoding strategy and then were required to reach a criterion of two consecutive correct recalls of the to-be-repeated item during List 1 before progressing to learning of List 2. Thus, encoding of the to-be-repeated pair during study of List 1 was confirmed and any differences in performance were based on the effect of recognition rather than a failure to encode during learning of List 1.

In addition to ensuring the to-be-repeated pair was studied during List 1, the current experiments also make an important contribution to the literature on recognition during relearning by directly measuring recognition rather than relying on indirect evidence such as model predictions. Shiffrin and Steyvers (1997) REM model successfully fit a variety of data using the assumption that there was a benefit of recognizing repeated information due to sampling and accessing the more detailed memory traces created during original learning; yet, recognition during a repetition was never directly tested. Indirect measures of recognition can also be found in subsequent research using the REM framework (Malmberg & Shiffrin, 2005; Sahakyan & Malmberg, 2018) and in theories such as study-phase retrieval where the benefit of distributed practice is eliminated if the memory trace from original learning is not accessed during a subsequent learning experience (Isarida & Isarida, 2010; Verkoeijen, Rikers & Schmidt, 2004). In these cases, recognition was assumed if the data fit the predicted pattern rather than by directly measuring recognition of repeated information.

Experiments 1 and 2 utilized a post-study recognition questionnaire which allowed division of participants into conditions based on a direct measure of recognition but may have resulted in undetected recognition. It is important to note that the current experiments contained a single pair that repeated between lists which enabled effective use of a questionnaire to assess recognition of the repeated pair after study of List 2 was complete. An experiment with 10 or 20 repeated pairs may require a different direct measure of recognition (e.g., asking participants after studying every pair whether it repeated from List 1) which, depending on the method used, may be reactive and change how participants study during List 2. Thus, while a non-reactive method of directly assessing relearning was used in Experiments 1 and 2 because it occurred after learning was complete, alternative methods may be required to directly assess recognition in paradigms with many pairs that repeat between lists. However, an offline measure such as a post-study questionnaire may also have resulted in undetected recognition where participants recognized the repeated pair during study of List 2 but failed to report their recognition on the questionnaire, possibly as a result of forgetting. The current experiments were exclusive on who was considered a recognizer and, due to the strict criterion, some of the participants who were identified as non-recognizers may have actually been undetected recognizers. If this was the case, it is possible that the small benefit received by non-recognizers during study of the repeated pair on List 2 was a result of undetected recognition rather than a benefit without recognition. Future research implementing a sufficiently sensitive recognition assessment while limiting the reactive nature of the measure may further elucidate the impact recognition failure has during relearning.

While recognition of repetition as a mechanism of benefitting from relearning has important potential applications in many areas the benefit may be especially pertinent to learning inside and outside the classroom. Inside the classroom, recognition may be used as a tool to provide students opportunities to identify when material, or closely associated material, has been taught previously (either within one class or across classes) and thus increase the speed of relearning by facilitating access to the memory traces for original learning. Additionally, self-taught learning is becoming an increasingly necessary skill, even in a classroom setting where it is expected that students will learn a portion, if not most, of the material outside of class. During self-taught learning it may be important to add in time to reflect on prior learned material as part of the learning process in order to ensure time is being used efficiently and the same material is not being slowly relearned repeatedly.

APPENDIX A

IRB APPROVAL

Office of the Vice President for Research
Human Subjects Committee
Tallahassee, Florida 32306-2742
(850) 644-8673 · FAX (850) 644-4392

APPROVAL MEMORANDUM

Date: 10/23/2017

To: Colleen Kelley <kelley@psy.fsu.edu>

Address: 4301

Dept.: PSYCHOLOGY DEPARTMENT

From: Thomas L. Jacobson, Chair

Re: Use of Human Subjects in Research
Learning and Context

The application that you submitted to this office in regard to the use of human subjects in the proposal referenced above have been reviewed by the Secretary, the Chair, and two members of the Human Subjects Committee. Your project is determined to be Expedited per 45 CFR § 46.110(7) and has been approved by an expedited review process.

The Human Subjects Committee has not evaluated your proposal for scientific merit, except to weigh the risk to the human participants and the aspects of the proposal related to potential risk and benefit. This approval does not replace any departmental or other approvals, which may be required.

