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# Context Effects in Memory through the Lens of the Outshining Hypothesis

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Abstract

Memory performance is often better for events or items that are retrieved in a context similar to the context in which they were experienced. The presence or absence of such context effects can be explained by the outshining hypothesis (Smith & Vela, 2001), which states that, at retrieval, there are two types of cues that memory depends on, the context cue and the item cue. The stronger of these two cues suppresses, or "outshines" the weaker cue thus strengthening or eliminating context effects. Context effects are eliminated when memory performance is driven by the stronger item cue, which then 'outshines' the weaker context cue. In the present study, I examine the outshining hypothesis by manipulating the strengths of the context and item cues using concrete words (stronger item cue) and abstract words (weaker item cue) studied in two different kinds of context, videos (stronger context cue) and background color (weaker context cue). Contrary to the predictions of the outshining hypothesis, the context effect for abstract words was no greater than for concrete words. The study also failed to find greater context effects for video than background color context effects. These results can either provide evidence against the outshining hypothesis or raise questions about the relative strengths of the context and item cues used in the study.

*Keywords*: outshining, context-dependent memory, recall, context effect, word concreteness, retrieval cues

## Context Effects in Memory through the Lens of the Outshining Hypothesis

Taking a test in the same room where the material was learned has often been shown to be beneficial in terms of performance because reinstating the study context provides a cue to remember previously studied material (Grant, Bredahl, Clay, Ferrie, Groves, McDorman & Dark, 1998). However, students may still do well even if their exam takes place in a room different from the room in which they first studied the material. These contradictory facts raise the question of whether there are other factors that affect such context effects like (1) the type of context in which the material was first learned, i.e., the study context, or (2) the depth of learning of the material. The present study will manipulate these two factors in the laboratory to understand the variations in context effects.

Study context can be seen as the physical, emotional, or psychopharmacological state of the participant or any visual, auditory, or other sensory aspects that are external to the studied item or event. In the laboratory, memory performance has often been found to be better for events or items that are retrieved in a context similar to the context in which they were experienced (Smith & Vela, 2001), a result consistent with the encoding specificity principle (Tulving & Thompson, 1973) which states that memory performance is improved when there is a greater overlap between the cues available at the first encounter with the material and the cues available at retrieval.

In experiments where such context effects are investigated, there is a study phase where participants study stimuli, typically a list of words, in a given context, followed by a test phase where participants are asked to perform a memory task involving the studied items. The test occurs in a context that may be the same as the study context or different from the study context. Distractor tasks are often administered in these studies to avoid rehearsal of items encountered at

the study phase. A context effect is observed when memory performance in the same study-test context condition is greater than that in the different study-test context condition (Smith & Vela, 2001).

In a classic study, Godden and Baddeley (1975) studied context effects of two natural environments. Participants were scuba divers who studied a list of words either on land or under water and then were tested with a free recall task in the same natural environment or in the other environment. There was a context effect, i.e. memory performance was better in the same study-test context conditions than in the different study-test context conditions.

Context effects have been obtained in experiments that created contexts through a variety of different mediums. Examples include use of experimental rooms (Smith, 1979; Smith, Glenberg, & Bjork, 1978), odors created by aroma diffusers (Isarida, Sakai, Kubota, Koga, Katayama & Isarida 2014; Herz, 1997), background music (Balch, Bowman, & Mohler, 1992; Smith, 1985), presence or absence of noise (Grant et al. 1998), and background color of the monitor on which the stimuli are presented (Isarida & Isarida, 2007). Few studies have created context through videos (Smith & Manzano, 2010; Smith, Handy, Angello & Manzano, 2014).

Typical context manipulations through place and background color have exhibited context effects in some studies but not in others (Isarida and Isarida, 2007; Rutherford, 2007). Failures to observe context effect in different studies (e.g., Smith, 1979; Smith 1984) may be because of (1) overloading context cues and/or (2) the ease with which the participants can mentally imagine the study context during the test phase. A typical study investigating context effects has multiple words presented in a given context. When the context is created by background color, for example, multiple to-be-remembered items are present on the same background color. As the words change, the context does not and so all the words are associated with a static context that

may overload the context cue (Watkins & Watkins, 1975). Overloading the context cue then weakens the ability of the context to evoke the memory of the words as was seen in Isarida and Isarida (2007) and Rutherford (2004). In addition, because of the constant nature of the context, i.e. the same background color for all the to-be-remembered items, it may be easier for participants to mentally imagine the study context when their test context is different from their study context (Chu, Hadley & Cooper, 2003). The ease with which a participant can imagine the color context in the different study-test condition may work against finding a context effect (Smith, 1979) because both the same and different study-test blocks end up being the same study-test blocks.

