Age and Metamemory: Do Older Adults Perform Poorly?

Md. Zayeed Bin Alam*, Asheek Mohammad Shimul

Dhaka University Memory Research Unit, Department of Psychology, University of Dhaka, Bangladesh

*Corresponding Author: shafiul.alam066@gmail.com

Copyright © 2014 Horizon Research Publishing All rights reserved.

Abstract

The purpose of the present study was to determine whether there is any age effect on metamemory judgments i.e. Judgment-of-learning (JOL) and Feeling-of-knowing (FOK). Based on previous findings it was hypothesized that age would only affect FOK resolution not JOL. Twenty younger adults and twenty older adults participated in this study under within subject design. The order of the FOK and JOL tasks were counterbalanced across participants. For both tasks, the first phase was the study phase and they studied twenty different Bangla word pairs in each task. The second phase was the judgment phase for JOL task and recall phase for the FOK task. The third phase was just opposite; recall for JOL and judgment for FOK. The last phase was recognition for both tasks. Results indicate no significant age effect on both recall performance \(t_{(38)} = 0.728, p > 0.05\) for JOL task, \(t_{(38)} = 1.195, p > 0.05\) for FOK task and recognition performance \(t_{(38)} = 0.366, p > 0.05\) for JOL task, \(t_{(38)} = -0.178, p > 0.05\) for FOK task. It also indicates no significant age effects on judgment accuracy \(F_{(1,38)} = 0.156, p > 0.05\). The results have been discussed in the light of recent developments in metamemory research.

Keywords Metamemory, Aging, Feeling-of-Knowing, Judgment-of-Learning

1. Introduction

Metamemory is relatively new concept in the field of memory research. It is the process by which we are able to examine the content of our memories and make judgments about them. It focuses on peoples’ self-monitoring and self-control of their own memories. In the theoretical framework of metamemory there are two aspects; one is monitoring (the subjective experience) and other is control processes (the behavior) [20]. Nelson and Leonesio [21] found that both monitoring and control operates in a feedback loop: through memory monitoring, we can control our memory function and implement appropriate mnemonic strategies [33]. Accurate judgment is necessary because wrong judgment may lead to ineffective control actions.

Among different metamemory phenomena, two most studied phenomena are Feeling-of-knowing and Judgment-of-learning. Rene Descartes’s ‘methodic doubt’ was regarded the basis of metamemory [19]. Later on, Bowne and James thought and worked with metamemory judgment but did not systematically examined the relationship between memory judgments and memory performance at their own time [7].

Feeling-of-knowing judgment means the likelihood of feelings whether or not a specific knowledge exists within memory [10]. This judgment can be made either before memory target being found, known as initial rapid Feeling-of-knowing paradigm [24] or following a failed attempt to locate the target, known as post retrieval failure paradigm. Many researchers using post retrieval failure paradigm found that accuracy was significantly above chance but far from perfect [2], that is, participants were relatively accurate in their predictions [27]. The foremost theory to explain FOK is the target-strength account. According to this theory, FOK judgments are directly dependent on how strongly a target is activated in memory. Another theory is the heuristic-based accounts. This theory can be divided into two parts; one is cue familiarity hypothesis and another is target accessibility hypothesis. Cue familiarity hypothesis suggests that the cue or question, and not the target, is crucial for making metamemory judgments [25]. Another heuristic basis for FOK judgment is the target accessibility. According to this hypothesis FOK judgments are directly dependent on how strongly a target is activated in memory. Another theory is the heuristic-based accounts. This theory can be divided into two parts; one is cue familiarity hypothesis and another is target accessibility hypothesis. Cue familiarity hypothesis suggests that the cue or question, and not the target, is crucial for making metamemory judgments [25]. Another heuristic basis for FOK judgment is the target accessibility. According to this hypothesis FOK judgments are based on the total amount of information retrieved about the target, regardless of whether the information is correct or incorrect. Recent research suggests that contextual information is crucial for Episodic FOK judgment [8]. Souchay, Moulin, Clarys, Taconnat, and Isingrini [30] found a significant correlation between FOK accuracy scores and remember responses (contextual information which accompanies a memory). Brain imaging technique supports the conclusion that frontal lobe is the key contributor of the accurate FOK judgment [14].