If you submitted a proposed consent form with your application, the approved stamped consent form is attached to this approval notice. Only the stamped version of the consent form may be used in recruiting research subjects.

If the project has not been completed by 10/22/2018 you must request a renewal of approval for continuation of the project. As a courtesy, a renewal notice will be sent to you prior to your expiration date; however, it is your responsibility as the Principal Investigator to timely request renewal of your approval from the Committee.

You are advised that any change in protocol for this project must be reviewed and approved by the Committee prior to implementation of the proposed change in the protocol. A protocol change/amendment form is required to be submitted for approval by the Committee. In addition, federal regulations require that the Principal Investigator promptly report, in writing any unanticipated problems or adverse events involving risks to research subjects or others.

By copy of this memorandum, the chairman of your department and/or your major professor is reminded that he/she is responsible for being informed concerning research projects involving human subjects in the department, and should review protocols as often as needed to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

This institution has an Assurance on file with the Office for Human Research Protection. The Assurance Number is IRB00000446.

Cc: Jeanette Taylor <taylor@psy.fsu.edu>, Chair
HSC No. 2017.22020

APPENDIX B

IRB RE-APPROVAL

The Florida State University
Office of the Vice President For Research
Human Subjects Committee
Tallahassee, Florida 32306-2742
(850) 644-8673 · FAX (850) 644-4392

RE-APPROVAL MEMORANDUM

Date: 9/24/2018

To: Colleen Kelley

Address: 4301
Dept.: PSYCHOLOGY DEPARTMENT

From: Thomas L. Jacobson, Chair

Re: Re-approval of Use of Human subjects in Research
Learning and Context

Your request to continue the research project listed above involving human subjects has been approved by the Human Subjects Committee. If your project has not been completed by 9/23/2019, you must request a renewal of approval for continuation of the project. As a courtesy, a renewal notice will be sent to you prior to your expiration date; however, it is your responsibility as the Principal Investigator to timely request renewal of your approval from the committee.

If you submitted a proposed consent form with your renewal request, the approved stamped consent form is attached to this re-approval notice. Only the stamped version of the consent form may be used in recruiting of research subjects. You are reminded that any change in protocol for this project must be reviewed and approved by the Committee prior to implementation of the proposed change in the protocol. A protocol change/amendment form is required to be submitted for approval by the Committee. In addition, federal regulations require that the Principal Investigator promptly report in writing, any unanticipated problems or adverse events involving risks to research subjects or others.

By copy of this memorandum, the Chair of your department and/or your major professor are reminded of their responsibility for being informed concerning research projects involving human subjects in their department. They are advised to review the protocols as often as necessary to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

Cc: Jeanette Taylor, Chair
HSC No. 2018.25714

APPENDIX C

IRB APPLICATION

Human Subjects Application For Full IRB and Expedited Exempt Review

1. Project Title and Identification

1.1 Project Title

- Learning and Context
- Project is: ongoing research

1.2 Principal Investigator (PI)

Name (Last name, First name MI):
- Kelley, Colleen M.

Highest Earned Degree:
- Doctorate

University Department:
- PSYCHOLOGY DEPARTMENT

The training and education completed in the protection of human subjects or human subjects records:
- NIH

Occupational Position:
- Faculty

1.3 Co-Investigators/Research Staff

Name (Last name, First name MI):
- Sorenson, Parker ; Co-Investigator

Highest Earned Degree:
- Bachelor's Degree

University Department:
- PSYCHOLOGY DEPARTMENT

The training and education completed in the protection of human subjects or human subjects records:
- CITI

Occupational Position:
- Student

1.4 Faculty Advisor/Department Chair/Dean Information

Name (Last name, First name MI):
- Taylor, Jeanette ; Chair

University Department:
- PSYCHOLOGY DEPARTMENT

2. Funding

2.1 Is this research funded by an internal (FSU) or external agency?

-No

How costs of research will be covered?

- Minor costs for copying consent forms will be paid from PI's annual allocation in Department.

3. Institutional Oversight

3.1 Is this research proposal being reviewed by any other institution or peer review committee?

- No

4. Conflict of Interest

Federal guidelines encourage Institutions to assure there are no conflicts of interest in research projects that could adversely affect the rights and welfare of human subjects. If this proposed research study involves a potential conflict of interest, additional information will need to be provided to the IRB. Examples of potential conflicts of interest may include: any sort of compensation, in cash or other form, for services to an individual and his or her immediate family, the value of which exceeds $10,000 in a one-year period or an equity interest which exceeds $10,000 or which exceeds a five percent ownership interest.

