EFFECTS OF ORTHOGRAPHIC DISTINCTIVENESS ON CUED RECALL IN PURE AND MIXED LISTS

by

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A Thesis Submitted to the
Faculty of the College of Graduate Studies
in Partial Fulfillment
of the Requirements for the Degree of
Master of Arts
in Psychology

Middle Tennessee State University
May 2014

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I dedicate this research to my family, friends, and Miss Pickey.
I love you.

Big thanks to my colleagues, mentors, and committee members for their suggestions and guidance!

ABSTRACT

Orthographic distinctiveness in memory was evaluated with a cued recall design of common and distinct word pairs. Research has noted that distinctiveness effects arise in mixed lists for free recall and recognition, with cued recall receiving minimal research attention. Forty-four Middle Tennessee State University undergraduates were recruited to participate. Participants viewed four lists of eight word pairs that consisted of two pure lists and two mixed lists. Recall tests presented the first word from each pair, and asked participants to recall the missing word. Results showed a non-existent distinctiveness effect and a list type main effect, with mixed lists providing better recall of common and distinct material than pure lists. Alternative explanations such as the cue overload principle, associative pair strength, and intra-item relations are discussed as factors that could suppress a distinctiveness effect in cued recall. Findings from the cued recall design can be applied to other distinctiveness domains.

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CHAPTER I

Introduction

A major memory phenomenon throughout the history of psychology is the remembrance of weird, unusual, or distinctive events when compared to normal everyday experiences (Hunt & Worthen, 2006; Schmidt, 1991; Schmidt, 2008). Researchers refer to this as “the distinctiveness effect” (Hunt, 2006). However, understanding the distinctiveness effect has been somewhat challenging for researchers due to the complexities behind experimental designs and manipulations. Distinctiveness has been studied in a variety of domains (e.g., bizarre imagery, word frequency, and word orthography), employing different list structures, and by analyzing free recall and recognition of unusual and common stimuli. The main finding in distinctiveness research is that superior free recall of unusual stimuli is often confined to mixed lists of both common and unusual stimuli (Hunt & Worthen, 2006). Exceptions include the word-frequency effect, the generation effect, and the bizarre imagery effect in recognition (McDaniel & Einstein, 1986; DeLosh & McDaniel, 1996; Hunt & Worthen, 2006). In pure list designs, common stimuli are often better remembered than unusual stimuli (Hunt & Worthen, 2006; Hunt & Elliot, 1980; Hunt & Einstein, 1981). The present study attempts to better understand the distinctiveness effects produced in different list designs by evaluating cued recall of orthographically common and orthographically distinct word pairs in pure and mixed lists. A brief discussion of the original development of the distinctiveness effect will be presented, followed by a literature review of a few domains that can be applied to distinctiveness effects (e.g., bizarre imagery and orthographic distinctiveness) within mixed lists. Finally, three hypotheses will be discussed in relation to cued recall of word pairs and orthographic distinctiveness: the attentional processing

(Wollen & Cox, 1981), order-encoding (DeLosh & McDaniel, 1996) and pre-existing association hypotheses.

Hunt and colleagues were the first researchers to develop the theoretical framework of distinctiveness and how it may be applied to organizational theories (Hunt & Elliot, 1980; Hunt & Einstein, 1981; Hunt & Mitchell 1982). Organizational frameworks, as related to Gestalt approaches, suggest that distinctive items are incongruent within the context of their spatial or temporal neighbors (Schmidt, 2008). For instance, imagine receiving eleven red roses and one white rose in a bouquet of a dozen roses. Normally, bouquets of a dozen roses consist of the same colored rose throughout the bouquet, but in this case, the white rose stands out as incongruent within the context of the eleven red roses. According to Hunt, distinctiveness can be operationally defined as the process of identifying difference in the context of similarity (Hunt, 2006). In order to achieve differential and similar processing among items, the distinctiveness framework relies on individual-item and relational processing to assist with the evaluation of distinctive encoding (Hunt & Einstein, 1981). Relational processing refers to the encoding of similarities shared by items within an event (Hunt & Einstein). If participants identify feature overlap through relational processing, they are increasing traces of encoded material. Therefore, the long-term memory search set is reduced due to the increase in feature overlap within encoded items, increasing the probability of correct item sampling (Hunt & McDaniel, 1993). On the other hand, individual-item specific processing refers to the processing of distinctive features that are not shared by other items within an event (Hunt & Einstein). A good example of item-specific processing is Hunt and Elliot’s (1980) study concerning unusual word orthography, in which an uncommon word intermixed within a homogenous list of common words produces better recall of the unusual word in mixed lists. This example highlights the process of defining unique attributes within a search (e.g., unusual letter combinations of an uncommon word), which would then aid retrieval of the item from the search set (Hunt & McDaniel, 1993). Given the framework of item-specific and relational processing, many researchers have been interested in the utility of both when working in tandem. In general, experimental studies have highlighted that the interaction of item specific and relational processing optimizes the retention of to-be-remembered material (Einstein & Hunt, 1980; Hunt & Einstein, 1981). In this sense, relational processing defines the context of the event, while item specific processing evaluates specific properties of particular items within the event, providing a complete evaluation of the content. Thus, the interactions of the two types seem to provide an important memory function (Hunt & McDaniel, 1993).