Judgment of Learning (JOL) is another important metamemory phenomenon which people make either in the course of learning or afterwards about how well they have learned the particular target materials. JOLs can be made
either in a cumulative manner (assessment over an entire list) or item-by-item judgments. Item-by-item judgments can be of two types; one is immediate and another is delayed. Immediate JOLs are based on encoding fluency and delayed JOLs are based on retrieval fluency [15]. A number of studies and meta-analysis conducted by Dunlosky, Connor, and Hertzog [9], Kelemen, Frost, and Weaver, [12], Kelemen and Weaver [13], Rhodes and Tauber [26] have shown that participants are relatively accurate in their JOLs predictions. Son and Metcalfe [29] proposed a two-stage model to explain JOL accuracy. According to this model, JOLs are based either on the familiarity with the cue or on the attempt to retrieve the information.

From the aging literature, such as Bruce, Coyne, and Botwinick [3], Conor, Dunlosky, and Hertzog (1997) it is seen that JOL resolution is largely age insensitive. Studies conducted by Allen-Burge and Strondt [1], Lachman, Lachman and Thronesbery [16] have also shown that younger and older adults do not differ in their abilities to predict which semantic information they will be able to recognize i.e. semantic FOK resolution. However, a number of studies performed by Perrotin, Tournelle, and Isingrini [23], Souchay, Isingrini, and Espagnet [32] Souchay et al. (2007) have found that the resolution of episodic FOKs is impaired in aging. So the problem of the present study was to investigate the age effect on both metamemory judgment resolutions. In the lights of previous studies it was hypothesized that age will only affect episodic FOK resolution but not semantic FOK and JOL resolutions.

Studies on metamemory and aging have some potentially important implications. First, the study of McFarland, Ross, and Giltrow [18] established empirical evidence that individuals hold a stereotype of declining memory as a dominant feature of aging. This belief about memory may impede memory performance in everyday life including heightened anxiety and negative affect. Research findings from aging and metamemory studies may help in reconstructing of beliefs about the nature of memory and aging, and thereby helps protecting the mental health of older adults.

2. Method

2.1. Participants

There were forty participants in this study. Among them twenty were younger (mean age= 21.8, SD= 1.643) and the rest twenty participants were older (mean age=53.5, SD= 6.201). Younger participants consisted of 10 male and 10 female participants, and older participants consisted of 12 female and 8 male participants. The participants were selected by using purposive sampling. All the younger participants were literate and student of Dhaka University. Among all the participants 15 used reading glasses or spectacles to view the words. Both young and older participants had a minimum of 14 years of education. None of the participants complained about memory problems.

2.2. Materials

A list of 40 paired words was used in this experiment, which were selected from Bangla words. The paired words (e.g. পতাকা–সৈনিকি, মিছিল–শিবির) were neutral words and each paired word was far more different from each other. These paired words were divided into two subsets each containing twenty paired words. One subset is used for JOL task and another is used for FOK task. The pairs were presented to the participants by using an ASUS branded K43U model laptop. The size of the monitor was 14 inch. The paired words were presented by Microsoft Office PowerPoint 2007 software. The font, point size, and alignment of presented Bangla paired words were Vrinda (Headings), 29, and middle respectively. In each phase (except study phase) participants’ responses were collected in tabulated papers.

2.3. Experimental Design

There were two independent variables in this experiment; one was age and another was metamemory judgments. These two independent variables varied in two ways. The two levels of age variable were younger and older adults and other two levels of variable metamemory judgment were Judgment-of-learning (JOL) and Feeling-of-knowing (FOK). In this experiment a repeated measurement design was used. There were two tasks in this experiment; one was JOL task and another was FOK task. Each task was again divided into four phases. The four phases of JOL task were study, judgment, recall, and recognition phases. Study, recall, judgment, and recognition were the four phases of FOK task. The order of the task was counterbalanced across participants.

