# Optimizing Cue Use in Student Restudy Decisions

**Alison Robey (alisonrobey@gmail.com)**
Department of Psychology, 4094 Campus Dr.
College Park, MD 20742 USA

**Michael Dougherty (mdougher@umd.edu)**
Department of Psychology, 4094 Campus Dr.
College Park, MD 20742 USA

**Abstract**

It is believed that decisions about what information needs additional study before an upcoming exam are dependent upon metacognitive processes. While a great deal of research has explored these processes, far less work has explored how to optimize restudy decisions. In the present study we examined both what cues are most predictive of future retrieval and test two potential ways of nudging learners to use these cues when making their restudy decisions. All methods and analyses were pre-registered on the Open Science Framework. Assessment of cue-utilization revealed that pre-judgment recall accuracy and pre-judgment retrieval latency, but not stimulus font size, predicted future retrieval. Additionally, both feedback about pre-judgment retrieval accuracy and having participants make retrospective confidence judgments led learners to more heavily weigh prejudgment retrieval accuracy when making their restudy decisions. This increase in relevant cue use, however, did not carry over into more accurate restudy decisions. These findings suggest that subtle manipulations can push learners to utilize more appropriate cues when making their restudy decisions.

**Keywords:** Self-guided learning; Restudy Decisions; Metacognitive Judgments; Cue Use

## Background

Accurately determining what information still needs to be studied for an upcoming exam is an important academic skill thought to be controlled by metacognitive processes (see Kornell & Finn, 2016 for review). A great deal of research has explored the underlying mechanisms of metacognitive judgments, though comparatively little work has explored the inter-relationship between metacognitive judgments and decisions about what information should be studied (or re-studied).

Cue Utilization Theory is a predominant theory for metacognitive judgments (Koriat, 1997). This theory proposes that metacognitive judgments are based on information aggregated from three types of cues, (1) intrinsic cues, cues related to the specific stimuli (e.g., font size or relatedness {i.e., 'traffic – jam' versus 'traffic – phone'}), (2) extrinsic cues, cues related to the learning of the stimuli (e.g., number of study episodes or amount of time spent studying), and (3) mnemonic cues, cues directly related to memory processes (e.g., retrieval accuracy or retrieval fluency). Mnemonic cues have direct effects on metacognitive judgments, whereas intrinsic and extrinsic cues can have direct effects on metacognitive judgments or indirect effects by influencing mnemonic processes (see Figure 1). Although cue-utilization theory was developed to describe metacognitive judgments, we believe that it can also be useful for understanding restudy decisions.

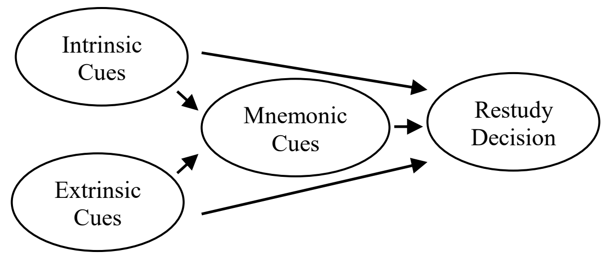


Figure 1. Model of Cue Utilization Theory

Objectively, cues vary in their usefulness of predicting later memory retrieval. For example, the number of study trials or the orientation of the stimuli are highly predictive of future retrieval (Kornell & Bjork, 2009; Sungkhasetee, Friedman, & Castle, 2011), whereas, the font size or loudness of the to-be-remembered stimuli are unpredictive of future retrieval (Rhodes & Castle, 2008; Rhodes & Castle, 2009). Although font size does not predict future memory retrieval, many studies have shown that when participants make judgments of learning (JOLs), predictions of their future memory performance, they erroneously predict that larger font words will be better remembered than smaller font words (McDonough & Gallo, 2012; Mueller, Dunlosky, Tauber, & Rhodes, 2014; Rhodes & Castle, 2008). This example is just one of many showing the mismatch between cues that *actually* predict later memory retrieval and the cues that learners *believe* predict later memory retrieval (see Schwartz & Efklides, 2012 for review).