Primary and Secondary Distinctiveness

Distinctiveness can be parsed into two separate classes, primary and secondary distinctiveness. According to Schmidt (1991), primary distinctiveness is defined as stimuli that are incongruent with the immediate surrounding context of information being processed in working memory. Therefore, information that is incongruent to the overall context of stimuli being encoded will be identified as distinctive. For example, a pure list consisting of words such as professor, banker, and nurse would construct a conceptual category of professions, but if an animal (e.g., cat) were added to the list, the animal would be incongruent within the context of professions. While primary distinctiveness relates to active working memory for currently processed information, secondary distinctiveness is related to information stored in long-term memory. Therefore, secondary distinctive items are any irregular members of a conceptual class that is stored in permanent memory (Schmidt, 1991). A good example of secondary distinctiveness is the word-frequency effect in recall and recognition (Gregg, 1976; DeLosh & McDaniel, 1996). Gregg found that high-frequency words were easily remembered when compared to low-frequency words, but low-frequency words were recognized easier than high-frequency words (1976; Clark, 1992). However, when low and high frequency words are intermixed within a single list set, the superior recall of high-frequency words is eliminated, with low-frequency words being better recalled (DeLosh & McDaniel, 1996).

Schmidt (1991) suggests that primary distinctiveness must be manipulated in within-subject designs in which participants receive all types of stimuli, whether common or distinctive, causing the distinctive stimuli to be dissimilar within the current context of working memory. On the other hand, secondary distinctiveness can be operationally manipulated in either within-or between-subject designs (Schmidt, 1991). It is important to note that distinctive effects are often confined to within-subjects designs (Hunt & Elliot, 1980; Zechmeister, 1972; McDaniel & Einstein, 1986). A general overview of research associated with secondary distinctiveness is provided below. First, there will be a brief discussion of research on bizarre imagery, and then a concise overview of research concerning orthographic distinctiveness. Bizarre imagery and orthographic distinctiveness were chosen mainly due to the fact that processing of such distinct material is incongruent with information stored in long-term memory. Bizarre sentences (e.g., The solider licked the kitten) produce images that have never been experienced or imagined, and words with irregular orthography (e.g., llama, phlegm) differ from common words used in everyday discourse.

Bizarre Imagery Effects in Mixed and Pure Lists

Bizarre imagery research dates back to the late 1970s and early 1980s. In the majority of bizarre imagery designs, a nonbizarre sentence provides a coherent representation between the nouns and verb within the sentence (e.g., The soldier waved the flag), whereas a bizarre sentence is irregular or novel to the action within the sentence (e.g., The solider licked the kitten) (Cox & Wollen, 1981). Researchers interested in the mnemonic benefit of bizarre imagery were struggling to obtain superior memory effects in unmixed lists, meaning that participants received lists that consisted of only bizarre or only nonbizarre sentences (Wollen, Weber, & Lowry, 1972). However, researchers using mixed-lists designs were able to demonstrate superior memory for bizarre material (Merry, 1980). Given the conundrum between list designs, Cox and Wollen (1981) hypothesized that the superiority of bizarre materials should disappear when participants are given unmixed lists that contain only bizarre or only nonbizarre sentences. The unmixed list design used by Cox and Wollen did not produce superior memory for nouns or verbs within sentences, suggesting that the bizarreness effect is solely confined to mixed list designs (1981).

Further research confirmed that bizarre imagery enhances free recall when using mixed lists designs but not with pure lists designs (McDaniel & Einstein, 1986; McDaniel, Einstein, DeLosh, May, & Brady, 1995). McDaniel and Einstein (1986) extended bizarreness research to better understand the specific conditions in which bizarre imagery facilitates memory, in addition to exploring the mechanisms behind bizarreness effects on memory.

Two theories can be applied to the bizarreness effect in order to better understand effects in mixed lists. On one hand, the attentional hypothesis (Wollen & Cox, 1981) suggests that bizarre or novel stimuli attract more attentional resources and interest during encoding. In this sense, bizarre items will stand out as unusual when compared to common items in mixed lists, but not pure lists, due to the contextual backdrop that common items provide within mixed-lists. On the other hand, the bizarreness effect could also be attributed to the distinctiveness effect (Schmidt, 1991) where distinctiveness can be defined in terms of shared features in memory. This suggests that bizarre stimuli should produce encodings that are more distinctive when intermixed with common items than bizarre items, leading to enhanced retrieval. McDaniel and Einstein employed bizarre and common sentences in their design to analyze the effects of bizarreness on free recall and recognition (1986). In support of the attentional and distinctiveness ideas, higher free recall was found for bizarre items when compared with common items in mixed lists, suggesting that bizarre material was easily accessible. To further evaluate the effects of manipulations on mixed lists designs and orienting tasks, McDaniel and Einstein found higher recall for bizarre items when participants completed imagery processing instructions instead of semantic processing instructions in mixed-lists (1986, Experiment 2). Overall, the results of McDaniel and Einstein's study (1986, Experiment 1 & 2) are consistent with the attentional and distinctiveness ideas, but a third experiment was developed to specifically test the differences between attentional processing and distinctiveness effects. In the third experiment, it was found that bizarre imagery improved recall in a mixed-list design for both experimenter-paced and self-paced conditions, suggesting that the results obtained were inconsistent with the attentional hypothesis. Self-paced conditions allowed extra-processing of unusual stimuli because participants were able to attend to the material as long as they needed to store material. However, the experimenter-paced condition did not allow extra-processing time, conflicting against the attentional hypothesis. Finally, McDaniel and Einstein employed a unique design to differentiate the effects of the attentional and distinctiveness hypotheses by having participants read two lists prior to an unexpected recall test (1986). One group of participants received a bizarre sentence list and the second group received a common sentence list, with both groups receiving a second list containing all common sentences. When recall was measured after second list presentation, the group that read bizarre sentences first had superior recall for bizarre items over common items. Therefore, it is suggested that the distinctiveness effect fits nicely with the overall results of the studies in the experiment, in that bizarreness enhances recall only when bizarre items are presented within the context of common items.