4.1 Do any of the Investigators or personnel listed on this research have a potential conflict of interest associated with this study?

- No

5. Payment or Other Compensation for Research Subjects

5.1 Will you give subjects gifts, payments, compensation, reimbursement, services without charge or extra credit/class credit?

- Yes

Explanation:

- Participants will be recruited from among (a) general psychology students seeking credit toward their research experience requirement (typically seven hours) and (b) volunteers from other undergraduate psychology classes who are seeking extra credit for their participation and whose instructors choose to provide this option. In both cases, credits are earned at a rate of one per hour of research participation, with a minimum of one-half credit awarded for any time less than 30 minutes. Anyone who appears for an experiment at his or her scheduled time will receive at least one-half credit even if she/he declines to participate. If a participant does not complete the experiment, prorated compensation will be given at a rate of .5 credits for every 30 minutes of participation, with 0-30 minutes of participation earning .5 credits and 31-60 minutes of participation earning 1 credit. Prospective participants from both groups have an alternative way to earn credits via completion of brief reports on research articles selected by instructors for their relevance to the course. Instructors do not learn the identities of who participated in their experiments; only the number of credits participants earned for the class by research participation, so as to avert students' feeling coerced to participate in an instructor's research.

6. Protocol Description and Other Detail

6.1 Describe the objective(s) of the proposed research including purpose, research question, hypothesis, method, data analysis, research design and relevant background information etc.

- A fundamental function of memory is noticing repetitions and detecting changes across time and place. In prior work, we found that for people to benefit from prior learning, they must notice that the current learning contains material repeated from the prior learning. If people don't notice that prior learning can be used in the new situation, it takes as long for them to learn the repeated information as to learn entirely new information. The current experiment extends the prior work to more meaningful materials, and further asked about the effects of changes of context between initial and later learning on the likelihood that repeated and changed material is noticed as such.

- The general method is to have participants learn a set of cue-target pairs, where a cues and targets may be pairs of words, such as dog-collar, or pairs of words and faces of famous people (such as table-Jennifer Aniston), or names of famous people and made-up facts "Stephen Colbert's father was a fireman" Participants will see a cue (dog), and try to anticipate the response (collar), and keep cycling through the pairs until a pre-determined subset of the pairs are correctly anticipated 3 times, or for a maximum of 6 times through the list. A main measure will be how many trials it takes to learn the critical pairs on the first list

- After a 10 minute break, participants will learn a second set of pairs that are new except for the critical pairs, which will either repeat (Experiment 1), or Change (dog-collar, dog-table) from the first list to the second list (Experiment 2). We will also manipulate whether participants learn the second list in the same location or a different location. The two locations used will be a laboratory cubicle in Psychology, or in a covered location immediately outside the Psychology department (near the courtyard area between the A and C wing of Psychology). When the location is the same, the experimenter will be the same person as well, and when the location is changed between learning sessions, the experimenter will be changed. The dependent measure on the second learning session is the number of trials (complete run-through of the study list of pairs) it takes participants before they can correctly respond to the pairs repeated from the list learned first, to a maximum of 6 times through the list. Participants will also be asked a series of questions to determine whether they noticed that pairs were repeated between the lists, and the relation between their awareness of the repetitions and the speed with which they learn the repeated pairs will be assessed.

- In Experiment 3, we will repeat experiment 1 but with all participants experiencing the change of contexts between learning sessions. Participants will be learn the new second list as in Experiment 1, or they will first be informed that some of the pairs repeat from the first list.

6.2 Following categories will apply for the evaluation of the project:

- Questionnaires or Surveys to be administered
- Subjects studied at FSU
- Students as Subjects

6.3 Survey Techniques: the only involvement of human subjects will be in the following categories:

- Research on normal educational practices in commonly accepted educational settings

6.4 This study will include following methods:

- Experimental/Control Design

6.5 Describe the tasks subjects will be asked to perform.

Upload surveys, instruments, interview questions, focus group questions etc. Describe the frequency and duration of procedures, psychological tests, educational tests, and experiments; including screening, intervention, follow-up etc. (If you intend to pilot a process before recruiting for the main study please explain.)