Smith and Manzano (2010) tried to explain the variations in results in the literature and overcome these limitations by creating context through videos. Videos are changing, i.e., not static, unlike background colors, and are harder to imagine in the test context. Since video is changing, each word is associated with a different scene of the video. This changing nature of the video makes it harder for a participant to reinstate the exact context in which a word was shown unlike background color where all words are shown on the same color. In the experiment, participants studied a list of words superimposed on background movie scenes. Immediately after the study phase, the participants were given a recall test while movie scenes were played in the background. Even though this study was successful in finding video context effects, it is unclear whether this context effect is greater or lesser than other context effects created by manipulating other contexts like place context or odor context.

Different experiments have successfully demonstrated context effects for various types of contexts, but no individual experiment has tested the difference in the magnitude of the context effects for different types of context. Smith and Vela (2001) analyzed 93 published effect sizes to

conclude that with the average effect size of $d = 0.28$, context has a small but reliable effect in memory. The effect sizes were gathered from separate studies that manipulated contexts through place, odor, sound or background color. No study has compared the magnitude of the context effects between two different kinds of contexts.

Context effects are more often found in recall (Godden & Baddeley, 1975; Parker & Gellatly, 1997; Smith, Glenberg & Bjork, 1978) than in recognition (Godden & Baddeley, 1980; Fernandez & Glenberg, 1985; Smith et al., 1978). In a recognition task, words are presented for participants to determine whether or not they were shown in the study phase, whereas in a free recall task, participants have to recall words from the study phase with no words or cues presented.

The presence of context effects in recall and their absence in recognition have been explained by the outshining hypothesis (Smith, 1988). This hypothesis explains that the difference in context effects seen in recall and recognition is due to of the type of cues present in the two memory tasks. In a recall task, the only cue available to the participant is the context cue whereas in a recognition task, participants have the item cue in addition to the context cue. Therefore, memory performance in a recognition task is less dependent on the context cue than memory performance in a recall task. Because the item cue is present in the recognition task, that cue may 'outshine' the context cue, eliminating the context effect in recognition. In recall, however, memory performance is more dependent on the context cue because of the absence of an item cue that results in greater context effect in recall than in recognition.

One prediction from the outshining hypothesis is that as the relative strength of the to-be-remembered item increases, the magnitude of context effects will decrease because memory performance becomes increasingly more driven by the stronger item cue. The strength of the to-

be-remembered item is affected by factors like word concreteness, word frequency, meaningfulness of words (words vs. non-words) (Isarida, Isarida & Sakai, 2012), the duration for which the word is presented at study (Isarida et al., 2012) and the level of processing of words (Smith, 1986) in the study phase. When such item cues are present, participants' memory performance for the to-be-remembered items become more dependent on these cues compared to the context cues. The item cues, therefore, 'outshine' the relatively weaker context cues. Since item cues are present in both the same and different study-test context conditions, memory performance should not differ between the two conditions, thus eliminating context effects.

This prediction by the outshining hypothesis of a strong item cue 'outshining' context cues is consistent with the results obtained in Isarida et al. (2012), where they manipulated item cues by presenting words for either a long (4 seconds) or short (1.5 seconds) study time. Context was created in this experiment through the combination of place, experimenter and subsidiary task (simple calculation task or motor task). The results from the subsequent recognition test showed that there was a context effect in memory for words studied for a shorter time but not for words studied for a longer time. According to the outshining hypothesis, for words presented for 4 seconds, a longer study time strengthens the item cue weakening or eliminating context effects. For words presented for only 1.5 seconds, the item cue was not strong enough to outshine the context cue, resulting in context effects in this condition.

The item does not necessarily have to be presented in the test phase in order for item cues to outshine context cues. One such example of this phenomenon is seen in Isarida et al. (2014), where the participants performed a recall test, i.e. the stimulus items were not presented in the test phase, and item cues were still able to 'outshine' the context cues. The experimental design was similar to Isarida et al. (2012) with words presented for a short time (4 seconds) in one condition

and for a long time (8 seconds) in another. If the items had to be present in the test phase to outshine the context cue, then there should be context effects for all the items, regardless of how long their study time is because none of the items are presented at recall. However, Isarida et al. (2014) found that there was a context effect in memory for words studied for a short time (4 seconds), but not for words studied for a longer time (8 seconds). This result can also be explained by the outshining hypothesis by examining what happens at the study phase. Because the 8-second words were encoded for a longer time, it allowed the participant to make stronger associations than for the 4-second words, and the stronger associations were easier to retrieve at test. Due to the lower exposure time of the 4-second words, the associations were not strong enough in the study phase and therefore were not as easily recreated in the test phase.