As previously reported, McDaniel and Einstein's (1986) research concerning bizarreness effects are most commonly found in tests of free recall in mixed lists. However, bizarreness effects within cued recall tests do not produce a bizarreness advantage (Wollen & Cox, 1981; Einstein & McDaniel, 1987). Wollen and Cox were the first to report that bizarreness effects in cued recall were absent within their design of bizarre sentence cuing (1981). Participants were shown bizarre and nonbizarre sentences with two nouns and one verb within each sentence (e.g., The HEN SMOKED the CIGAR). At the time of testing, participants were given the first noun and verb, and were asked to recall the following noun. Wollen and Cox found that nouns from nonbizarre sentences were recalled significantly better than nouns from bizarre sentences. The absent bizarreness effect was explained by the idea that nonbizarre sentences provided complete sentence integration whereby means of categorical cuing could be used to recall material. For instance, participants were able to infer and validate what to recall from each sentence because the nonbizarre sentences made a coherent unit, instead of a nonsensical representation as in bizarre sentences. Thus, bizarre sentences do not afford integrative qualities that produce a coherent representation, whereas nonbizarre sentences are coherently understood. In contrast to this nonsignificant cued recall effect, an exception can be made in cued recall designs when cues other than parts of the target stimuli are used (Nicolas & Marchal, 1996). Therefore, the different results from the two designs could be attributed to the weakness of intra-item relations within bizarre sentences because the success of cued recall tests depends on strong intra-item relations between stimuli within lists. The inconsistent results within the field of bizarreness research clearly depends on the type of list manipulation, mixed and pure, in addition to whether or not cued or free recall is used within the design.

Order Encoding and Bizarre Imagery

More recently, researchers have promoted a more unified framework called the order-encoding hypothesis to account for the change of recall effects in mixed versus pure list designs within the bizarreness domain (DeLosh & McDaniel, 1996). The order-encoding hypothesis suggests that learners encode the serial order of list items and rely on this order to retrieve information from storage during free recall (DeLosh & McDaniel). For example, individuals use encoding and recall of serial order events in daily functioning because it allows them to rely on the sequence of events when trying to retrieve those events from memory storage (McDaniel, DeLosh, & Merrit, 2000). Order encoding is related to Hunt and McDaniel's (1993) relational and item-specific processing in the sense that recall of information from a list depends on the contribution of relational information that is gained from evaluating the relation between serial order items within a list. Order encoding is developed from the notion that uncommon items attract learners into encoding individual-item information, leaving fewer attentional resources to encode serial order information in mixed lists (McDaniel et al., 2000). Furthermore, manipulations of list design impact order encoding, influencing recall of common and bizarre items. For common items within a list or sentence, recall accuracy should decrease from pure to mixed lists because order encoding is negatively influenced by the presence of bizarre items. In contrast, recall of unusual items, such as bizarre sentences or orthographically distinct words, should increase from pure to mixed lists because order information and item-specific processing are present (DeLosh and McDaniel, 1996). Additionally, the order encoding view can explain why the bizarreness effect is reversed in pure lists. Bizarre items in a pure list should receive less order information processing to help free recall than common items in a pure list. McDaniel et al. (2000) evaluated the order-encoding framework and its impact on free recall of nouns embedded within either bizarre (e.g., The MINISTER ate the BIBLE after DINNER) or common sentences (e.g., The MINISTER read the BIBLE after DINNER) within either mixed or pure lists. As expected, pure lists of common items produced better order memory and recall than pure lists of bizarre sentences. Order memory was measured by providing a randomized list of the initial items that were presented, and participants were asked to reconstruct the order of those items as presented in the first list. In mixed lists, bizarre sentences were better recalled than common sentences, but order memory for bizarre items did not improve when compared to pure lists. The insignificant finding of order memory for bizarre items in mixed lists rejects the serial order-encoding hypothesis because it was originally hypothesized that order memory in mixed lists would be similar to order memory for pure lists, but the opposite was found. However, the distinctiveness effect was still present regardless the influence of order encoding. According to McDaniel et al. (2000), the insignificant finding may suggest a more integrative approach by combining order encoding and distinctiveness views, which has been referred to as the differential-retrieval process. In this vein, the retrieval process for pure lists of common items relies on order information, whereas the use of order information for both mixed and pure lists of bizarre information is discouraged. During free recall of mixed lists of bizarre and common items, item distinctiveness becomes a more salient retrieval cue than serial order encoding (McDaniel et al., 2000). The differential-retrieval process predicts that distinctiveness solely relies on the retrieval context, instead of elaborative processing during encoding. The retrieval context is more robust because the distinct items are different within the context of common items. Moreover, the differential-retrieval view provides an account as to why common items are better remembered than bizarre items in pure lists (McDaniel, Einstein, DeLosh, May, & Brady, 1995). Given the detailed review of the influence list design and type of dependent variable measurement has on the retention of to-be-learned material in bizarre imagery domains; it is possible to suggest that experimental designs provide inconsistent results across the board in bizarre imagery studies. Since bizarre imagery research has been well documented in the distinctiveness literature in an array of facets, researchers have been able to adapt and apply their findings from bizarreness to word-frequency effects and orthographic distinctiveness