- Two study and testing contexts will be used: A cubicle in the PI's laboratory (Psychology A404), and a sitting area in the courtyard between the A and C wing of the Psychology department (part of the courtyard is sheltered in case of rain). Participants will study lists of pairs of materials, such as word pairs (dog-collar), such that a subset of the pairs can be recalled perfectly across three trials of the list (a trial involves a run through of the whole list, where a cue word is given, dog-? and the participant attempts to recall the target word for that cue). After a 10 minute break, participants are escorted on a short walk and return to either the same place (same context) or move to a different place (different context), by the same or different experimenter. Participants then learn a new list, however, a critical subset of the pairs from the first List are repeated in the second list, and the remainder of the pairs are new. The number of trials to master the critical subset of pairs will be measured (e.g., 3 correct trials in a row), to a maximum of 6 trials on the second list. The number of trials to master a second subset of new pairs will also be measured to see if there is a speed-up in learning of the previously mastered pairs. Participants will then be questioned regarding whether they noticed the pairs that repeated between lists.

- We will do pilot work to determine the length of the lists in session 1 and session 2, and the number of critical pairs that can be carried over between lists without all participants immediately noticing. That pilot work will be accomplished by testing 20 participants with varying list lengths and varying number of pairs, in the changed context condition.

- Experiment 2 will have the same design as Experiment 1, but the critical pairs will change between lists, such that the same cue will be presented paired with a different target (dogcollar might change to dog-bark).

- Experiment 3 will be the changed context condition of Experiment 1, but half the participants will be informed prior to the second list that some pairs from the prior study session will be repeated. We predict that informing participants will increase the likelihood of noticing repetitions, and so reduce the number of trials it takes for participants to master the critical items on the second list.

6.6 How many months do you anticipate this research study will last from the time final approval is granted?

- 12

7. Participant (Subject) Population

7.1 Expected number of participants

- Number of male: 150 Number of female: 150
- Expected number of participants: 300

7.2 Expected Age Range

- 18-65

7.3 Inclusion/Exclusion of Children in this Research

- Exclusion

If this study would exclude children, NIH guidelines advise that the exclusion be justified, so that potential for benefit is not unduly denied. Indicate whether there is potential for direct benefit to subjects in this study and if so, provide justification for excluding children. Note that if inclusion of children is justified, but children are not seen in the PI's practice, the sponsor must address plans to include children in the future or at other institutions.

- No direct benefit established (exclusion of children permissible)

Provide justification for exclusion of children:

- Participants will be available college students enrolled in psychology courses, who are predominantly over 18.

7.4 Other Protected Populations to be Included in this Research

7.5 Inclusion and Exclusion of Subjects in this Research Study

Describe criteria for inclusion and exclusion of subjects in this study

Inclusion Criteria:

- Participants must be 18 years or older

Exclusion Criteria:

- Participants younger than 18 or over 65.

7.6 Location of subjects during research activity or location of records to be accessed for research

- Florida State University

7.7 Describe the rationale for using each location checked above
Upload copies of IRB approvals or letters of cooperation from other agencies or sites, if it has been granted or the application submitted if approval has not been granted.

- The PI's laboratory is on campus, and provides places for testing participants in such memory research. It is also convenient for the University students to come participate.

8. Recruitment of Participants (Subjects)

8.1 Describe the recruitment process to be used for each group of subjects
Upload a copy of any and all recruitment materials to be used e.g. advertisements, bulletin board notices, emails, letters, phone scripts, or URLs.

- Participants will sign up to participate online vis the psychology sign up website for the SONA research participation system. Each experiment is briefly described, and this one will be described as a study of learning and memory.

8.2 Explain who will approach potential subjects to take part in the research study and what will be done to protect individuals' privacy if required in this process

- Participants sign up for the experiment privately on the SONA research system, and chose freely from the experiments listed.

8.3 Are subjects chosen from records?

- No

8.4 FSU policy prohibits researchers from accepting gifts for research activities. Is the study sponsor offering any incentive connected with subject enrollment or completion of the research study (i.e. finders fees, recruitment bonus, etc.) that would be paid directly to the research staff?

