October XXth, 2025

Jennifer Wiley, PhD

Associate Editor

*Metacognition and Learning*

Dear Dr. Wiley:

We have submitted our revision of Meta-D-25-00113 “Judgments of Learning Facilitate Cued-Recall of Single and Double Semantically Mediated Word Pairs” for reconsideration. We appreciate the thorough examination provided by yourself and our reviewers and are pleased that our manuscript was well received. Below, we list our responses to each reviewer’s comments in addition to your own and cite page numbers when referring to specific changes. To facilitate the review process, all primary modifications to the manuscript have been made using blue-colored font. We look forward to your response and hope that our revised manuscript is now suitable for publication in *Metacognition and Learning*.

Sincerely,

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**Action Editor (Dr. Jennifer Wiley)**

Thank you for submitting this paper for consideration in Metacognition and Learning. I am sorry that it has taken far too long to get a full set of reviews, but they are finally here and I am happy to report that all readers including myself are quite positive about this report.  
  
Since I also read the paper closely myself, I will note my suggestions first which you will see converge with the comments made by the reviewers.    
  
**Comment 1:** First, this is a nice set of experiments, and there is a theoretically interesting pattern here. The stimuli are varied within and across studies which is great. Yet, one major weakness was in describing (in operational, empirical terms) the differences in the pairs within and across each study.   
  
Said another way, what is missing is support for the claims about the presence or lack of relatedness or associations, the presence or lack of obvious or perceptible associations, and differences in distances between the concepts. These claims are key to the logic of the paper, but similarities or differences in each of these constructs need to be demonstrated. Because I am still unclear exactly what you manipulated I am not certain what metrics need to be in a table.  But I suggest you add a table on p. 12 (in the section where the materials for 1A are first described). This table needs to report metrics that demonstrate the differences you claim throughout the paper.   
  
What metrics show differences in a priori or a posteriori associations? We need averages (ranges) for each metric for the related, unrelated and mediated stimuli. We need these for all 4 stimulus sets used in the first study (I assume related and unrelated stay the same), and for the two new double mediated sets in the second study. (If related and unrelated change, then include values for each study). Here are some metrics that were mentioned (I do not know which are different names for the same construct): relatedness, strength of relatedness cues, salience of relatedness cues, Nelson's association norms, forward association strength, backward association strength, distance, co-occurrence (suggested by a reviewer), a priori and a posteriori associations.  Please read through the paper carefully to make sure that any time you say one condition had stronger or weaker a priori or FAS that you show this is true.  As for claims whether relations were "obvious" or "perceptible"

I think the norming study (JAM) you reported for just 3 sets was a good start. This is needed for all types of pairs to support your claims.

***Response:*** When developing our forward associates, single-mediated, and double-mediated cue-target pairs, we manipulated the degree of direct association between the cue and target. For all forward pairs, direct association was measured in terms of Forward Association Strength (FAS) values, which were taken from Nelson et al.’s (2004) free-association norms. For single-mediated pairs, we selected targets which were not directly related to the cue via FAS (i.e., the FAS between cue and target was 0) but were instead linked through a non-presented mediator, which was directly related to the cue and target via FAS. Double-mediated pairs were developed using the same procedure but the final target was two-steps away from the cue (the FAS between cue and target was again 0). For both backward mediated pairs, we flipped the cue order such that the association ran from target to cue, leading us to use backward associative strength (BAS) to describe the relationships between cues, mediators, and targets for these pair types. Thus, the variable we manipulated within and between experiments was the FAS/BAS of the cue-target pairs.

Based on suggestions from Reviewer 3 and yourself, we have added an additional table to the Appendix (Table AX, pg. X) which reports the mean FAS between each concept in the associative pathway for single and double-mediated pairs, and mean BAS when both mediated pair types were presented in the backward direction. As noted by these tables, the direct associative strength between cue and target in mediated pairs is 0, indicating the lack of a direct, associative relationship.

Finally, throughout the manuscript, we have sought to streamline our discussion of relatedness effects on JOL reactivity, particularly in the Introduction (pg. XX, please also see our response to Reviewer X, Comment X) and have paid special attention to the language used to describe relatedness (see our response to Reviewer X, Comment X).