To the extent that restudy decision are based on metacognitive processes, cues that are known to influence metacognitive judgments should also influence restudy decisions. Therein, the current study has two goals. The first goal is to determine what cues are most predictive of future memory retrieval. Although judgments are based on a combination of intrinsic, extrinsic, and mnemonic cues, we believe that mnemonic cues will be most predictive of future retrieval success. More specifically, we believe an item's current retrievability (i.e., retrieval accuracy and retrieval fluency) will be most predictive of future retrieval.

Additionally, we expect that a surface level intrinsic cue, font size, will not be predictive of later memory retrieval.

The second goal of the present study is to determine if learners can be nudged to focus their attention on these mnemonic cues, assuming they are the most predictive, when making their restudy decisions. We hope that nudging learners to utilize the most effective cues will lead to better restudy decisions. The first manipulation aimed at shifting the learner's attention to the mnemonic cues is providing feedback on the prejudgment retrieval attempt. Previous research has shown that learners incorporate previous retrieval attempts, the memory-for-past-test effect (Finn & Metcalfe, 2008), into their metacognitive judgments. We expect that by providing learners with objective information regarding their prejudgment recall accuracy it will not only increase the use of this information for their metacognitive judgments, but also their restudy decisions.

The second manipulation we used is to vary the type of metacognitive judgment the learners make after their prejudgment retrieval attempt. Previous research has shown that retrospective confidence judgments (RCJs) are more predictive of future memory performance than JOLs (Dougherty, Robey, Buttaccio, in press; Dougherty, Scheck, Nelson, & Narens, 2005; Hines, Touron, & Hertzog, 2009; Robey, Dougherty, & Buttaccio 2017; Wattier & Collins, 2011). It is believed that this effect occurs because RCJs place a greater reliance on mnemonic cues than JOLs. Further, Robey et al (2017) showed that RCJs were both more predictive of future recall and led to more accurate restudy decisions compared to JOLs. We expect that compared to making a JOL, having participants make an RCJ focuses their attention on the current retrievability of the item, which should in turn increase their utilization of mnemonic cues.

# Method

All aspects of this study were preregistered on the open science framework, https://osf.io/xug7f.

## Participants

A total of 272 participants were recruited from a University subject pool and all received course credit for participation. Of those participants, 248 completed the study. Participants were randomly assigned to one of four metacognitive judgment conditions: RCJ (n = 62), JOL 10 mins (n = 63), JOL end of study (n = 64), or no judgment (n = 59). The a priori sampling goal was 200, however, in order to account for an unexpected lack of variability in participant responses, data were collected from an additional 72 participants. Specific numbers of subjects usable for each analysis are reported in the analysis section.

## Design

This study used a mixed 4 Metacognitive Judgment (RCJ JOL10, JOLend, No Judgment) x 2 Feedback (Feedback, No Feedback) design. The type of metacognitive judgment was manipulated between subjects and whether or not feedback was provided was manipulated within subject.

## Materials

Four hundred fifty word-pairs were created using the MRC Psycholinguistics Database (Wilson, 1988). Words were limited to 4-8 letter, 1-2 syllable nouns, with high familiarity, concreteness, and imageability ratings. Pairs were randomly created using the words, and 56 of the pairs were randomly selected to serve as the target word pairs. All remaining pairs went into a pool where they could be selected for the practice or distractor trials.

## Procedure

The design of this study was based on the design of Robey et al. (2017), which consisted of 4 blocks that each contained 5 phases repeated 14 times each. Before beginning the first block participants completed practice trials of the first 4 phases. In this study, an additional sixth feedback phase was added to two of the four blocks.

**Phase 1: Study**. Sets of 4 to 6 word pairs were presented one at a time and participants were instructed to study the pairs so that they would be able to recall the second word when presented with the first (a cued-recall task). Participants were instructed to study all word pairs; however, they were only tested on the target word pairs, which appeared as one of the first three word pairs viewed. The remaining word pairs served as distractors. Zero to two distractor pairs were presented before the target word pair and prevented participants from identifying which word pair they would be tested on. The number of distractors presented before the target word pair was randomly determined for each set. Three distractors were always presented after the target word pair, which allowed for a consistent delay between encoding and prejudgment retrieval of the target word pairs. Although the number of distractors before the target word pair was randomly determined for each set, all participants studied the same 56 target word pairs regardless of the number of distractors. All word pairs were presented for 5 seconds. Additionally, the font size of each set was manipulated so that all words of a particular set were either presented in a small font (text.height = 0.08) or a large font (text.height = 0.18).