Another way in which item strength can be manipulated is through the meaningfulness of presented words. Isarida et al. (2012) examined context effects in recognition memory for words and non-words, where words were associated with stronger item cues because they have greater meaningfulness than non-words. Meaningfulness of items has been shown to determine strength of item cues (McGeoch, 1930; Underwood & Shultz, 1960), e.g., words, constitute stronger item cues than non-words because words have more meaning than non-words. According to the outshining hypothesis, because non-words constitute weaker item cues compared to words, the item cues from the non-words would not be able to outshine the context cue whereas item cues from the words would be able to outshine the context cue. The results from this study were consistent with this prediction as there was a context effect for non-words but not for words.

The goal of the present experiment was to further examine the outshining hypothesis by manipulating the strengths of the item and context cues. Because context effects are more often evident in recall than in recognition (Godden & Baddeley, 1975, 1980; Smith et al., 1978) the

present experiment consisted of a free recall task in the test phase. Item cue strength was manipulated through word concreteness. The majority of the studies in the literature have manipulated item cues through meaningfulness of words and study time as described above but studies have not looked at factors like word concreteness. Previous studies have found that memory is better for concrete than abstract words (Walker & Hulmes, 1999; Kroll & Merves, 1986), suggesting that concrete words can be associated with stronger retrieval cues than abstract words. The outshining hypothesis predicts that since concrete words are associated with stronger item cues than abstract words, there will be a weaker context effect for concrete words than abstract words. Strong item cues from concrete words should 'outshine' the context cue more than the weaker item cues from abstract words, and so memory performance for concrete words should be less dependent on the context cue.

The present experiment manipulated context cues by creating two different contexts through the presentation of videos and background color. According to the outshining hypothesis, a context constituting stronger cues will lead to larger context effects. A video is perceptually multimodal because there are both visual cues, like movements and actions, and auditory cues. This combination of visual and auditory cues makes video give rise to strong context cues (Smith & Manzano, 2001). In addition, video context, unlike background color context, is not static and is changing constantly, and so the context cue will not be overloaded with multiple target words. Background color is unimodal because it has the visual aspect only, making background color a relatively weaker context cue. Therefore, the outshining hypothesis would predict relatively smaller context effects in memory when context is created through background color than when created through videos. It is important to note that color context is also static, unlike video context, and so the context cue may be overloaded with multiple target words. The videos used in this

study are not movie scenes as in Smith and Manzano (2010) because movie scenes can be distracting given the dialogue and the storyline the participant may have to follow. Instead, I used natural scenes with no dialogues, plot or people that could possibly distract the participant.

The outshining hypothesis predicts that the nature of the interaction between context match and context type would differ between the concrete and abstract words. For both concrete and abstract words, the hypothesis would predict that there would be greater context effect in the video than the color condition because video context constitute strong context cues that will outshine item cues more than color context. For concrete words, there would be a context effect in the video condition but none in the color condition because stronger item cues of concrete words would outshine the weaker color context but not the stronger video context. For abstract words, context effects would be present in both video and color conditions because weaker item cues from abstract words would not be able to outshine context cues; but the context effect in the video condition would be greater than that in the color condition since video constitutes stronger context cues than color.

## Method

### Participants

Seventy-two undergraduate students from Wellesley College, who are Native English speakers, participated in the experiment. Written informed consent was obtained from all participants and the experimental procedures were approved by the Ethics Committee of the Department of Psychology at Wellesley College. Each participant received $5 for their participation.

### Materials

The critical stimuli were 80 words, divided into two lists, each containing 20 concrete and 20 abstract words (See Appendix A). The words varied in length from four to eight letters. On a scale of 1 (low concreteness) to 7 (high concreteness), each concrete word had a rating of at least 5 and each abstract word had a rating of no more than 4 (Kroll & Mervis, 1986). Across the two lists, concrete words were matched on word length (List 1 $M = 6.1$, List 2 $M = 6.2$, $p = 0.90$), concreteness rating (List 1 $M = 6.2$, List 2 $M = 6.3$, $p = 0.53$) and frequency (occurrence per million, List 1 $M = 42.0$, List 2 $M = 41.1$, $p = 0.95$; Francis & Kucera, 1982). Similarly across the two lists, abstract words were matched on word length (List 1 $M = 6.3$, List 2 $M = 6.3$, $p = 1.00$), concreteness rating (List 1 $M = 2.6$, List 2 $M = 2.7$, $p = 0.52$) and frequency (occurrence per million, List 1 $M = 40.1$, List 2 $M = 39.3$, $p = 0.96$; Francis & Kucera, 1982). Finally, within each list, concrete and abstract words were matched on word frequency ($p = 0.90$ for List 1 and $p = 0.90$ for List 2) and word length ($p = 0.73$ for List 1 and $p = 0.81$ for List 2).