2.4. Procedure

At first the potential participant was taken to the laboratory and then he or she was provided adequate information about the experiment was followed by the presentation of informed consent form to sign up. The participant then provided with instruction for Judgment-of-learning task. This task was divided into four phases. The first phase was study phase. In that phase he or she was presented with twenty cue-target pairs one by one for five seconds with the help of laptop. The task of the participant was to keep in mind as much pair as possible. Then he or she was given thirty seconds time before the next phase. In the judgment phase the participant was presented with the first word of the item in a random order and his or her task was to judge the recall capacity of the second word. The judgment response was either a ‘yes’ or ‘no’: when participant thought he or she would be able to recall the
second word of that pair when prompted with the first, they put tick mark on the ‘yes’ portion of the data sheet and when they thought they would not be able to recall the second word they put tick mark on the ‘no’ portion. In the third phase he or she was confronted with the cue of the item in the random order and the task was to write the second word each within seven seconds time. In the last phase of the JOL task each time participants were shown cue-target items through slides and their task was to select the cue-target paired words, which they learned in the study phase, from two alternatives. In this case one cue-target items acted as distracter and another as main answer.

The participant was given five minutes rest before starting of the FOK task. Then the written and verbal instruction for Feeling-of-knowing task was given to the participant. Like the JOL task, FOK task was also divided into four phases. The first phase was study phase and twenty other different word pairs were shown to the participant to be recall later. After the study phase, participant was presented with the cues again, in a random order, and was given seven seconds to recall the target for a given cue. Next was the judgment phase. The judgment response was either a ‘yes’ or a ‘no’: when participant thought he or she would be able to recognize the second word of the item, he or she put tick mark on the ‘yes’ portion and when they thought they would not be able to recognize the second word, they put tick mark on the ‘no’ portion. The last phase of the FOK task was recognition task which is similar to last phase of JOL task. After completing the both tasks the participant was given thanks for the participation.

2.5. Scoring

Hamman difference index \((H)\) was used to calculate JOL and FOK resolutions. The formula for Hamman score \((H)\) is: 
\[
H = \frac{(a+d)-(b+c)}{(a+d)+(b+c)}\]
for yes predictions and 
\[
H = \frac{(a+b)-(c+d)}{(a+b)+(c+d)}\]
for no predictions. \(a\) = total number of correct judgments for yes predictions, \(d\) = total number of correct judgments for no predictions, \(b\) = total number of incorrect judgments for yes predictions and, \(c\) = total number of incorrect judgments for no predictions. JOL and FOK accuracy was measured by Hamman difference index between each participant’s JOL and recall performance and between each participant’s FOK and recognition performance respectively. For JOLs, Hamman difference index i.e. \(H\) were calculated on all judgments, but for FOKs, \(H\)s were calculated only on judgments made for non-recalled items. Hamman difference index is a continuous variable that ranges from -1 to +1. A large positive value means a high degree of accuracy, a value of zero means chance-level accuracy, and a negative value means less than chance level accuracy.

3. Results

To analyze the potential age difference \(t\) test was performed on the proportion of correct recall and proportion of correct recognition for both JOL and FOK tasks.

No significant age difference was observed \([t_{(38)} = .728\) and \(p>.05\) when proportion of correct JOL recall was considered and same trend of finding is obtained \([t_{(38)} = 1.195\) and \(p>.05\) when we analyzed for the proportion of correct FOK recall in both groups. On the other hand, mean proportion of correct JOL recognition for younger and older participants are 0.89 and 0.87 respectively, and no age effect is observe \([t_{(38)} = .366\) and \(p>.05\) when proportion of correct JOL recognition was considered. And once again, mean proportion of correct JOL and FOK recognition for younger and older participants are 0.90 and 0.91 respectively, and for FOK recognition performance, there was no difference \([t_{(38)} = -.178\) and \(p>.05\) between young and old groups.

To measure the accuracy effect of JOL and FOK a 2 (group) X 2 (conditions) factorial ANOVA was performed on H values. Significant conditions effect is observed \([F_{(1,38)} = 68.434, p<0.05\] and no significant age effect \([F_{(1,38)} = .156, p>0.05\] and interaction effect \([F_{(1,38)} = .198, p>0.05\] are seen.