**Phase 2: Pre-Judgment Recall.** Immediately following the encoding of the last distractor item, participants completed cued recall for the target word pair. Participants were presented with the first word of the pair and instructed to type of second word. All recall was self-paced, and participants were required to respond to all prompts.

**Phase 3: Metacognitive Judgment.** Immediately following pre-judgment recall, participants made a metacognitive judgment regarding their response. All judgments were made on a 6-point scale with 1 representing low confidence and 6 representing high confidence. The specific type of metacognitive judgment participants made depended upon their randomly assigned condition. Participants in the RCJ condition responded to the question: *How confident are you that the word you just retrieved is correct?* Participants in the JOL 10 minute condition responded to the question: *If given the same word pair on a future test in 10 minutes, how confident are you that you would be able to retrieve the correct word?* Participants in the JOL end of study condition responded to the question: *If given the same word pair on a future test at the end of the study, how confident are you that you would be able to retrieve the correct word?* Participants in the No Judgment condition did not make a metacognitive judgment, but were told to select a random number between 1 and 6 to keep their task as similar as possible to the other conditions.

**Phase 4: Feedback.** On two of the four blocks, participants were given feedback regarding the accuracy of their prejudgment recall. Participants were randomly assigned to receive feedback either after blocks 1 and 3 or after blocks 2 and 4. Participants were shown a screen that either stated: *The recall attempt you just made was CORRECT!* or *The recall attempt you just made was INCORRECT!*. In either case, participants were only given feedback and not shown the correct answer. For blocks where participants did not receive feedback they continued immediately from the metacognitive judgment phase to the restudy decision phase.

**Phase 5: Restudy Decision.** After making their metacognitive judgment, or receiving feedback, if it was provided, participants made their restudy decision. Participants were asked: *If given the opportunity, would you choose to restudy this item*? Participants made a binary decision by selecting either 1 – "yes restudy" or 0 – "no restudy", on the keyboard.

**Phase 6: Final Recall.** After participants completed the encoding, pre-judgment recall, metacognitive judgments, and restudy decision phases for all 14 sets in a block, they then completed final recall for all target word pairs and 14 randomly selected distractor word pairs from that block. Although participants were asked if they would choose to restudy a word pair during the restudy decision, no restudy opportunities were provided. Similar to pre-judgment recall, participants completed a self-paced cued-recall task for final recall by typing in their responses.

### Measures

From this design we measured three cues learners could use when making their restudy decisions: prejudgment recall accuracy (dichotomous: correct, incorrect), prejudgment recall fluency (measured by retrieval latency), and font size (dichotomous: small, large). These cues were used to predict final recall accuracy, metacognitive judgments, and restudy decisions. Additionally, the type of metacognitive judgment and whether feedback was provided were used as independent variables to determine if either of these manipulations influenced leaners' cue use.

## Results

The general analysis plan involved Bayesian model comparison with the BayesFactor package in R using the default priors. This package calculates a Bayes Factor (BF), which indexes the support of one model relative to another. In this manuscript all BFs are subscripted such that values greater than 1.0 represent support for the alternative or more complex model and values less than 1.0 represent support for the null or less complex model. Where appropriate proportion data were transformed using the logit transformation and all data were standardized prior to regression analyses. Due to lack of variability on dichotomous variables, select participants were excluded for specific analyses. The total N for each analysis is reported below.

### What cues best predict final recall?

To determine which of the measured cues best predicted final recall, Bayesian all subsets regression was run predicting final recall accuracy from prejudgment recall accuracy, prejudgment recall latency, and stimuli font size. This analysis included 248 participants. The best model for predicting final retrieval success included prejudgment recall accuracy and prejudgment recall latency ($BF_{10}$= 6.07 x $10^{2396}$). Including font size did not improve the model ($BF_{10}$= 0.06). The two-predictor model fit better than either prejudgment recall accuracy alone ($BF_{10}$= 7.73 x $10^{22}$) or prejudgment retrieval latency alone ($BF_{10}$= 8.55 x $10^{1441}$). Additionally, models were run including metacognitive judgment and feedback as factors. Inclusion of these variables did not improve model fit relative to the two-predictor model that included prejudgment recall accuracy and prejudgment recall latency. Standardized slopes for all predictors are presented in Table 1.

