INTRODUCTION

Learning is most effective when we monitor our progress and direct our efforts toward the areas of greatest need (McEvoy, Schmeck, & McEvoy, 2004). The concept of being aware of our learning is referred to as metacognition, and we are interested in what causes a change in judgements of learning (JOLs). JOLs are estimates of how well material has been learned (e.g. for studying an exam, a student may determine that they know Chapter 3 very well but do not know Chapter 4 as well). Prior research has supported the idea that JOLs are more accurate predictors of learning when there is a delay between study and judgement (e.g., Rhodes & Tauber, 2011). Additionally, a delay of at least 30 seconds has been found to increase the accuracy of JOLs (Skistrom & Jonsson, 2005).

The delayed JOL effect is our primary focus, and in this study we investigated whether there is a change in accuracy between immediate JOLs and JOLs taken after either a 20-, 40-, or 60-second delay. Undergraduate students aged 18-25 years and workers on Amazon’s Mechanical Turk aged 57 years and older were compared in terms of their performance on a task designed using Qualtrics online survey software. We completed a paired-associate task, wherein individual paired-associates (e.g. APPLE, CART) were studied. For nonzero delays, study was followed by a distractor task involving the mental rotation of 3-D objects, where participants decided whether two objects were identical when one object may be slightly rotated (Hayward et al., 2006). The normative difficulty of paired-associate memory tasks was manipulated, with participants either being normatively easy, average, or difficult-to-learn.

We hypothesized that JOLs would decrease in response to longer delays and greater difficulty. We also predicted that JOLs would decrease most following a 60-second delay in comparison to no delay and when comparing normatively-easy and difficult-to-learn stimuli. Difficulty of stimuli was also expected to impact cued-recall performance more than size of delay. Lastly, we anticipated similar memory monitoring accuracy for younger and older adults in terms of both JOLs and post-test confidence judgements (CJ).

METHOD

Younger adult data was gathered from UWEC undergraduate students who participated through the SCINA online research pool; participants received course credit or credit for participation. Older adult data was gathered using Amazon’s Mechanical Turk, where participants were paid. Participation followed informed consent and ended with debriefing. All participants were native English speakers with a U.S. high school degree, and all participants were located in the United States.

Participating Demographics:

<table>
<thead>
<tr>
<th>Number of Participants</th>
<th>Gender</th>
<th>Average Age</th>
<th>Age Range</th>
<th>Shipley Vocabulary</th>
<th>Average Vocabulary</th>
<th>Race</th>
<th>Ethnicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Younger Adults</td>
<td>45</td>
<td>22</td>
<td>18-25</td>
<td>100</td>
<td>80</td>
<td>61%</td>
<td>White/Caucasian</td>
</tr>
<tr>
<td>Older Adults</td>
<td>39</td>
<td>57</td>
<td>56-86</td>
<td>100</td>
<td>80</td>
<td>39%</td>
<td>Hispanic/Latin American</td>
</tr>
</tbody>
</table>

Paired-Associates Construction:

Difficulty was varied according to normative forward association strength (Nelson, McEvoy, & Schreiber, 2004). The forward association for Easy (0.75 - 1.25), Moderate (1.26 - 1.75), and Hard (1.76 - 2.0) was 80%, 70%, and 60% respectively. Items were created so that 10 different items were paired with each difficulty level, and a list of 20 items for each difficulty level was used. The first item of each list was an easy item, the second was of moderate difficulty, and the third was of hard difficulty. Each list consisted of 60 items with 20 items for each difficulty level.

Part 1: Study

A randomized sequence consisting of 16 stimuli from each difficulty (easy, moderate, and hard) was created. Each word pair was studied, a delay of either 0, 20, 40, or 60 seconds commenced. For nonzero delays, participants engaged in a 3-D mental rotation distractor task, where two stimuli were displayed and participants were asked to determine whether the two objects were identical or not. They used a computer mouse to select either “Yes” or “No”, after which new image pairs were shown until the delay was finished.

Participants were asked to give a judgement of learning (JOL) based on their confidence in remembering the previous word pair in about 15 minutes, scaled from 0-100. Only the stimulus portion of the word pair was shown during JOL reporting (e.g. APPLE-...). After each word pair, participants gave a confidence judgement for their response on a scale from 0-100.

Part 2: Test

During cued recall testing, the first portion of each word pair was shown without the target (e.g. APPLE-...). Participants were asked to type the second portion of the word pair. We scored responses based on the first three letters being correct.

After each word pair, participants gave a confidence judgement for their response on a scale from 0-100.

RESULTS

Our first hypothesis was unsupported by our finding that JOLs were actually higher after the 60s delay compared to the 0s delay. As expected, however, JOLs decreased along with increasing difficulty. This was complicated by an Difficulty x Age interaction such that length of delay did not impact easy items, but offered marginal differences for moderately difficult and hard items, with higher JOLs paired with longer delays.

Stimulus difficulty impacted cued recall accuracy as expected, with harder items associated with lower recall accuracy. Accuracy was also a bit higher following a 60s delay, perhaps benefiting from distributed retrieval practice.

DISCUSSION

In future studies, we plan to examine further variations in delay and also tighten the timing of the delays. Qualities limitations created some degree of impression in the implementation of delays in this initial study; a more advanced approach might solve this issue. We also intend to collect data in the context of a multilingual learning experience to determine how specific JOL delays in trial 1 might relate to subsequent JOLs in trial 2 (similar to Hines, et al., 2015).

REFERENCES


Contrary to predictions, younger adults’ JOLs were more predictive of cued recall performance than were those of older adults. This may have resulted from overall better memory performance on the part of older adults coupled with a bit of underconfidence on their part during study. No age-related difference was found for CJ scores, however, indicating intact monitoring of retrieval processes.

FUTURE DIRECTIONS

In future plans, we plan to examine further variations in delay and also tighten the timing of the delays. Qualities limitations created some degree of impression in the implementation of delays in this initial study; a more advanced approach might solve this issue. We also intend to collect data in the context of a multilingual learning experience to determine how specific JOL delays in trial 1 might relate to subsequent JOLs in trial 2 (similar to Hines, et al., 2015).


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