- No

8.5 Is the study going to be posted on the Research Studies at Florida State University recruiting website?

- No

9. Risks and Benefits

9.1 The research may involve following possible risks or harms to subjects:

9.2 Does the Research Involve Greater Than Minimal Risk to Human Subjects?
"Minimal Risk" means that the risks of harm anticipated in the proposed research are not greater, considering probability and magnitude, than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests.

- No

9.3 Explain what steps will be taken to minimize risks or harms and to protect subjects' welfare. If the research will include protected populations (see question 7.4) please identify each group and answer this question for each group.

- Participants will be informed at the beginning of the study, during the consent process, that they may stop participation at any time and are not obligated to finish the experiment. They will be informed that the credit will be allocated on the prorated basis of 1/2 credit for 30 minutes.

9.4 Describe the anticipate benefits of this research for individual subjects in each subject group. If none, state "None".

- none

9.5 Describe the anticipated benefits of this research for society, and explain how the benefits outweigh the risks.

- Noticing the link between earlier learned material and later repetitions or variants of that materials appears to be critical for the benefits of prior learning. Therefore it is really important to understand if the prior work with meaningless materials scales up to what we study here, and whether environmental and experimenter-context matters.

10. Confidentiality of Data

10.1 Will you record any direct identifiers, names, social security numbers, addresses, telephone numbers, email addresses, cookies etc.?

- No

10.2 Will you retain a link between study code numbers and direct identifiers after the data collection is complete?

- No

10.3 Will you provide the link or identifier to anyone outside the research team?

- No

10.4 Where, how long, and in what format (such as paper, digital or electronic media, video, audio, or photographic) will data be kept? In addition, describe what security provisions will be taken to protect this data (password protection, encryption, etc.)

- Electronic data from tasks will be kept indefinitely in the de-identified format used by our testing program. Each participant's data is linked to a subject code, but we don't keep a link to the subjects' ID after the second testing session is completed.

10.5 Will you place a copy of the consent form or other research study information in the subjects' record such as medical, personal or educational record?

- No

10.6 If the data collected contains information about illegal behavior, please refer to the NIH Certificates of Confidentiality Kiosk for information about obtaining a Federal Certificate of Confidentiality.

10.7 Will you be given or have access to personal information regarding employee, customer, student, parent and/or patient accounts with Florida State University?

- No

11. Use of Protected Health Information (PHI): HIPAA Requirements

In the course of conducting research, researchers may desire to obtain, create, use, and/or disclose individually identifiable health information. Under the HIPAA Privacy Rule, covered entities (healthcare providers, health plans, employer or healthcare clearinghouses) are permitted to use and disclose protected health information for research with individual authorization, or without individual authorization under limited circumstances set forth in the Privacy Rule.

11.1 As part of this study, will you be accessing PHI from a covered entity for research purposes?

- No

12. Informed Consent Process

12.1 Recognizing that consent itself is a process of communication, please expand on your responses to questions 8.1 and 8.2 and describe what will be said to the subjects to introduce the research.

- Participants will be informed of the tasks that they will perform during the course of the experiment, including learning the associations between cues and targets. Participants will be presented with the consent form, and will be asked if they have any questions. They will be asked if they understand that they can quit at anytime without incurring a penalty, and will receive credit on a prorated basis.

12.2 In relation to the actual data gathering, when will consent be discussed and documentation obtained? (e.g., mailing out materials, delivery of consent form, meetings)

- Consent will be obtained upon the arrival of the participant to the laboratory for the experiment, before any data collection has begun.

12.3 Please name the specific individuals who will obtain informed consent and include their job title/credentials and a brief description of your plans to train these individuals to obtain informed consent and answer subject's questions:

-Undergraduate research assistants who are psychology majors, and who have completed a research methods class that informs students about ethical issues associated with conducting research will obtain informed consent. They will be trained by Parker Sorenson, who has completed the CITI course on protecting human research participants. Parker will show them how to test participants, and then ask them to test him as if he were a participant, to give feedback on how to obtain informed consent and answer subjects' questions.

12.4 What questions will you ask to assess the subjects' understanding of the risks and benefits of participation?

-Do you know what you will be doing in the experiment? Do you know that you can stop the experiment without penalty? Do you know what credit you receive if you stop the experiment early?