(DeLosh & McDaniel, 1996; McDaniel, Cahill, Bugg, & Meadow, 2011). Below is a detailed review of orthographic distinctiveness literature from recall and recognition designs in pure and mixed lists. More importantly, the results covered within the section can be attributed to bizarre imagery effects, with the difference being the type of material used as an independent variable (i.e., distinctive orthography). Unusual orthography and bizarre imagery within pure and mixed lists provide the basic effect of distinctiveness, so it may be useful to delineate the effects as influenced by method of dependent variable measurement and independent variable manipulation.

Orthographic Distinctiveness

Orthographic distinctiveness is best defined as one or more of the various structural features present in a word that make it unusual or interesting when compared to other words of the same frequency or length (Zechmeister, 1969; Zechmeister, 1972). Examples of such distinct orthography can be afghan, epoxy, and khaki (McDaniel, Cahill, Bugg, & Meadow, 2011). Individuals identify unusual orthography by relying on recall and recognition of unusual word features (e.g., contiguous double letters and contiguous double consonants) from long-term memory, which can be classified as a form of secondary distinctiveness (Schmidt, 1991). Zechmeister (1972) was one of the first researchers to report that orthographically distinct words are better remembered than orthographically common words. Moreover, this distinctiveness effect of irregular orthography has been found in recognition (Zechmeister, 1972; McDaniel et al., 2011), free recall (Hunt & Elliot, 1980; McDaniel et al., 2011) and word fragment completion (Hunt & Toth, 1990). McDaniel et al. applied the order-encoding hypothesis to list manipulation effects of orthographic distinctiveness in free recall tests (2011). The item-order framework relies on the assumption that free recall depends on the interaction of item-specific and relational processing among list items (Hunt & McDaniel, 1993). Moreover, the framework also relies on the influence of serial order encoding in pure lists of unrelated items, which is achieved by encoding relational information (Burns, 1996). Lists composed of entirely unusual stimuli lures attention to encoding item-specific information, which decreases the ability to encode information in serial order. In contrast to the distinct pure list effect, common pure lists do not allow individuals to encode item-specific information. Instead, they encode information serially because relational processing is present and robust. The interaction of item-specific and relational processing, and serial order encoding techniques within the order encoding view provides unique explanations as to why list design and manipulations influence distinctiveness effects within the orthographic distinctiveness domain.

McDaniel et al. (2011) extended the serial order encoding view by hypothesizing that a free recall advantage of orthographically distinct items would be present in mixed lists but eliminated under pure list conditions. Participants were randomly assigned to one of three conditions, either an orthographically distinct pure list, an orthographically common pure list, or a mixed list that was split into half common and half distinct. Four lists of eight words were presented to participants in each of their respective conditions. Participants engaged in a distracter task for thirty seconds after each list was presented, and were then asked to recall the words that were shown prior to the distracter task. As expected, an orthographic distinctiveness effect was confirmed within mixed lists, whereas orthographically common words were better remembered in pure lists. This pattern of results relates to the order-encoding account because orthographically distinct and common items encouraged item-specific and serial order processing across lists. For the pure list condition, distinct items did not induce serial order encoding techniques because item-specific processing was more robust, whereas common items were serially encoded and retrieved better than distinct words because item-specific processing did not interfere with relational processing. In contrast, mixed lists encouraged item-specific processing of distinct items at encoding, which detracted from the use of serial order encoding, thus leading to superior memory for distinct words.

In line with recent explanations of distinctiveness effects and list design, the orthographic distinctiveness effect seems to be confined to mixed list designs of both recognition and free recall (Zechmeister, 1972; Hunt & Mitchell, 1982). However, recent research by McDaniel et al. (2011) reported that orthographically distinct words were better remembered than orthographically common items on recognition tests in both mixed and pure lists. The pure list effect of orthographically distinct words in recognition tests appears to stimulate more robust item-specific encoding than do common items, suggesting increased attention to the items. As suggested earlier in the manuscript, the attentional hypothesis (Cox and Wollen, 1981) can provide support for the distinctive effects of recall and recognition within mixed lists due to the notion that distinct items receive increased processing during encoding, whereas pure lists of common and uncommon items will not provide increased processing because all items within the list are of the same content. Therefore, the finding of superior recognition for orthographically distinct items in pure lists counters the attentional hypothesis.