Table 1: Standardized slopes (standard error) predicting final recall accuracy from measured cues.

| Cue | β (se) |
|---|---|
| Prejudgment Retrieval Accuracy | 0.57 (0.01) |
| Prejudgment Retrieval Latency | -0.03 (0.003) |
| Stimuli Font Size (large) | -0.008 (0.01) |

### Do the manipulations nudge learners to utilize better cues when making their metacognitive judgments and restudy decisions?

Policy-capturing methodology, widely used within the decision sciences, was used to determine which cues learners used when making their metacognitive judgments and restudy decisions (Hammond, Rohrbaugh, Mumpower, & Adelman, 1977; Hammond, McClelland, & Mumpower, 1980, Karelaia & Hogarth, 2008). Multiple regressions predicting both decisions from the three measured cues were run at the participant level. The regression weights derived for each participant reflect that learner's cue-utilization

Table 2: Mean slope estimates (standard error), and BFs testing difference from zero, for cues predicting metacognitive judgments for each condition. BFs test cue use against a point null hypothesis of 0.

| | Prejudgment Retrieval Accuracy | | Prejudgment Retrieval Fluency | | Stimuli Font Size | |
|---|---|---|---|---|---|---|
| Metacognitive Judgement | Mean β (se) | $BF_{10}$ | Mean β (se) | $BF_{10}$ | Mean β (se) | $BF_{10}$ |
| RCJ | 2.89 (0.37) | $1.31 \times 10^{30}$ | -0.26 (0.03) | 214925567 | 0.02 (0.00) | 0.16 |
| JOL10 | 1.64 (0.21) | $8.96 \times 10^{15}$ | -0.15 (0.02) | 3757.95 | -0.04 (0.00) | 0.26 |
| JOLend | 2.03 (0.25) | $4.59 \times 10^{18}$ | -0.18 (0.02) | 2245.74 | -0.03 (0.00) | 0.18 |
| No Judgment | 0.12 (0.02) | 0.24 | -0.00 (0.00) | 0.14 | 0.05 (0.01) | 0.24 |

when making a particular decision (metacognitive judgment or restudy decision). Single-sample Bayesian t-tests were run to determine if each cue's beta weights differed from zero, which signified the cue was being used. Bayesian ANOVAs were then run separately on the regression weights of each of the three cues for each decision (metacognitive judgment and restudy decisions) to determine if the manipulations influenced the learner's cue use. For cue use during metacognitive judgments, only the type of metacognitive judgment was tested, as feedback, when provided, appeared after the metacognitive judgment had been made. For cue use during restudy decisions, metacognitive judgment, feedback, and a judgment x feedback interaction were tested. Two-hundred forty-seven participants were included in metacognitive judgment analyses and 218 participants were included in the restudy decision analyses.

**Metacognitive Judgments.** The mean beta weights and Bayes factors for cue use in predicting metacognitive judgments for each group can be found in Table 2. The group of learners who made RCJs and both groups of learners who made JOLs utilized prejudgment retrieval accuracy and fluency when making their metacognitive judgments. Surprisingly, there was no font-size effect in the present study with neither JOL group basing their metacognitive judgment on font size. Supporting the belief that the no judgment group was truly selecting a random number, this group's responses were not related any of the available cues.

Bayesian ANOVAs revealed a main effect of condition for the use of prejudgment recall accuracy as a cue when making metacognitive judgments ($BF_{10}$ = 28707699). Follow-up Bayesian t-tests, revealed that the RCJ group used prejudgment retrieval accuracy more than either of the JOL groups (JOL10 $BF_{10}$ = 164777231, JOLend $BF_{10}$ = 2647.19). Results were inconclusive regarding whether the two JOL groups used this cue differently ($BF_{10}$ = 1.27). There were no differences between metacognitive judgments in the use of font size as a cue for making metacognitive judgments ($BF_{10}$ = 0.11). Results were inconclusive regarding differences in the use of prejudgment retrieval latency as a cue ($BF_{10}$ = 0.80).