12.5 Informed Consent Waivers

Request waiver of documentation of consent.

The only record linking the subject and the research would be the consent form and the principle risk of the research would be the potential harm from a breach of confidentiality (If Checked, explain below):

The research involves minimal risk and includes no procedures for which written consent is normally required outside the research context.

Request waiver of some or all elements of consent.

The research involves no more than minimal risk to the subjects.

A waiver will not adversely affect the rights and welfare of the subjects.

The research could not practicably be carried out without waiver or alteration.

Where appropriate, the subjects will be provided with additional pertinent information after participation (If checked, explain below):

APPENDIX D

INFORMED CONSENT FORM (APPROVAL)

Informed Consent Form for Undergraduate Participants

I freely and voluntarily consent to be a participant in the research project entitled “Learning and Context”. The principal investigators are Dr. Colleen M. Kelley and Parker Sorenson, Department of Psychology at Florida State University. I will receive course credit for this experiment, at the rate of .5 experimental credits per half hour spent participating. The entire experiment will take approximately 90 minutes.

I will be asked to learn a list word pairs, picture-face pairs, or famous name and fact pairs. The purpose of this study is to investigate the effects of different contexts, such as being indoors or being outdoors on learning. I understand that the experimental tasks do not present more risks than people encounter in everyday life, doing academic work or attempting to study. I may become tired at some point, and I may ask the experimenter to take a short break between tasks.

If at any point I want to stop the experiment, I can tell the experimenter and withdraw my consent without any penalty or loss of benefits to which I am otherwise entitled. That is, my grade in the course will not be affected if I chose to withdraw from the experiment, nor will I receive an experiment credit penalty. However, I will still be obliged to fulfill my experiment participation obligation for the General Psychology course according to guidelines in the course syllabus.

There is no direct benefit for participating in the research, although I understand that I will be given a lesson about the experiment so that I may learn about learning in different contexts.

I understand that the records of this research which refer to my data will be given a code so that no one except the investigators and their designated assistants will have access to the data, and that no identifiable data, including handwritten information that I have supplied, will be used for publication. In addition, the records of this research, which refer to my performance, will be kept confidential to the extent allowed by law. I understand that any information, including written records, and computer files used in this project will be retained indefinitely in the locked Kelley Lab (A404) suite at the Florida State University Department of Psychology.

I have been given the right to ask and have answered any inquiry concerning this consent form. Questions, if any, have been answered to my satisfaction. I understand that I may contact Dr. Colleen M. Kelley, phone: (850) 644-3816 (email:Kelley@psy.fsu.edu), for answers to pertinent questions about this research. If I have questions about my rights as a subject/participant in this research, or if I feel that I have been placed at risk, I can contact the Chair of the Human Subjects Committee, Institutional Review Board, through the Office of the Vice President for Research at (850) 644-8633.

I have read and understand this consent form, and I am 18 years or older.

____ ______________________
(Participant) (Date)

FSU Human Subjects Committee approved on 10/23/17. Void after 10/22/18. HSC # 2017 - 22020

APPENDIX E

INFORMED CONSENT FORM (RE-APPROVAL)

I freely and voluntarily consent to be a participant in the research project entitled "Learning and Context". The principal investigators are Parker Sorenson and Dr. Colleen M. Kelley, Department of Psychology at Florida State University. I will receive course credit for this experiment, at the rate of .5 experimental credits per half hour spent participating. The entire experiment will take approximately 90 minutes.

I will be asked to learn a list of word pairs, picture-face pairs, or famous name and fact pairs. The purpose of this study is to investigate the effects of different contexts, such as being indoors or being outdoors on learning. I will also be asked to do some brief tasks of imagination and remembering. I understand that the experimental tasks do not present more risks than people encounter in everyday life, doing academic work or attempting to study. I may become tired at some point, and I may ask the experimenter to take a short break between tasks.

If at any point I want to stop the experiment, I can tell the experimenter and withdraw my consent without any penalty or loss of benefits to which I am otherwise entitled. That is, my grade in the course will not be affected if I chose to withdraw from the experiment, nor will I receive an experiment credit penalty. However, I will still be obliged to fulfill my experiment participation obligation for the General Psychology course according to guidelines in the course syllabus.