Current Research Purpose

The purpose of the present study is to apply the attentional hypothesis, order-encoding hypothesis and pre-existing association hypothesis to cued recall of word pairs as influenced by list design within the orthographic distinctiveness domain. More specifically, the main research question aims to better understand the influence distinctive orthography has on cued recall so a general idea can be gathered on the differences between each hypothesis within cued recall designs. The findings from the present study could then be applied to bizarre imagery effects within recall, recognition, and cued recall domains to better delineate the reported effects. Distinctiveness and memory literature is replete with inconsistent findings that are attributed to recall and recognition on the basis of list and design manipulation (e.g., bizarreness, orthography, and word frequency; mixed and pure lists). However, cued recall has seemed to fade away behind the veil of research concerning free recall and recognition.

The attentional processing hypothesis predicts that orthographically distinctive word pairs within a mixed list of orthographically common word pairs will lead to greater cued recall effects for orthographically distinctive words because distinctive pairs intermixed within common pairs will lead to extra processing of the irregular items. For pure lists of both orthographically distinct and common word pairs, it is suggested that equivalent recall will be present due to the fact that extra processing during encoding is absent in pure lists. In other words, pure lists of distinct and common word pairs will not allow extra processing because distinctiveness is absent within pure lists.

The order-encoding hypothesis predicts that pure lists of orthographically common items will have superior cued recall than pure lists of distinct items due to the fact that serial order encoding of information is strengthened in common pure lists. Relational processing within pure lists of common items is robust, whereas pure lists of distinct items will induce item specific processing rather than relational processing, leading to insufficient order encoding because of the item specific disruption within lists. For mixed lists, orthographically distinct word pairs will lead to superior cued recall of the adjacent word from the presented pair than orthographically common word pairs. This assumption stems from past research that suggests the interaction of relational and item specific processing within a single list will lead to superior memory of distinctive material (Hunt and McDaniel, 1993). Relational processing will define the context of the list due to the presence of common items, while item specific processing highlights specific properties of items within the list, more notably, distinctive items.

Finally, the pre-existing association hypothesis was developed after evaluating word frequency data for the common and distinct words that were used in McDaniel, Cahill, Bugg, and Meadow's study on orthographic distinctiveness (2011). In short, after constructing trial word pairs from the materials used in the McDaniel et al. (2011) study, it was found that common words were more likely to be associated with one another than distinct words in the English language on the basis of pair frequency. Therefore, the finding of common words being better remembered in pure lists may be the result of pre-existing associations between the common words rather than to differences in relational or serial order encoding during list presentation. In mixed lists, distinct and common words would be presented one after another, thus canceling out the common-common pre-existing associations within pure lists of common items, and leading to better recall of distinct words. The pre-existing association hypothesis suggests that if common and distinct word pairs are consistently matched on associative strength using pair frequency (e.g., 0-150) within both pure and mixed lists, distinctive word pairs should be better remembered than common word pairs in both mixed and pure lists (See Table 1 for all hypotheses).

Table 1

Hypotheses for Cued Recall in Pure and Mixed Lists

Hypotheses	Pure Lists	Mixed Lists
Attentional Processing	Common = Distinct	Common < Distinct
Order-Encoding	Common > Distinct	Common < Distinct
Pre-Existing Association	Common < Distinct	Common < Distinct

Chapter II

METHOD

Participants and Design

Forty-four Middle Tennessee State University students were recruited through the General Psychology course research pool. A 2 (distinct versus common) x 2 (between-list versus within-list) within-subjects analysis of variance was constructed with word type as one independent variable and list type as the other independent variable. Participants received an experiential research course credit that was required of students enrolled in General Psychology 1410.

Materials

Orthographically common and distinct words were obtained from McDaniel, Cahill, Bugg, and Meadow's (2011) research concerning orthographic distinctiveness. McDaniel et al. completed a pilot study in which participants rated the "visual weirdness" of 321 words on a scale from 1 to 5 (2011). These ratings produced 32 orthographically distinct words (M = 3.31) and 32 orthographically common words (M = 1.98) with a significant rated difference between the two sets of words, $p < .001$ (see Appendix A). Common and distinct words were matched as closely as possible for similar frequency within lists (Hyperspace Analogue to Language (HAL) norms; Lund & Burgess, 1996). Four lists (one pure orthographically distinct, one pure orthographically common, and two mixed lists) consisting of eight word pairs for a total of sixteen words per list were constructed from both common and distinct word pair lists (see Appendix B). A practice trial list was constructed using eight word pairs that were gathered from a corpus of words that were rated for emotion and word frequency. Neutral words were chosen for the practice trial with each word providing a similar word frequency (M = 8.06) across the board. Word pairs in both pure common and pure distinct lists were constructed with pair frequency ratings ranging between 0 and 150, with pure common lists (*M* = 22.25) and pure distinct lists (*M* = 20.88) providing similar word frequency averages across all word pairs within each list. Word frequency was equated consistently throughout each pure list so the pre-existing association hypothesis could be tested. Additionally, common (*M* = 6.4) and distinct (*M* = 5.7) words provided somewhat similar word familiarity ratings (Speech & Hearing Lab Neighborhood Database at Washington University in St. Louis).