[COMMENT ABOUT THE JAM STUFF – DEPENDS ON IF WE WANT TO COLLECT MORE DATA]  
  
**Comment 2:** Second, please discuss how the proposed relational processing account might relate to an elaboration account. Similar to reviewers, I also had strong overtones of elaboration when I first read the Maxwell & Huff results on pp. 8-9. I am curious how you view the two accounts (as also noted by Reviewer 3). At the same time, I wondered how you tested for awareness of mediators (p. 10)? I thought the second reviewer's suggestions to look at the viewing times during encoding would make a great addition. (It would be helpful for you to confirm that the prior study was also self-paced, and discuss the rationale for this design choice, and whether similar results have been found with fixed presentation time).

***Response:*** We now include a brief description of Chang and Brainerd’s (2025) findings on pg. XX of the Introduction. Additionally, we now include a brief discussion of our findings within the context of their elaboration account of pg. XX of the General Discussion while noting the need for more research in this area (please see our response to Reviewer 3, Comment X).

Based on Reviewer 2’s suggestion, we now include a set of supplemental analyses which tested for differences in encoding latencies as functions of encoding group and pair type. Please see our response to Reviewer 2, Comment X for more details.  
  
**Comment 3:** Third, I appreciate the suggestion to include a mini meta-analysis of these studies which will allow you to provide evidence for the comparisons across forward and backward, single and double mediated conditions in the discussion.

***Response:*** Our revised manuscript now includes mini meta-analysis, which compares provides a cross-experimental comparison of effect sizes for each pair type (pg. X). Please see our response to Reviewer X, Comment X. We thank Reviewer X for this suggestion.

**Comment 4:** Please see the suggestions from each of the reviewers in their original context. I am fine with adding the pbic at the end of each result, even when significant using NHST, since its so short.

***Response:*** In our revised manuscript, we now include *p*BIC values following each result. Additionally, we now include greater detail regarding interpretation of *p*BICs (pg. XX; please see our response to Reviewer X, Comment X).

**Reviewer 1**

The manuscript details four experiments designed to investigate whether positive judgments of learning (JOL) reactivity on related cue-target word pairs reflects a relational encoding process. Experiment 1A and 1B demonstrated that JOLs improved memory for both forward and backward mediated pairs. Experiment 2A and 2B showed that the positive reactivity effect extended to forward and backward double-mediated pairs. The authors propose that these results indicate making JOLs enhances the relational encoding process, which contributes to the positive reactivity effect on word pair learning.

The study demonstrates that requiring participants to make JOLs can reactively enhance performance on related pair learning, but not on unrelated pair learning. This may result from JOLs strengthening pre-existing cue-target relations or increasing the relational encoding process. The current study used co-occurring word pairs as materials and found that making JOLs increased the recall of co-occurring pairs, regardless of the forward or backward co-occurrence. Moreover, the positive reactivity effect persisted even when the associative distance between cue and target was increased. While I believe this research provides further evidence for the role of relational processing in JOL reactivity, the evidence supporting the relational processing hypothesis is still more analysis, please refer to the Major Revision 2.

**Comment 1:** The current study did not provide information on the relatedness among the three types of word pairs (i.e., related, mediated, and unrelated). Given this omission, the findings from Experiment 1 and Experiment 2 that making JOLs enhances mediated pairs may not necessarily indicate enhanced relational processing but could instead be attributed to relatedness processing.

***Response:*** Normative relatedness values for each pair type (FAS/BAS) are now reported in the Appendix (Table AX, pg. X). In addition to reporting direct relatedness between cue and target in terms of FAS/BAS, this table also displays mean association strength between all steps in the associative pathway for mediated pair types (i.e., FAS from cue 🡪 mediator 🡪 target for single mediated pairs; FAS from cue 🡪, Mediator 🡪 Mediator 🡪 Target for double-mediated pairs).  
  
**Comment 2:** The relational processing hypothesis didn't predict that making JOLs would alter the performance of double-mediator pairs. The manipulation of double-mediator pairs may have increased the distance between cue and target, making it less likely for participants to guess the intermediary items. However, this increase must be compared with a baseline, such as single - mediator pairs. Yet, Experiment 2 failed to include such a comparison. I suggest conducting a comparative analysis of the results from Experiment 1 and Experiment 2.

***Response:*** A relational account of JOL reactivity predicts JOL reactivity whenever the cue and target share a relationship, regardless of whether pairs are directly related or indirectly related through mediators. Per this account, double-mediated pairs should still show a positive reactivity effect, given the presence of an indirect relation between the cue and target.