There is no direct benefit for participating in the research, although I understand that I will be given a lesson about the experiment so that I may learn about learning in different contexts.

I understand that the records of this research which refer to my data will be given a code so that no one except the investigators and their designated assistants will have access to the data, and that no identifiable data, including handwritten information that I have supplied, will be used for publication. In addition, the records of this research, which refer to my performance, will be kept confidential to the extent allowed by law. I understand that any information, including written records, and computer files used in this project will be retained indefinitely in the locked Kelley Lab (A404) suite at the Florida State University Department of Psychology.

I have been given the right to ask and have answered any inquiry concerning this consent form. Questions, if any, have been answered to my satisfaction. I understand that I may contact Dr. Colleen M. Kelley, phone: (850) 644-3816 (email:Kelley@psy.fsu.edu), for answers to pertinent questions about this research. If I have questions about my rights as a subject/participant in this research, or if I feel that I have been placed at risk, I can contact the Chair of the Human Subjects Committee, Institutional Review Board, through the Office of the Vice President for Research at (850) 644-8633.

I have read and understand this consent form, and I am 18 years or older.

____ ____________________
(Participant) (date)

____________________ ______________________________

FSU Human Subjects Committee approved on 09/24/2018, void after 09/23/2019. HSC #2018.25714

APPENDIX F

POST-STUDY QUESTIONNAIRE

Participant ID: ______

POST-STUDY QUESTIONNAIRE

What do you think this experiment is about?

____
____
____
____
____
____
____

Did you notice anything special about any of the pairs in the list you just learned? Yes No

If yes:

What did you notice that was special?

____
____
____

When did you notice this?

____
____

Were all of the pairs in the second list different from the pairs in the first list you learned?

a) Yes
b) No
c) Unsure

One of the pairs in List 2 also appeared on the first list. Did you notice this **during** learning of List 2?

Yes No

If yes:

Do you remember which pair was on List 2 that you recognized from List 1?

Yes No

If yes, which one ? (If no, leave blank):

Pair: ____________________

REFERENCES

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BIOGRAPHICAL SKETCH

Curriculum Vita
Parker Sorenson

EDUCATION

Anticipated 2021	Ph.D. COGNITIVE PSYCHOLOGY Florida State University, Tallahassee, FL
Anticipated 2019	M.D. COGNITIVE PSYCHOLOGY Florida State University, Tallahassee, FL
Fall 2016	B.S., BEHAVIORAL SCIENCE, *PSYCHOLOGY EMPHASIS*, Summa Cum Laude, with Departmental Honors *Utah Valley University*, Orem, UT

PROFESSIONAL EXPERIENCE

Feb 2015–May 2016 **Research Assistant.** Behavioral and Cognitive Neuroscience Lab
Utah Valley University, Orem, UT

Supervisors

Dr. Jessica Hill, Assistant Professor, Department of Psychology
Dr. Claudia Lieberwirth, Assistant Professor, Department of Behavioral Science

Duties

Data collection, literature reviews, leading two independent projects, co-investing a project, maintaining confidentiality, Citi certified

Aug 2017-Present **Teaching Assistant.** EXP3422C: Conditioning and Learning
Florida State University, Tallahassee, FL

Supervisors

Dr. Gina O'Neal Moffitt, Adjunct Professor, Department of Biomedical Sciences
Dr. Elizabeth Hammock, Assistant Professor, Departments of Psychology and Neuroscience

Duties

Teaching a weekly lab (~45 students per semester), developing student academic writing skills through interactive classroom activities and specific feedback, encouraging scientific thinking, facilitating student application of classroom material to real-life situations, instructing students on best practices for humanely handling rats and equipment

Aug 2015–May 2016 **Instructional Assistant.** PSY 1010: Introduction to Psychology
Utah Valley University, Orem, UT

Supervisor

Dr. Jessica Hill, Assistant Professor, Department of Psychology

Duties

Teaching a PSY1010 lab weekly, creating rubrics, interfacing professionally with students, conducting office hours, grading papers, attending class, recording research experience data for 400+ students

CONFERENCE PRESENTATIONS/PARTICIPATION

*Presenter indicated by **

Sorenson*, P., Kelley, C., Mitchum, A. (2018, November) Metacognitive Judgements and Memory Performance. Poster presented at Psychonomics 2018, New Orleans, LA.