Procedure

All stimuli were presented on Dell CRT monitors located within a small testing facility on the campus of Middle Tennessee State University. Before the start of each experimental testing trial, participants were given a consent form to complete to ensure their enrollment in the testing section. Participants were instructed to observe word pairs presented on the screen and were asked to remember them for a later recall test. All word pairs were presented in black lowercase type in the center of a white background for 1,500 ms with a 200-ms interstimulus interval. Additionally, word pairs contained a hyphen between each word (e.g., fjords-gnaw) to signify separation. Participants viewed four lists of eight word pairs that consisted of two pure lists (common and distinct) and two mixed lists of half common and half distinct words. Participants were shown every word pair that was constructed from the original word lists, but in randomized order, without repeating word pairs that were used in earlier lists. Once a word pair was used in a specific list, it was removed from the remaining pairs in the word pair bank. After list presentation of the first eight word pairs, participants completed a 30 second distracter task in which they were asked to solve simple arithmetic problems, and provide the correct answer on the monitor. Once the distracter task was completed, participants were shown the first word from the word pairs and were asked to recall the adjacent word within 10 seconds. Each list was tested in the exact same order it was presented. After successful recall of the following word from the first list of eight word pairs, participants then underwent the exact same procedure for the remaining three lists. The first word was given in all word pairs to maintain possible serial order encoding.

Chapter III

Results

Design and Descriptive Statistics

A 2 (word type: distinct versus common) x 2 (list type: between-list versus within-list) within-subjects analysis of variance (ANOVA) was constructed with word and list type as independent variables. Dependent measures consisted of position-cued recall and total cued recall. Position-cued recall was measured by evaluating whether or not participants recalled the correct word in the correct position, whereas total cued recall was measured by scoring all correct recall responses regardless of correct position. Justification for the total cued recall scoring arose during the initial scoring of position-cued recall after noticing participants recalled correct words, but in the wrong position. Therefore, cued recall success could be evaluated through two different processes. Attention should be given to the position-cued recall statistics since it is the main focus of the current study, with total cued recall providing additional information regarding overall cued recall success. Means and standard errors for the dependent measures from each list type are presented below in Table 2.

Table 2

Descriptive Statistics for Position and Total Cued Recall.

	Pure Lists	Mixed Lists
	Correct Position	
Common	.13 (.02)[a]	.20 (.02)
Distinctive	.11 (.02)	.14 (.02)
	Total Recall	
Common	.16 (.02)	.26 (.02)
Distinctive	.18 (.02)	.21 (.02)

[a] Parenthetic values are standard errors

Analysis of Variance

For position-cued recall, the 2 x 2 ANOVA produced a significant main effect of list type, *F* (1, 43) = 8.42, *MSE* = .12, *p* < .01. The results suggest that mixed lists (*M* = .17) led to better recall of common and distinctive words than pure lists (*M* = .12) of common and distinctive words. The main effect for word type was not significant, *F* (1, 43) = 3.80, *MSE* = .07, *p* > .05, suggesting that common word (*M* = .17) and distinctive word (*M* = .13) recall did not provide a significant difference. Finally, there was a non-significant interaction between word and list type, *F* (1, 43) = 1.30, *MSE* = .02, *p* > .05.

For total cued recall, the 2 x 2 ANOVA confirmed a significant main effect of list type, *F* (1, 43) = 11.64, *MSE* = .18, *p* < .01, which is similar to the position-cued recall main effect for list type, with total cued having higher recall. The total cued recall results for list type suggest that mixed lists (*M* = .23) led to better recall of common and distinctive words than pure lists (*M* = .17) of common and distinctive words. The increase in recall from position to total cued recall makes sense considering total cued recall scoring techniques were less stringent than position-cued recall, allowing participants the opportunity to answer correctly in the absence of correct position. A paired samples *t*-test supports the notion for increase in recall from position cued recall (*M* = .15, *SD* = .12) to total cued recall (*M* = .20, *SD* = .12), *t* (43) = 6.52, *p* < .001. The main effect for word type was not significant, *F* (1, 43) = .62, *MSE* = .02, *p* > .05, suggesting that common (*M* = .21) and distinctive word (*M* = .20) recall was somewhat equivalent throughout each list type. The interaction for total cued recall of word and list type was non-significant, *F* (1, 43) = 2.17, *MSE* = .05, *p* > .05.

Chapter IV

Discussion

The findings of the current experiment are in contrast to all the hypotheses proposed in the introduction. However, the nonsignificant findings associated with each hypothesis can provide interesting knowledge to the foundation of distinctiveness and memory in cued recall designs. The results revealed a significant effect of list type, which suggests that mixed lists provided superior recall of distinct and common words when compared to pure lists. Past research suggests that mixed lists produce superior memory in free recall for distinctive items within an array of domains such as bizarre imagery, word-frequency, and orthographic distinctiveness (McDaniel, Einstein, DeLosh, May, & Brady, 1995; Cox & Wollen, 1981; McDaniel, Cahill, Bugg, & Meadow, 2011). Hypotheses that were discussed in the introduction suggested that a distinctiveness effect would arise in mixed lists, but this effect was non-existent. Each hypothesis will be covered in detail to discuss why the distinctiveness effect was absent, in addition to a discussion on the present significant results across list types.