**Restudy Decisions.** The mean beta weights and Bayes factors for cue use in predicting restudy decisions for each group can be found in Table 3. When making their restudy decisions, learners in the RCJ, no judgment and JOLend conditions utilized Prejudgment Recall Accuracy, however it was inconclusive whether learners in the JOL10 condition also utilized this cue. Prejudgment retrieval Latency was only conclusively used by learners in the No Judgment condition when no feedback was provided. These results were inconclusive for RCJ learners and JOLend learners when feedback was provided. Learners in the JOL10 condition never utilized prejudgment retrieval fluency when making their restudy decisions. No groups used stimuli font size as a cue when making their restudy decisions, however findings were inconclusive for learners in the RCJ condition when they received feedback.

Main effects were found for both the influence of metacognitive judgment ($BF_{10}$= 499.70) and feedback ($BF_{10}$= 47.15) on the use of prejudgment retrieval accuracy as a restudy decision cue. There was, however, no interaction between metacognitive judgment and feedback ($BF_{10}$= 0.05). Learners were more likely to use prejudgment recall accuracy as a cue when feedback was provided (mean β = -0.34) than when feedback was not provided (mean β = -0.26). Follow-up Bayesian t-tests comparing metacognitive judgment conditions found that the learners who made RCJs and the learners who made no judgment were more likely to use prejudgment retrieval as a cue than learners in either the JOL10 condition ($BFs_{10}$= 239.09, 151.90) or learners in the JOLend condition ($BFs_{10}$= 13.3, 9.40). There were no differences in the use of this cue between the RCJ and no judgment conditions ($BF_{10}$= 0.26). It was inconclusive whether prejudgment recall accuracy was used differentially between the two JOL conditions ($BF_{10}$= 0.40)

Neither manipulation showed any support for having an influence on the use of prejudgment retrieval latency (Condition $BF_{10}$= 0.06, Feedback $BF_{10}$= 0.19, Condition x Feedback $BF_{10}$= 0.02) or font size as a cue (Condition $BF_{10}$= 0.03, Feedback $BF_{10}$= 0.16, Condition x Feedback $BF_{10}$= 0.02).

## Do the manipulations lead to better restudy decisions?

Accuracy of restudy decisions was calculated at the individual subject level by computing a Kendall's tau rank order correlation between a participant's restudy decisions and final recall accuracy. A correlation closer to -1.0 signifies better restudy decisions as one would hope that the items selected for restudy (restudy = 1) are the items the

Table 3: Mean standardized slope estimates (standard error), and BFs testing difference from zero, for cues predicting restudy decisions for each condition. BFs test cue use against a point null hypothesis of 0.

| | Prejudgment Retrieval Accuracy | | Prejudgment Retrieval Fluency | | Stimuli Font Size | |
|---|---|---|---|---|---|---|
| Metacognitive Judgement | Mean β (se) | $BF_{10}$ | Mean β (se) | $BF_{10}$ | Mean β (se) | $BF_{10}$ |
| Feedback | | | | | | |
| RCJ | -0.51 (0.07) | 892068270 | 0.03 (0.00) | 0.53 | 0.02 (0.00) | 0.38 |
| JOL10 | -0.14 (0.02) | 2.45 | 0.01 (0.00) | 0.28 | 0.00 (0.00) | 0.15 |
| JOLend | -0.26 (0.04) | 228.84 | 0.02 (0.00) | 0.30 | 0.00 (0.00) | 0.15 |
| No Judgment | -0.47 (0.06) | 9763599 | 0.02 (0.00) | 0.44 | -0.01 (0.00) | 0.21 |
| No Feedback | | | | | | |
| RCJ | -0.37 (0.05) | 1307092 | 0.04 (0.00) | 1.20 | -0.01 (0.00) | 0.21 |
| JOL10 | -0.14 (0.02) | 2.67 | 0.01 (0.00) | 0.16 | 0.00 (0.00) | 0.15 |
| JOLend | -0.15 (0.02) | 3.26 | 0.03 (0.00) | 0.84 | 0.00 (0.00) | 0.15 |
| No Judgment | -0.37 (0.05) | 2547988300 | 0.06 (0.01) | 13.44 | -0.02 (0.00) | 0.31 |

learner is unable to retrieve at final recall (accuracy = 0) and vice versa. Due to lack of variability in either restudy decision or final recall accuracy these analyses included only 169 participants. The mean tau's for all groups are presented in table 4.