Videos were clips from YouTube that depicted natural scenes of a rainy day (HD Rain Video - Watch Cold Lush Drops to Relax), a train (The Jacobite-October 2012), and a boat ride (Boat Ride out of Cathedral Canyon, Lake Powell). The three background colors used were red, blue and green.

**Design**

This experiment employed a 2 X 2 X 2 mixed-factorial design with a between-subject variable of context type (video vs. background color) and within-subject variables of study-test context match (same vs. different) and type of word (abstract vs. concrete). Participants were randomly assigned to one of the two context conditions. A chi-square analysis was done to examine the distribution of students from different class years in the video and color groups

(Table 1). These distributions did not differ between the two groups, $\chi^2$ (3, $N$ = 72) = 3.00, $p$ = .39.

**Procedure**

The total procedure took approximately 30 minutes. The experiment consisted of two study-test blocks, one where the context at test matched the context at study (same-context condition) and the other where the context at test was different from the context at study (different-context condition). Half of the participants had the same-context block first while the other half had the different-context block first.

Participants completed a distractor task between the study and the test phase in each block, and between the two study-test blocks.

**Study Phase.** In each study phase, participants were shown a list of words presented on a projection screen. For participants in the video context condition, each word was superimposed on a video background for four seconds. For participants in the background color context condition, each word was superimposed on color background for four seconds. Each list contained 20 abstract and 20 concrete words presented in a pseudo-random order, with no more than two concrete/abstract words appearing consecutively. There were three filler words at the beginning and three at the end of the list to avoid primacy and recency effects on memory for the stimuli. Participants were asked to pay attention to both the video/background color and the words for a memory test afterwards.

**Test Phase.** Participants were instructed to complete a paper-and-pencil free recall test and were given 3 minutes to do so. While participants performed the task, context was created through the same video/background color in the same-context block and through a different

video/background color in the different-context block. Each participant in the video context condition, therefore, was shown three videos – one in the same-context block and two in the different-context block. The same was true for participants in the background color context condition. Across participants, the three videos/background colors appeared equally often in the same and different context conditions.

**Distractor Phase.** Participants were given a distractor task consisting of 25 arithmetic problems and were asked to complete as many as possible in 2 minutes. The distractor task was administered between the study and test phases to avoid rehearsal of studied items, and between the two study-test blocks so that participants remained naive to the purpose of this experiment

After completion of the two study-test blocks, participants were asked to fill out a demographic survey asking them information on ethnicity, race, gender, class year, study habits and major.

## Results

The dependent variable was the proportion of words recalled. The maximum number of words that could be recalled was 40. The dependent variable was calculated by dividing the number of words recalled by 40. The means, standard deviations and confidence intervals for memory performance for concrete and abstract words in the different context type (video vs. background color) and context match (same vs. different) conditions are shown in Table 2.

The data were submitted to a 2 x 2 x 2 mixed-factorial ANOVA with a between-subject factor of context type (video vs. background color) and two within-subject factors of study-test context match (same vs. different) and type of word (abstract vs. concrete). There was no significant main effect of context type $F(1, 70) = .82$, $p = .368$, $\eta_p^2 = .012$, indicating that there was no difference in proportion of words recalled in the video, ($M = .24$, $SD = .08$, 95% CI

[.21, .26]) and background color contexts, (*M* = .25*, SD* = .08 *,* 95% CI [0.23, 0.28]). The ANOVA revealed a significant main effect of context match, $F(1, 70) = 5.31$, $p = .024$, $\eta_p^2 = .071$, with more words recalled in the same-context, (*M* = .26*, SD* = .10*,* 95% CI [0.24, 0.29]), than in the different-context condition, (*M* = .23*, SD* = .09*,* 95% CI [0.21, 0.25]). There was a significant effect of word type, $F(1, 70) = 21.79$, $p < .001$, $\eta_p^2 = .237$, with more concrete words (*M* = .27*, SD* = .10*,* 95% CI [0.25, 0.29]) recalled than abstract words, (*M* = .22*, SD* = .08, 95% CI [0.20, 0.24]).