In regards to the attentional hypothesis, it was anticipated that mixed lists of common and distinct word pairs would produce a distinctiveness effect for distinct pairs due to extra attentional resources attributed to orthographically distinct pairs. In contrast, the current results suggest that distinctive items did not receive extra attentional resources in mixed lists. Instead, mixed lists aided in the recall of both common and distinct pairs. The nonsignificant finding could be related to the equated pair frequency of all word pairs within experimental lists. Therefore, common and distinct words within mixed lists may have been processed similarly due to the level of pair association within lists. A distinct word pair would not stand out as incongruent within a mixed list of common word pairs with similar pair frequency. However, pairs in the mixed lists still differed in terms of word orthography. Word pairs were operationally defined as distinctive or common on the basis of word orthography, instead of word-frequency, which was equated throughout pairs. Given the distinction between the operational definitions of distinctive and common material in the study, word-frequency should not have mattered in mixed lists since word orthography could be perceived as distinctive (Zechmeister, 1969) (e.g., continuous double letters and contiguous double consonants). Another assumption could be the absence of item-specific processing in mixed lists due to equated pair frequency. In this sense, distinct words would not induce an exaggerated form of item-specific processing since all pairs were equated. Instead, relational processing could be robust due to the fact that all pairs were similar in frequency. However, as stated earlier, frequency was not used to operationally define distinct and common items. Nonetheless, the equated pair frequency in mixed lists could explain the absent distinctiveness effect in mixed lists.

The order-encoding hypothesis also suggested that a distinctiveness effect would be evident in mixed lists, with pure lists of common pairs being better remembered than distinct pairs due to serial order increasing relational processing. This assumption was not supported since mixed lists produced robust recall for common and distinct pairs. However, the order-encoding hypothesis suggests that the interaction of relational and item specific processing is present in mixed lists because the common items provide a general context of the lists, with item specific processing being achieved by highlighting specific properties of items in the lists (i.e., orthographically distinctive pairs). Quite possibly the interaction of relational and item specific processing aided in the retention of distinct and common words, since relational processing provided the list context, and item-specific processing highlighted distinct pairs (Hunt & McDaniel, 1993). Additionally, the interaction of relational and item specific processing may have been primed by the first word in each pair. In this sense, a common word presented at time of recall would elicit relational processing for the list context, with a distinctive word eliciting item specific processing because the words differ from the context. However, a true distinctiveness effect was not found in the mixed lists with distinct pairs being better remembered than common pairs, as recent research has suggested (McDaniel, Cahill, Bugg, & Meadow, 2011). Pair frequency could have influenced level of recall in mixed lists, with common and distinct pairs being remembered equally well in mixed lists when compared to pure lists.

Finally, the pre-existing association hypothesis did not produce distinctiveness effects in pure and mixed lists as previously hypothesized. Common and distinct words were consistently matched on associative strength using pair frequency, which suggests that unusual orthography should produce a distinctiveness effect in both pure and mixed lists. Instead, common and distinct pairs were better remembered in mixed lists when compared to pure lists, which differs from the pre-existing hypothesis. Quite possibly, equal associative pair strength could have influenced recall of distinct and common words in mixed lists since there were only four pairs of each pair type, distinct and common.

Alternative Explanation

The absence of a distinctiveness effect in the cued recall domain is somewhat of a conundrum given that the present experiment was similar to past experiments that produced a distinctiveness effect in free recall and recognition (McDaniel, Cahill, Bugg, & Meadow, 2011). The inconsistencies in results from free recall and recognition to cued recall highlights differences in experimental design and methodology. The cue overload principle could explain why mixed lists produced better recall for common and distinct words when compared to pure lists (Watkins & Watkins, 1975). The cue overload principle hypothesizes that the recall probability of targets diminishes as more targets share similar retrieval cues (Watkins & Watkins). For instance, pure lists consisted of eight word pairs of the same word type, common or distinct, whereas mixed lists consisted of four common and four distinct pairs. On one hand, the pure lists consist of a single category with eight pairs that must be stored and retrieved, and on the other hand, the mixed lists consist of two categories that can be separated into distinct and common on the basis of word orthography. Therefore, when participants encountered the first word of each pair in mixed list recall tests, their retrieval cues were allocated to a specific category. The categorical retrieval technique enhanced recall of common and distinct words in mixed lists because participants could discriminate between stimulus presentations of the first word in the pair. In contrast, the pure lists could not provide this level of stimulus discrimination because all retrieval cues were of the same category. Patterson found similar results in which recall probability from a categorized list decreased as category size increased (1972). In sum, the main effect for list type, in which mixed lists produced superior recall for common and mixed pairs, could possibly be due to stimulus discrimination by influence of the cue overload hypothesis.

The absence of a distinctiveness effect could also be influenced by a few limitations of the experimental design. Cued recall tests have been limited to bizarre imagery studies in which bizarre and nonbizarre sentences were used as stimuli, instead of word pairs (Cox and Wollen, 1981). Wollen and Cox found that nonbizarre sentences produced better recall of nouns than bizarre sentences. The superior recall of items from nonbizarre sentences suggests that participants were able to categorically cue and integrate the first noun and verb within each sentence to the necessary item at time of recall to make a coherent representation. Bizarre sentence items produced a nonsensical representation that interrupted word integration and categorical cueing. Therefore, it seems that bizarre sentences and distinct word pairs produce weak intra-item relationships, which are necessary to the success of cued recall tests. In free recall tests, inter-item relations are concerned with how strongly items of a single list are related to each other. Given the differences between intra and inter-item relationships, distinct pairs and bizarre sentences disrupt intra-item relationships, and inter-item relationships are only disrupted in mixed lists when unusual material is encountered within the context of common material.