Table 4: Mean tau (se) between restudy decisions and final recall accuracy for each condition

| | Feedback | No Feedback |
|---|---|---|
| RCJ | -0.39 (0.06) | -0.39 (0.06) |
| JOL 10 | -0.17 (0.03) | -0.22 (0.04) |
| JOL end | -0.28 (0.04) | -0.29 (0.04) |
| No Judgment | -0.35 (0.05) | -0.38 (0.06) |

A mixed Bayesian ANOVA was run on the tau's to determine if restudy accuracy differed between learners who made different metacognitive judgments (a between subjects factor) or between trials when feedback was or was not provided (a within subjects factor). There was no interaction between type of metacognitive judgment and feedback on restudy decisions accuracy ($BF_{10}$= 0.04) and no main effect of Feedback ($BF_{10}$= 0.21). Additionally, although numerically the correlations were more strongly negative for the RCJ and no judgment groups compared to JOL groups, the evidence regarding differences was inconclusive ($BF_{10}$= 0.82).

## Discussion

This study aimed to discover what cues are most predictive of future memory retrieval and determine if learner's use of those cues when making restudy decisions could be improved leading to better restudy decisions. Of the three cues included in the present study, prejudgment recall accuracy and prejudgment recall latency were found to predict later memory retrieval, whereas stimuli font size was not. All leaners were found to use these cues when making their metacognitive judgments, however leaners who made RCJs placed a greater weight on prejudgment recall accuracy when making their metacognitive judgments than learners who made either type of JOL. Although all learners appeared to use these cues when making the metacognitive judgments, learners in the JOL10 condition did not utilize prejudgment recall accuracy and no learners used prejudgment recall latency when making their restudy decisions. Additionally, both providing feedback and having learners make an RCJ or no judgment, caused learners to place greater weight on prejudgment recall accuracy when making their restudy decisions, relative to when no feedback was provided or when learners made JOLs. Neither manipulation, however, had an impact on increasing the use of prejudgment recall latency when making restudy decisions. Unfortunately, although the manipulations where able to increase the use of a reliable cue when making restudy decisions, there was no clear transfer of this increased use into more accurate restudy decisions.

Although many studies have explored individual cues' relations to future recall (see Schwartz & Efklides, 2012 for review), fewer have attempted to look at the importance of multiple cues from different domains of cue-utilization theory in one study, or how these cues are utilized when making restudy decisions. Similar to past research, mnemonic cues were predictive of later memory retrieval whereas font size was not. Different from past research however, none of our learner's metacognitive judgments were influenced by stimuli font size. Because the font size was consistent for an entire set of word-pairs, the differences in size for the present study may not have been as detectable as if the font size had varied at the trial level. Additionally, previous studies examining the font-size effect have measure immediate JOLs with no prejudgment retrieval attempt. An alternative explanation is that the influence of the retrieval attempt is so strong it washes out beliefs related to font size. Although we did not replicate the font size effect in the present study, we view this as a positive that this cue was not used in making either metacognitive judgments or restudy decisions as font size is not predictive of future retrieval.

Although both manipulations in the present study increased reliance on one of our relevant cues, there was no support for improvements in the accuracy of restudy decisions. Numerically, however, restudy decisions appear to be better for learners who make RCJs or no judgment relative to learners who make JOLs, consistent with the findings of Robey et al (2017). Additionally, Dougherty et al. (in press, study 4), found similar magnitudes of correlations to the present study when comparing restudy decisions after making RCJs or JOLs for a test in 10 minutes. Restudy decisions were surprisingly similar when feedback was and was not provided, but this may be related to feedback being manipulated within subject. Manipulating feedback between subjects may provide a clearer picture of the impact of this factor.