4. Discussion

Although previous findings on metamemory research showed significant age effect on FOK accuracy but not JOL accuracy, present study suggests concordance of FOK resolution or accuracy on both younger and older adults. Results of this experiment are thus partially consistent with the previous findings where aging effects on episodic FOK and JOL accuracy were analyzed.

Serra and Dunlosky [28] argued that JOL resolution was largely age insensitive i.e. the younger and older adults do not differ in their ability to predict which information they would be able to recall. Result of the present study is consistent with this finding. In our experiment participants were asked to use any particular strategies at study phase and in JOL task participants were not asked to retrieve the target information before judgment phase. Koriat and My’ayan [15] argued that immediate JOL would be based on encoding fluency, while delayed JOLs would rely on retrieval fluency. We used delayed JOL paradigm in our experiment. According to Souchay and Isingrini, if participants are asked to use any particular strategies at study, their delayed JOLs will be based on retrieval fluency which is an automatic and age invariant process. For this reason JOL resolutions may have been found to be similar between younger and older adults.

A number of studies have shown that episodic FOK is impaired in aging and there must be a difference between younger and older adults’ episodic FOK resolutions. The finding of our study is inconsistent with the argument that there is a general age deficit in episodic FOK resolution or accuracy. Souchay and Isingrini explained the age differences in episodic FOK accuracy in their experiment by memory constraint hypothesis. This hypothesis tells that [11]
deficient encoding process will lead to less partial and contextual information which is responsible for impairment in episodic FOK resolutions. However, in some studies conducted by Carroll and Nelson [4], Hertzog, Dunlosky, and Sinclair (2010) and Nelson, Leonesio, Shimamura, Landwehr, and Narens [22], it was argued that if the encoding process was deeper or if the quality of encoding was increased, then episodic FOK resolution would improve. The inconsistent result in our study might be due to the deeper encoding process of the older adults in the FOK task. The cued recall phase of the FOK task (before FOK judgment phase) which may drive the FOK reliance on recollection process [30] and similar higher level of performance in recognition test of the older adults ensure the increase in the quality of encoding process.

In the recognition task Souchay and colleagues typically used Yes-No target recognition test. But we used forced choice item recognition test. According to Cohn, Emrich, and Moscovitch[5], one major disadvantage of Yes-No target recognition test is that, it is more sensitive to misleading familiarity effects than forced choice item recognition test and may invoke different strategies at retrieval which in turn influence age differences in memory and FOK accuracy. In one unpublished experiment, Stephanie and Hertzog found no age differences in episodic FOK accuracy for forced choice item recognition test [17]. Therefore, no age differences in our study might be due to the use of forced choice recognition test in the recognition phase.

According to Maclaverty and Hertzog (2009) education level is an important factor which may influence episodic FOK accuracy. In previous experiments conducted by Souchay, Isingrini, and Espagnet [32], and Souchay and Isingrini [33] where age differences were observed, researchers used such older participants whose educational level was poor compared to the younger participants. Recent research suggests that, individuals with lower educational level have lower functions across their life span and this can impair the FOK accuracy [6]. Therefore, it can be said that, the observed episodic FOK impairment of older adults in those experiments may not be due to aging but because of persistent low level of functions across life span. In our experiment, all the younger participants were undergraduate students (minimum 14 years of schooling) and the minimum schooling of older participants was 16 years. Most of the older participants were service holder and they were actively participating in the decision making process of their families. Both of the younger and older adults of our experiment were functional. Consequently, we can argue that due to this characteristic of the younger and older participants no significant age difference was observed in episodic FOK accuracy or resolution.

An important fact which cannot be ignored is the social context of the older participants. In Bangladesh, most families do not recognize older adults as separated from the family or family matters. Older adults are also considered as part of the society. Old home practice is still in the bud stage.

Most of the previous researches on metacognition and age were conducted with participants living in the western world. And this is the first and foremost metacognition research in Bangladesh. So, there might be cultural differences. Wright and Frederick [34] gives emphasis on researches on differences in metacognition processing across cultures and unfortunately these differences have not been widely studied. More precise and advance research should be carried out on this issue.

REFERENCES