Sorenson*, P. (2018, April) Is Prior Learning Beneficial?: The Role Recognition Plays in Relearning. Poster presented at Graduate Research Day 2018, Tallahassee, FL.

Sorenson*, P. (2017, April) Metacognitive Judgments and Memory Performance. Poster presented at Graduate Research Day 2017, Tallahassee, FL.

Weiland*, K., **Sorenson, P.**, Olsen, J., & Hill, J. C. (2016, April). Is the pen mightier than the keyboard?: Assessing whether distinct types of note-taking influence retention. Paper presented at the 30th Annual National Council on Undergraduate Research Conference, Asheville, NC.

Weiland, K., **Sorenson*, P.**, Olsen, J., & Hill, J. C. (2016, April). Is the pen mightier than the keyboard?: Assessing whether distinct types of note-taking influence retention. Paper presented at the 86th Annual Rocky Mountain Psychological Association Conference, Denver, CO.

Weiland*, K., **Sorenson, P.**, Olsen, J., & Hill, J. C. (2016, March). Is the pen mightier than the keyboard?: Assessing whether distinct types of note-taking influence retention. Paper presented at the 8th Annual Conference on the Scholarship of Teaching and Engagement, Orem, UT.

Sorenson, P., & Hill, J. C. (2016, March). The potential of engaged learning in breakout sessions to mitigate the negative effects of large class sizes. Oral presentation at the annual conference for the Scholarship of Teaching and Engagement, Orem, UT.

RESEARCH INTERESTS

Memory, Learning, Metacognition, and Remindings

PROFESSIONAL DEVELOPMENT ACTIVITIES

<u>Structured Learning:</u>

Fall 2017 **PSY6945: Teaching Psychology Practicum.**

This graduate-level course was designed to assist graduate students as they prepared to teach their own course by considering such topics as the purpose of assignments and tests, motivating students to learn, how to structure my class to best reach all students, and, finally, how to identify what went well and what could be improved and create a plan to implement those improvements.

Fall 2016, Fall 2017 **Pie Conference: Day 1 & Day 2**

Addressed critical policies such as FERPA, HIPPA, SDRC and other accommodations, setting clear expectations with students, how to determine and teach based on course objectives, effective use of the course syllabus, and interactive ways to involve students in all class types.

Spring 2018 – Present **Teaching Brown Bag.**

A variety of topics were included such as how choice and spacing can improve student learning (1/17/18), effectively using pre-class time (3/2/18), the first (3/30/18) and last (4/27/18) minutes of class, technology use in the classroom (9/19/18), the impact of divided attention on learning (10/17/18), how to deal with boring material and decrease passivity through technology (11/14/18).

<u>Self-directed Learning:</u>

Brown, P. C., Roediger III, H., L., McDaniel, M. A. (2014). Make it stick: The science of successful learning. Belknap Press: An Imprint of Harvard University Press

VOLUNTEER EXPERIENCE

Jun 2014–Dec 2014 **Principles Coach**, Telos Residential Treatment Center

Orem, UT

Supervisor

John Hall

Duties

Investing personal time to build relationship with a struggling adolescent, providing support for adolescent in stressful situations, teaching life skills (eg. how to appropriately express frustration), exemplifying non-conditional love towards another

Aug 2013–Dec 2013 **Youth Teacher.** Strengthening Families Program

Orem, UT

Supervisor

Marjorie Lopshire

Duties

Teaching lessons for both adolescents (12 students) and families (30 students) ages 12-50, maintaining confidentiality, incorporating examples pertinent to student's lives and facilitating deeper understanding of material

HONORS, AWARDS, AND MEMBERSHIPS

Apr 2018 **Russell and Eugenia Morcom GRD Excellence Award**, Florida State University

$100 award for best poster presentation in the Cognitive area

Aug 2015 – Present **Phi Theta Kappa,** Member

Aug 2012 – 2016 **Dean's List.** Utah Valley University

Aug 2014 – 2016 **UVU Honors Program**, Member

Aug 2014 – 2016 **Honors Program Scholarship**, Utah Valley University
Approximately $1,300 per semester

Aug 2012 – Apr 2013 **Outstanding Academic Merit Scholarship.** Utah Valley University
2 semester full-tuition scholarship (about $5,000)