Contrary to my predictions, the context effect for abstract words was no bigger than that for concrete words [context match x word type, $F(1, 70) = .61$, $p = .439$, $\eta_p^2 = .009$] (Figure 1). In addition, contrary to my prediction, the context effect was no bigger in the video context condition than the color context condition [context match x context type, $F(1, 70) = .17$, $p = .683$, $\eta_p^2 = .002$] (Figure 2), and the context match x context type interaction did not differ for concrete and abstract words [3-way interaction, $F(1, 70) = .51$, $p = .478$, $\eta_p^2 = .007$].

A follow-up analysis was conducted on the data from the first study-test block alone because of possible carryover effects on the second-study block. The data were submitted to a 2 x 2 x 2 mixed-factorial ANOVA with between-subject factors of context type and study-test context match (unlike the primary analysis, the context match was a between-subject variable in this analysis) and a within-subject factor of type of word. All the main effects and interaction effects were of a similar nature as the previous ANOVA.

The survey that participants filled out at the end of the study had questions about an individual's productivity level while watching TV and listening to music, and about math stress levels. Because I did not observe the predicted differences in context effects in the video and background color conditions, independent sample t-tests were done to see if the video and color

context groups differed in levels of math stress or productivity. If there was a difference in math stress level or productivity between the two groups, then the absence of the desired variation in context effects in the video and color conditions might have been due to the differences between the two experimental groups on these individual differences measures and not because of the hypothesis being wrong. There was no significant difference in the productivity level between the video ($M$ = 2.56, $SD$ = .94) and color group ($M$ = 2.17, $SD$ = .89), $t(69) = 1.77$, $p = 0.08$. There was no significant difference between the math stress levels caused by the distractor task in the video ($M$ = 2.72, $SD$ = 1.16) and color groups ($M$ = 2.74, $SD$ = 1.01), $t(69) = 0.08$, $p = .94$.

## Discussion

Two aspects about the results from the present study are consistent with the literature. Concrete words were, in fact, better remembered than abstract words, and memory for words retrieved in a context that was the same as the study context was better than that for words retrieved in a context different than the study context.

However, the magnitude of the context effect did not differ between the video and color context conditions. The outshining hypothesis had predicted that because video constitutes stronger context cues than color, the video context effect would be greater than the color context effect. In addition, there was no difference in the level of context effect between concrete and abstract words. The hypothesis also predicted that because concrete words constitute stronger item cues than abstract words, context effect would be weaker for concrete than abstract words.

The present study manipulated context match as a within-subject factor and this manipulation had raised the concern of carryover effects from the first study-test block to the next. Participants commented that they might have become better while doing the second study-test block. In order to eliminate these carryover and practice effects, I looked at the results from

the first study-test block alone. Results from this secondary analysis were no different from the primary analysis, which shows that the nature of the performance in the first study-test block was no different than that in both study-test blocks.

The results from the study are inconclusive regarding the predictions made by the outshining hypothesis about the strength of contexts and the resulting magnitude of context effects. There was no significant difference between the magnitudes of the context effects with video and color contexts i.e., the video context effect was no bigger than the color context effect. This result could mean that the outshining hypothesis is wrong and that context effects do not differ as a function of the strength of the contexts. When only video context effect was examined for the present study, it was not significant and the effect size was $d = 0.23$. However, Smith and Manzano (2010) found significant context effects when they created context using videos, with an effect size greater than $d = 1.0$. This effect size is much larger than the average effect size of $d = 0.28$ calculated by Smith and Vela (2001). The larger effect size for video context effect in Smith and Vela (2001) suggests that video could be a stronger context than other types of context, which is consistent with the outshining hypothesis, but inconsistent with the results from the present study.