Limitations of Methodology

The present study adapted the method and design of a free recall and recognition study that focused on orthographic distinctiveness (McDaniel, Cahill, Bugg, and Meadow, 2011). The first major limitation is the use of very unusual words within a population that may not have been exposed to such stimuli. However, distinctive stimuli must be used to elicit some form of secondary distinctiveness. Nonetheless, the participants that were recruited for the present study were all enrolled in General Psychology, so their vocabulary may not have been extensive enough to process and recall the distinct words effectively in such short amount of time (i.e., 10 second recall period). Another limitation could possibly be the rate of stimulus presentation for the word pairs. Word pairs were presented at a rate of 1500 ms with a 200-ms interstimulus interval, which is equivalent to McDaniel, Cahill, Bugg, and Meadow's presentation rate (2011). In future cued recall designs, the presentation rate could be doubled to elicit equal processing for both words in each pair. Finally, there was a mixture of long and short length words in both types of lists. Word length may have influenced the amount of time each participant had to process each pair. For example, "glue-amplification", reminder-refinement" and "rheumatism-afghan" could have caused inconsistent processing times. Therefore, it may be beneficial to increase presentation rates and control for word length in future research that is interested in evaluating cued recall.

In sum, the present study has paved new routes into the understanding of the mechanisms behind distinctiveness and memory in cued recall designs. Cued recall in distinctiveness and memory has shadowed free recall and recognition studies, but the present study highlights the importance of cued recall. More specifically, cued recall allows researchers to apply free recall and recognition findings to the cued recall domain to evaluate if distinctiveness effects are strictly present in recognition and recall. The results have also been beneficial in understanding the interaction of encoding and retrieval mechanisms for distinctive material in cue designs. All word pairs were encoding equally well, with retrieval techniques following some sort of categorical recall if two separate categories were present. Future research could use word frequency and familiarity as independent variables to evaluate whether or not distinctiveness effects are influenced by associative word frequency and familiarity in cued recall designs. Moreover, research could analyze the influence categorical cueing has on the retention of distinct and common material. Overall, it is unfortunate that a distinctiveness effect did not arise in the present study, but the study has been helpful in understanding alternative explanations such as the cue overload principle and associative pair frequency.

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Appendices

Appendix A

Complete Word Bank

Orthographically Common	Orthographically Distinct
abstain	afghan
almond	alfalfa
amplification	asphyxiation
arcade	asylum
bison	calypso
cedar	crypt
cookie	czar
cube	epoxy
eraser	fjords
flank	gnat
glacier	gnaw
glue	gypsum
grit	hyena
harp	hymn
kennel	khaki
kidney	knoll
leaky	llama
lens	lymph
loser	lynx
mentor	methyl
parachute	phlegm
pawnshop	physique
postmark	pneumonia
probate	ptomaine
refinement	rhetoric
reminder	rheumatism
ruler	rhyme
setter	sphinx
shank	suede
sleet	svelte
tram	tsar
trinket	typhoon

Appendix B

Word Pairs

Orthographically Common	Orthographically Distinct
pawnshop-cookie	svelte-rhetoric
eraser-kennel	hymn-suede
abstain-cube	lymph-rhyme
lens-sleet	physique-gnat
setter-kidney	phlegm-methyl
flank-ruler	lynx-pneumonia
almond-postmark	crypt-llama
tram-harp	fjords-gnaw
cedar-leaky	czar-calypso
amplification-reminder	khaki-epoxy
mentor-trinket	knoll-tsar
loser-refinement	alfalfa-hyena
shank-glacier	typhoon-sphinx
arcade-grit	rheumatism-afghan
probate-glue	asphyxiation-ptomaine
parachute-bison	asylum-gypsum

Appendix C

IRB Approval Letter

1/17/2014
Investigator(s): Austin Riley Finch
Department: Department of Psychology
Investigator(s) Email Address: rpf2k@mtmail.mtsu.edu
Protocol Title: EFFECTS OF ORTHOGRAPHIC DISTINCTIVENESS ON CUED RECALL IN PURE AND MIXED LISTS
Protocol Number: #14-185

Dear Investigator(s),
Your study has been designated to be exempt. The exemption is pursuant to 45 CFR 46.101(b)(2) Educational Tests, Surveys, Interviews, or Observations.

We will contact you annually on the status of your project. If it is completed, we will close it out of our system. You do not need to complete a progress report and you will not need to complete a final report. It is important to note that your study is approved for the life of the project and does not have an expiration date. The following changes must be reported to the Office of Compliance before they are initiated:

. Adding new subject population
. Adding a new investigator
. Adding new procedures (e.g., new survey; new questions to your survey)
. A change in funding source
. Any change that makes the study no longer eligible for exemption.

The following changes do not need to be reported to the Office of Compliance:
. Editorial or administrative revisions to the consent or other study documents
. Increasing or decreasing the number of subjects from your proposed population

If you encounter any serious unanticipated problems to participants, or if you have any questions as
you conduct your research, please do not hesitate to contact us.

Sincerely,

Kellie Hilker
Compliance Officer

615-494-8918