We agree that a comparative analysis of Experiments 1 and 2 would provide useful information for the reader while providing additional context for interpreting our findings. We now report a set of cross-experimental analyses in our Supplemental Materials. Additionally, based on suggestions from Reviewer X, we now include a set of cross-experimental meta-analyses, which provide a comparison of effects sizes between pair types (pg. XX; please our response to Reviewer X, Comment X).

**Minor Comments**

**Comment:** The concepts of a priori and posteriori relatedness may be somewhat confusing. Given that "a priori and a posteriori associations are not mutually exclusive, (p.7, line 11-12)" it's important to clarify that posteriori relatedness essentially reflects a type of co-occurrence frequency. To enhance clarity and distinction, I suggest renaming posteriori relatedness to "co-occurrence relatedness." This adjustment would help differentiate between the two types of relatedness and align the terminology more closely with the constructs being discussed.

***Response*:** Thank you for this suggestion. We agree that clarifying the difference between a priori and a posteriori relatedness types would aid the reader and make discussions of our results clearer. In our revised manuscript, we now refer to a priori relatedness as *normative* relatedness, since this type of relatedness is based on free-association norms (while free-association norms can capture information regarding lexical co-occurrence, these norms also capture associations which are not directly based on co-occurrence; e.g., *doctor* – *stethoscope*).

***Comment*:** I suggest that the Bayes factors (BF) for all statistical results be provided. This would enable readers to more effectively assess the strength of evidence supporting the alternative hypothesis.

***Response:*** In our revised manuscript, we now report *p*BIC values for all comparisons. Thank you for this suggestion.

***Comment:*** The relational processing hypothesis overlaps with the cue-strengthening hypothesis. However, what deficiencies of the cue-strengthening hypothesis does the exploration of the relational processing hypothesis address? Additionally, what are the application values of exploring the relational processing hypothesis? Describing the above content will enhance the value and application prospects of this article.

***Response:*** We agree that the relational and cue-strengthening accounts share conceptual overlap. However, as noted in our initial submission (pg. XX), the cue-strengthening hypothesis does not identify the exact cues which JOLs are purported to strengthen and instead simply notes that JOLs strengthen intrinsic cues about stimuli.

From an application standpoint, the relational processing account can potentially inform the design of learning interventions. For example, having learnings make JOLs in contexts where relational information is critical (e.g., thematic learning) may enhance retention. Thus, this account may be particularly informative in learning scenarios where understanding the connections between ideas is more important the recalling specific facts. We now briefly discuss the applied value of this account in the General Discussion (pg. XX) while also noting the need for more research investigation JOL reactivity within applied settings.

Thank you for taking the time to review our manuscript.  
  
  
**Reviewer 2**  
  
The current research evaluated underlying mechanisms of JOL reactivity, which is the finding that making a JOL can facilitate learning and memory. Across all experiments, participants were asked to learn a list of word pairs and completed a final cued memory test. Experiments 1A involved participants learning forward association word pairs, semantically mediated word pairs, and unrelated word pairs. Experiment 1B used the same materials except the word pair order was reverse, such that there was a backward association. The JOL reactivity effect was observed across all word pairs (except for unrelated, as expected). Experiments 2A-B implemented the same methodology but instead used  double-mediated pairs. Results replicated those observed in Experiment 1A-B. Taken together, results suggest that while cue-strengthening may be one mechanism underlying the effect, a relational encoding process also contributes to JOL reactivity.     
  
At outset, I will say that I found the research to be novel and interesting, while also making a substantial contribution to the literature in terms of our understanding of JOL reactivity. I found the manuscript to be well organized, well written, and thorough. I think the work meets the high standards of Metacognition & Learning and is likely to attract readership. I am favorable to the research being published pending a couple of recommendations outlined below.   
  
**Comment 1:** I was a bit surprised that time on task was self-paced (particularly during encoding). Given that the work was replicating Maxwell and Huff (2024), I assume this methodological decision was used there, which in turn makes sense here. Nonetheless, I would be interested in knowing if there were differences in time on task across the JOL vs. no-JOL groups and/or the different types of word pairs. Is it possible that differences in encoding time may be part of the explanation? I'm not convinced yes, as the current data are very strong, but I do think for transparency and completeness, the reporting of encoding time -and any potential differences across groups or conditions- is important information to provide to readers.

***Response:*** We elected to use self-paced encoding to stay consistent with Maxwell and Huff’s (2024) study. We have clarified the rationale behind this decision in the Experiment 1A Procedure (pg. XX).