One of the assumptions that the present study rested on was that color context was a static context and could be overloaded with multiple to-be-remembered items more so than video context. The videos used in my study, however, were more 'static' than the action-filled, plot-driven videos used in Smith and Manzano (2010) because my videos consist of relative unchanging scenes of boat moving through a cliff, raindrops, and a train moving through a desert. These videos, by their nature, were moving, but they were functionally static contexts compared to the videos used in Smith and Manzano (2010). Smith and Manzano used videos with an

evolving context, which allowed participants to encode a particular word with a specific context. Because of the relatively static nature of my videos, they may have been overloaded with multiple to-be-remembered items just as much as the color context. An evolving context like that used by Smith and Manzano (2010) resolves the problem of overloading the context, which could be the reason they found a much larger video context effect that my study did. The constant nature of the video also suggests that the video used in the present study may not have been sufficiently strong a context to 'outshine' the item cues. So, the outshining hypothesis may not be wrong and the absence of the difference in video and color context effect may have been due to a methodological limitation instead. The present study could, therefore, be replicated using movie scenes in order to get the robust effect like in Smith and Manzano (2010). If the outshining hypothesis is right, results from that study should show a larger context effect of video than color and that would suggest that the video context used in the present study did not constitute strong enough context cues. Another possible experiment would be testing two different kinds of video context effects of relatively static and evolving videos in the same experiment and observe which one creates a larger context effect. Results showing larger context effects for the evolving video will support the outshining hypothesis.

The present study was novel in comparing context effects of two different types of context, but the two contexts used may have been too similar in nature. As mentioned before, even though video is a changing context, the videos in the present study are relatively static and therefore similar to the color context. More importantly, given the relatively static nature of the videos used in the present study, participants may be able to mentally imagine the video context as easily as they can imagine the background color context when the test context was different than the study context, essentially turning it into the same study-test condition (Chu et al., 2003). Such

uninstructed, spontaneous mental imagination of contexts by the participants may have weakened the experimental manipulation of the different contexts e.g., in Smith (1979).

Another reason the context effect of video might have been smaller might be that the video context was not fully reinstated by me in the test phase. During every study and test phase, lights were switched off so that the participants would only concentrate on the projection screen. When context was created using background color, the color from the projection screen created a 'hue' effect in the experiment. Even though participants may have been looking down at the paper while recalling words, the color was still reinstated. For the video context, however, while trying to write down the words on their sheet, the participants may have missed the visual part of the video, which made them remember fewer words than they could have otherwise. The lack of video context reinstatement in the test phase may have resulted in a lower video context effect in the present study.

One way to resolve this problem would be to use a recognition test rather than a recall test. The present experiment used recall because experimental comparisons have shown context manipulations that have affected recall performance but not recognition (Smith & Vela, 2001). However, if recognition was the memory task in the test phase, then participants would have to look up at the screen and video context would have been reinstated more successfully than it was in the recall test, making it more likely for participants to perform better in the same than the different context condition. Future experiments could compare context effects in recall and recognition tasks using the present study's methodology.

The present study was the first study that manipulated the strength of item cues through concreteness of words. However, it was unsuccessful in finding a greater context effect for abstract words than concrete words. This result could mean that the outshining hypothesis is

wrong and in fact there are no differences in context effects for items differing in their levels of strength. However, the outshining hypothesis would only be wrong based on my assumption that concrete words constitute stronger item cues than do abstract words. This assumption was based on the finding that memory is better for concrete than abstract words, which was a finding from the results of the present study as well. Memory of a certain type of item may not be an accurate way to determine the strength of the item cues it may constitute. For example, there have been contradictory results on whether level of processing of words affect context effects. When a word is processed at a deeper level, it is remembered better than a word processed at a shallow level (Craik, 1979; Craik & Lockhart, 1972). However, memory performance may not necessarily be linked to whether an item constitutes a strong item cue. While Smith (1986) found context effects for shallow-processed and not for deep-processed words (consistent with the predictions of the outshining hypothesis), Smith, Vela and Williamson (1988) found that level of processing did not alter the magnitude of context effects. Smith et al. (1988) concluded that level of processing did not affect context effects in memory. Therefore, even though level of processing has been shown to affect memory performance, the above findings suggest that greater memory performance may not necessarily mean stronger item cues. And so my assumption of concrete words constituting stronger item cues than abstract words based on the greater memory performance may not have been justified.

Even though concreteness (present study) and level of processing for words (Smith, 1988) were unsuccessful in testing the outshining hypothesis, these findings do not eliminate other item cues that could alter the magnitude of context effects. The strength of item cues can be manipulated successfully using study time (Glenberg, 1979) and meaningfulness of words (McGeoch, 1930; Underwood, 1966; Underwood & Shultz, 1960). Isarida and colleagues (2012,

2014) manipulated the strength of item cues using study time and meaningfulness of words, which produced results supporting the outshining hypothesis. The magnitude of the context effect did change with the changes in meaningfulness and study time for target items, with larger context effect for less meaningful and shorter study-time items. Therefore, proper assessments of the relative strengths of item cues compared to that of the context cues must be taken into consideration while testing the outshining hypothesis.