This study serves a first step in learning how to improve the accuracy of students' restudy decisions, but there is still much more work to be done. First, the present study explored only a very small selection of cues and did not cover all cue domains from cue utilization theory. Future research should include a greater variety of cues including more intrinsic cues such as frequency of the stimuli and relatedness of the word pairs along with extrinsic cues such as length of the learning episode, ease of learning, and the number of learning episodes. Additionally, more manipulations for improving cue utilization and restudy decisions should be explored. Both manipulations in the present study increased the use of prejudgment recall accuracy, but not prejudgment recall latency. As no improvements in restudy decisions were found a logical next step would be to try and increase the use of prejudgment recall latency, as it too was found to predict future memory retrieval. The current results show evidence that leaners' cue utilization can be influenced with simple manipulations, but the best manipulations for transfer to improved restudy decisions remain to be found.

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## References

Dougherty, M. R., Robey, A., & Buttaccio, D. R. (in press). Do metacognitive judgments alter memory performance beyond the benefits of retrieval practice? *Memory and Cognition*.

Dougherty, M. R., Scheck, P., Nelson, T. O., & Narens, L. (2005). Using the past to predict the future. *Memory & Cognition, 33*(6), 1096-1115.

Finn, B. & Metcalfe, J. (2008). Judgments of learning are influence by memory for past test. *Journal of Memory and Language, 58*, 19-34.

Hines, J. C., Touron, D. R., & Hertzog, C. (2009). Metacognitive influence on study time allocation in an associative recognition task: An analysis of adult age differences. *Psychology of Aging, 24,* 462-475.

Hammond, K.R., McClelland, G., & Mumpower, J. (1980). *Human judgment and decision making: Theories, methods, and procedures*. New York, NY: Praeger Scientific.

Hammond, K.R., Rohrbaugh, J., Mumpower, J., & Adelman, L. (1977). Social judgment theory: Applications in policy formation. In M. Kaplan & S. Schwartz (Eds.), *Human judgment and decision processes in applied settings* (pp.1–29). New York, NY: Academic Press

Karelaia, N. & Hogarth, R.M. (2008). Determinants of linear judgment: A meta-analysis of lens model studies. *Psychological Bulletin*, *134*, 404-426.

Koriat, A. (1997). Monitoring one's own knowledge during study: A cue-utilization approach to judgments of learning. *Journal of Experimental Psychology: General,* 126, 349-370.

Kornell, N. & Bjork, R. A. (2009). A stability bias in human memory: Overestimating remembering and underestimating learning. *Journal of Experimental Psychology: General, 138*, 449-468.

Kornell, N. & Finn, B. (2016). Self-Regulated Learning: An Overview of Theory and Data. In J. Dunlosky & S. K. Tauber (Ed.) *The oxford handbook of metamemory (*pp. 325-340). New York, NY: Oxford University Press.

McDonough, I. M. & Gallo, D. A. (2012). Illusory expectation can affect retrieval-monitoring accuracy. *Journal of Experimental Psychology, 38*, 391-404.

Mueller, M. L., Dunlosky, J., Tauber, S. K., & Rhodes, M. G. (2014). The font-size effect on judgments of learning: Does it exemplify fluency effort or reflect people's beliefs about memory? *Journal of Memory &Language, 70*, 1-12.

Robey, A. M., Dougherty, M. R., & Buttaccio, D. R. (2017). Making retrospective confidence judgments improves learners' ability to decide what not to study. *Psychological Science, 28*(11), 1683-1693.

Rhodes, M. G. & Castle, A. D. (2008). Memory predictions are influenced by perceptual information: Evidence for metacognitive illusions. *Journal of Experimental Psychology: General, 137*, 615-625.

Rhodes, M. G. & Castle, A. D. (2009). Metacognitive illusions for auditory information: Effects on monitoring and control. *Psychonomic Bulletin & Review, 16*, 550-554.

Schwartz, B. L. & Efklides, A. (2012). Metamemory and memory efficient: Implications for student learning. *Journal of Applied Research in Memory & Cognition, 1*, 145-151.

Sungkhasetee, V. W., Friedman, M. C., & Castle, A. D. (2011). Memory and metamemory for inverted words: Illusions of competency and desirable difficulties. *Psychonomic Bulletin & Review, 18*, 973-978.

Wattier, N. W. & Collins, C. A. (2011). Metamemory for faces, names, and common nouns. *Acta Psychologica, 138*, 143-154.

Wilson, M. D. (1988). The MRC psycholinguistic database: Machine readable dictionary, Version 2, *Behavioural Research Methods, Instruments, and Computers, 20*, 6-11.