Based on your suggestions, analyses of encoding latencies for as functions of pair type and encoding group for each experiment are now reported in in our Supplemental Materials. Consistent with other studies which have explored JOL reactivity under self-paced encoding conditions (e.g., Maxwell & Huff, 2022; 2024), encoding latencies were higher for participants in the JOL group relative to the No-JOL control group. Additionally, forward associates had lower encoding latencies relative to unrelated and mediated pairs, regardless of encoding group. Encoding latencies for mediated and unrelated pairs, however, did not differ. Additionally, no interactions were detected between Pair Type and Encoding Group.

**Comment 2:** The authors may want to consider streamlining the beginning of the Introduction. The manuscript is incredibly well written, which is perhaps why this section seemed a little overly verbose. More specifically, the recapping of the studies seems like it could be condensed a bit. Particularly because there are mini-discussions throughout Experiments 1A-B/2A-B.

***Response:*** Thank you for this suggestion. We have revised our Introduction for clarity and concision.

We thank you for reviewing our manuscript.  
  
**Reviewer 3**

In four experiments, participants studied related, unrelated, and either singly mediated (Exp. 1) or doubly mediated (Exp. 2) cue-target word pairs, with associations running forward (Exps. 1a and 2a) or backward (Exps. 1b and 2b). They were assigned to either a JOL or a no-JOL condition. Across all experiments, the classic JOL-reactivity effect emerged. Importantly, JOL reactivity for related pairs also extended to mediated pairs, regardless of whether the mediation was single or double both in forward and backward directions.

General evaluation  
Over the past decade, JOL-reactivity has been widely studied, yet the findings often fail to align neatly with existing theoretical accounts. The cue-strengthening hypothesis has been a leading candidate, offering somewhat better explanatory power than alternatives, though it remains incomplete. The current study advances this line of work by testing the claims of the cue-strengthening hypothesis more directly, proposing a new explanation that emphasizes the role of pre-existing connections between cue and target, while also acknowledging that cue strengthening alone cannot fully account for the results. This is an interesting and valuable perspective on JOL-reactivity. The manuscript is clearly written, the predictions are well-articulated, and it could merit publication in this journal. I do, however, have a few questions that I believe should be addressed in revision.

**Comment 1:** One central issue concerns participants' awareness of the relationships between mediated word pairs (e.g., lion-stripes), particularly in the single-mediated condition. From what I understand, participants were not explicitly informed about the nature of the pairings (related, unrelated, or mediated). As I reviewed the OSF word lists, I noticed that I was spontaneously generating the mediators myself without any prompt. This raises the possibility that single-mediated pairs might inherently invite greater elaboration, independent of JOL solicitation. If so, what appears to be an effect of JOLs might instead reflect additional elaboration opportunities afforded by the stimuli themselves, rather than the activation of pre-existing connections. The ultimate way to test this would be to have differing groups who have awareness of the types of pairs that they will be exposed to , and whether awareness actually causes a difference.

The issue, as I see it, is that the authors assume the effect occurs automatically through spreading activation, without participants necessarily being aware of the connections. While Experiment 2 may make a stronger case for this assumption, I am not fully convinced; particularly in the forward and single-mediated conditions, these connections could well be generated consciously.

***Response:*** This is an interesting observation. You are correct that participants in all experiments were not informed about the specific relations between each pair type prior to encoding (i.e., participants were not informed that some pairs were direct associates, others mediated, etc.). As noted on pg. XX of our initial submission, our concerns that participants might just be guessing the mediators in Experiments 1A/1B directly influenced our decision to use double-mediated pairs in Experiments 2A/2B. Because the cue and target in double-mediated pairs are mediated through two concepts, participants would be less likely to guess the specific associative pathway linking the cue and target. Findings from the pilot study reported on pg. XX of our initial submission are consistent with this account, as JAM ratings (which assess perceived relatedness) did not differ between double-mediated pairs and unrelated pairs, suggesting that participants were not aware of the underlying relationship between double-mediated cues and targets. Thus, our finding that reactivity patterns also extended to double-mediated pairs strongly suggests that JOL reactivity can occur in the absence of observable relatedness cues. We have clarified this point when discussing our Experiment 2A/2B findings in the General Discussion (pg. XX).