When there is a context effect, it is often hard to identify what aspect of the experience gives rise to the effect. Changes in internal context of a participant can often affect context effects as well. Concepts like the mood mediation hypothesis (Eich, 1995) explain that some environmental context effects could be a result of mood dependent memory. The present study, like other studies, has only manipulated external context in the study and test phases and had no control over and did not measure any internal state/context a given participant may have in the two phases, e.g., mood of the participant.

Studies have explored internal context effects, like the effect of the mood state of participants (Bower, 1981; Bower, Monteiro, & Gilligan, 1978) where changes in mood state from study to test have lowered memory performance. The manipulations of psychopharmacological states (e.g., through ingestion of alcohol, general anesthetic, or drugs) have also yielded context effects in memory (Eich, 1980; Adams, Castro & Clark, 1974, Downey 1975). Changes in such internal states of the participant lower memory performance compared to when there are no changes, thus exhibiting a context effect. The encoding specificity principle would explain this situation as less overlap of context between encoding and retrieval leading to lower memory performance.

It is difficult to isolate one factor that explains the variations in context effects in memory,

i.e., why context effects are present sometimes and not at other times. The outshining hypothesis, the mood mediation hypothesis, and cue-overloading concepts are a few of many concepts that have attempted to explain context effects and factors that alter context effects. The outshining hypothesis attempts to provide an explanation for the contradictory results in studies observing context effects. In addition, the hypothesis also provides a practical explanation of context effects that may be useful for students. This theory gives students strategies they can use to maximize their performance. If one has a strong understanding of the topic they are studying, then according to the outshining hypothesis, the student's overall performance would not be affected by a change in the context of the test room. This prediction would then encourage students to internalize the material as much as they can in order to maximize performance. On the other hand, the outshining hypothesis also encourages students to maintain the similarity of their study and test contexts as much as possible in terms of not watching TV or listening to music while studying, because these contexts would be unavailable during test and could negatively affect their performance. Therefore, it is important to study more theoretical questions regarding context effects in memory so that they can help answer these practical questions that can attempt to ease the difficult life of the students!

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Table 1

*Crosstabulation of Class Year and Context Type*

| Context Type | Class year | | | | | |
|---|---|---|---|---|---|---|
| | First Year | Sophomore | Junior | Senior | $\chi 2$ | Cramer's V |
| Video | 7 | 10 | 5 | 14 | 3.00* | 0.20 |
| Color | 12 | 11 | 5 | 8 | | |

*Note*. * $p = .39$.

Table 2

*Mean proportion of words recalled.*

| | | Word Type | | | |
|---|---|---|---|---|---|
| | | Concrete | | Abstract | |
| Context Type | Context Match | M (SD) | 95% CI | M (SD) | 95% CI |
| Video | | | | | |
| | Same | 0.28 (0.14) | [0.24, 0.33] | 0.21 (0.10) | [0.18, 0.25] |
| | Different | 0.24 (0.12) | [0.21, 0.28] | 0.21 (0.11) | [0.17, 0.24] |
| Color | | | | | |
| | Same | 0.30 (0.14) | [0.25, 0.34] | 0.25 (0.11) | [0.21, 0.28] |
| | Different | 0.26 (0.10) | [0.22, 0.30] | 0.21 (0.09) | [0.18, 0.24] |

*Note.* CI = confidence interval.

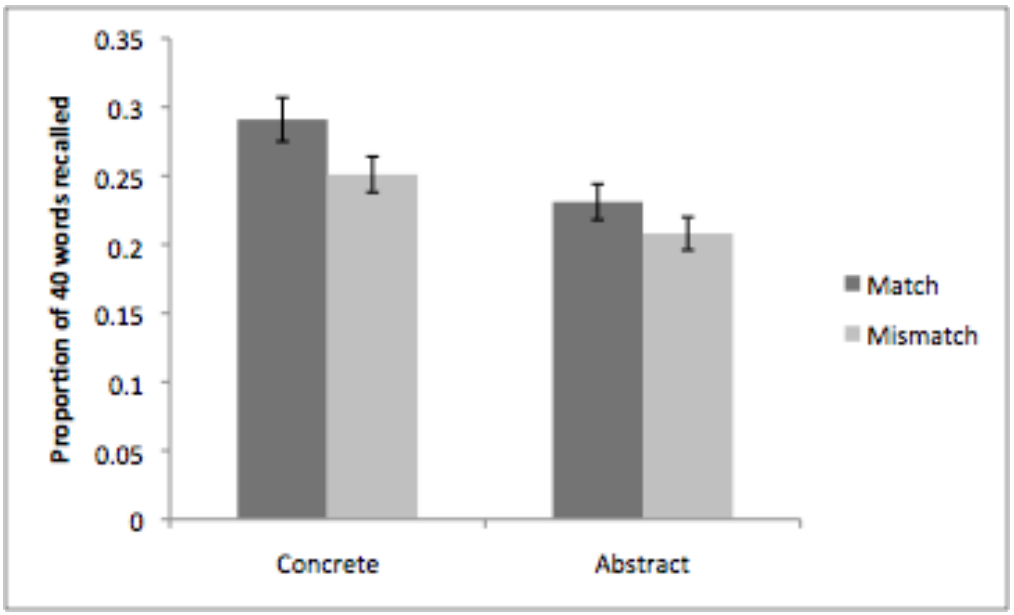


*Figure 1.* Mean proportion of concrete and abstract words recalled in the same or different study-test context conditions. Standard errors are represented in the figure by the errors bars attached to each column.

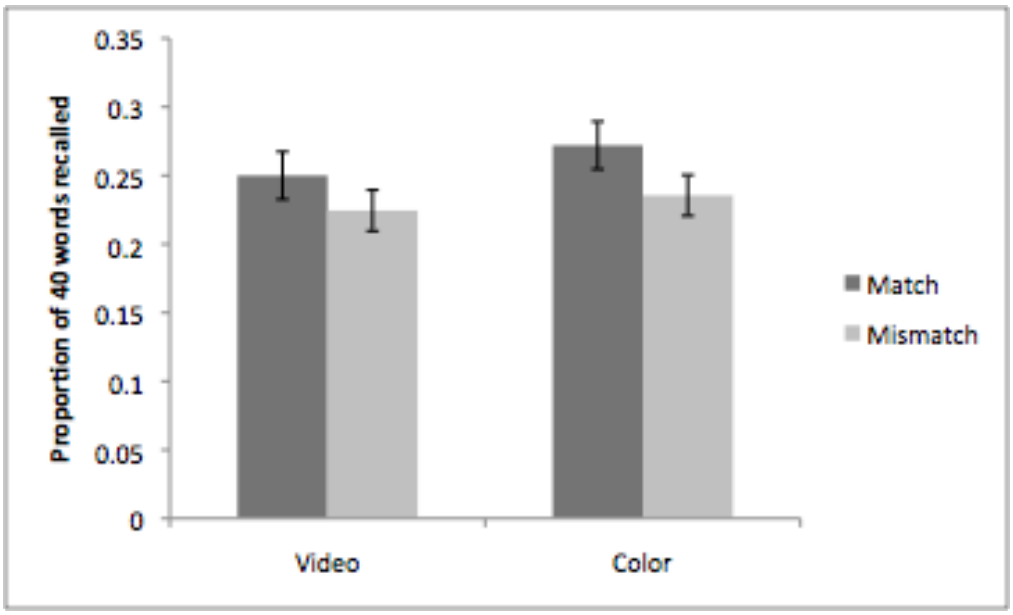


*Figure 2.* Mean proportion of words recalled in the same or different study-test conditions of video/color contexts. Standard errors are represented in the figure by the errors bars attached to each column.

Appendix A.
*List of critical words*

**Concrete**

| | | | |
|---|---|---|---|
| Thumb | Carriage | Mouse | Attic |
| Tooth | Letter | Feather | Gate |
| Bucket | Girl | Turkey | Computer |
| Bone | Brochure | Avocado | Dollar |
| Mustache | Audience | Hospital | Jungle |
| Flower | Lawyer | Skirt | Square |
| Jelly | Recipe | Hotel | Pumpkin |
| Luggage | Textile | Lavatory | Husband |
| Nurse | Evening | Couch | Capitol |
| Juice | Chapter | Yacht | Address |

**Abstract**

| | | | |
|---|---|---|---|
| Effort | Memory | Economy | Capacity |
| Chaos | Illusion | Fun | Jeopardy |
| Welfare | Instance | Boredom | Prestige |
| Interim | Malice | Method | Deceit |
| Joy | Loyalty | Tragedy | Madness |
| Kindness | Allegory | Crisis | Pacifism |
| Hatred | Mercy | Misery | Glory |
| Ability | Figment | Quest | Irony |
| Folly | Mood | Passion | Truth |
| Jealousy | Moral | Betrayal | Fate |