**Comment 2:** A second important suggestion is to incorporate discussion of the recent study by Chang and Brainerd (2025) in JML. I recognize that this paper may have appeared after the submission of the current manuscript, so the authors might not be aware of it. However, Chang and Brainerd (2025) also emphasize the importance of semantic relatedness and pre-existing connections. How do the present authors' claims align with or diverge from that work?

More broadly, if the observed effects are a consequence of semantic processing in general—potentially unconscious in the present case—can the authors' framework accommodate findings attributable to semantic elaboration of any kind? Moreover, why is it that the related pairs always have higher JOL-reactivity than mediated pairs? Are they explaining it with the shorter distances between cue and target words for related than mediated pairs?

***Response:*** Thank you for this suggestion. This paper had not yet been published at JML when we initially submitted our manuscript for review. We now briefly describe this work in the Introduction (pg. XX) and discuss how our findings potentially fit within an elaboration account in the General Discussion (pg. XX).

Regarding the magnitude of JOLs, related pairs likely have higher JOLs due to the presence of strong perceived relatedness cues (i.e., a posteriori relatedness) in addition to strong normative relatedness (e.g., a priori relatedness). Based on Soderstrom et al.’s (2015) cue-strengthening account, participants use intrinsic cues about the stimuli to inform the magnitude of their JOLs. Because pre-existing relations are a highly salient marker of later remembering (i.e., strong associates are more likely to be recalled relative to unrelated pairs), word pairs which appear related at encoding should receive high JOLs (see pg. XX of our initial submission). However, as noted throughout the manuscript, mediated pairs lack a direct associate via norms and should appear unrelated at encoding, though if participants can guess the mediator, this may inflate their JOLs relative to unrelated pairs. This may explain why participants in Experiments 1A/1B assigned higher JOLs to single-mediated pairs relative to unrelated pairs. However, our observation that double-mediated pairs had lower JOLs relative to single-mediated pairs suggests that participants were less likely to guess the mediators for this pair type.

**Comment 3:** Finally, I believe that the paper could benefit from a single-paper meta-analysis. If they can show that single, double, backward and forward mediations all produce same type of effect size, and this is always higher than unrelated and lower than related pairs, this could support their view further.

***Response:*** Thank you for this suggestion. Our revised manuscript now reports a set of random-effects meta-analyses (pg. XX) which assessed 1) the overall JOL reactivity effect for all pair types and 2) separate JOL reactivity effects for each pair type (forward, mediated (collapsed across type), and unrelated). Additionally, a forest plot (Figure X) has been added on pg. XX.

Overall, these analyses revealed a strong reactivity effect on forward pairs (*d* = 0.98), a moderate reactivity effect on mediated pairs (*d* = 0.53), and a null reactivity effect on unrelated pairs (*d* = 0.06). Taken together, mediated pairs typically show a reactivity effect that is larger than unrelated pairs but smaller than forward pairs. Findings from these additional analyses are now discussed on pg. XX of our General Discussion.

**Minor Comments**

**Comment:** When the authors are presenting the readers with Bayesian statistics, it might be useful to the reader to explain what pbic values stand for.

***Response:*** We have updated our description of *p*BIC values on pg. XX to provide this information.

**Comment:** If the findings can actually be explained by spreading activation, does that not have a direction either? Please explain.

***Response:*** Given that JOL reactivity was observed for mediated pairs presented in both the forward and backward directions, it is unlikely that any effects of spreading activation would be limited to a single direction. Instead, it is likely that any spreading activation effects are bi-directional in nature. This is also consistent with previous JOL reactivity studies which have found reactivity on backward cue-target word pairs (e.g., Maxwell & Huff, 2022; 2023).

**Comment:** When mediated pairs are used, the effects sizes for all seem to be very similar regardless of the distance from the original cue word. How does the spreading activation account  for this? One could expect that as the distance increases, the helpfulness of the mediators should also decrease.

***Response:*** This is an interesting observation. One explanation is that the presence of an indirect relationship alone may be sufficient for JOLs to improve memory within this context. However, it may be the case the associative pathways between cue and target in double-mediated pairs were still sufficiently close enough for similar reactivity patterns to be observed. At this point, it remains unclear what specific level of distance would be necessary for reactivity to no longer occur.

Finally, we note that while a spreading activation account can explain why JOL reactivity extends to mediated pair types, the present study was not specifically designed to test this account. As such, more work is needed to fully explore the extent to which spreading activation contributes to JOL reactivity (please see the General Discussion, pg. XX).

We thank you for taking the time to review our manuscript.