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Selective deficits in episodic feeling of knowing in ageing: A novel use of the general knowledge task

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ABSTRACT

Failure to recall an item from memory can be accompanied by the subjective experience that the item is known but currently unavailable for report. The feeling of knowing (FOK) task allows measurement of the predictive accuracy of this reflective judgement. Young and older adults were asked to provide answers to general knowledge questions both prior to and after learning, thus measuring both semantic and episodic memory for the items. FOK judgements were made at each stage for all unrecalled responses, providing a measure of predictive accuracy for semantic and episodic knowledge. Results demonstrated a selective effect of age on episodic FOK resolution, with older adults found to have impaired episodic FOK accuracy while semantic FOK accuracy remained intact. Although recall and recognition measures of episodic memory are equivalent between the two age groups, older adults may have been unable to access contextual details on which to base their FOK judgements. The results suggest that older adults are not able to accurately predict future recognition of unrecalled episodic information, and consequently may have difficulties in monitoring recently encoded memories.

1. Introduction

Many studies have now found that age has differential effects on episodic and semantic memory. For tasks requiring a large degree of involvement from semantic memory processes (e.g., general knowledge tasks), older adults are typically able to perform at similar levels to young adults. However for tasks measuring episodic memory (e.g., word list learning), older adults are not able to match younger adult performance; problems at encoding and/or retrieval lead to lower levels of accuracy in older adult samples (see Anderson & Craik, 2000; Zacks, Hasher, & Li, 2000 for reviews). Related memory processes involving the knowledge and control of memory, termed metamemory (Flavell, 1979), may also be affected by ageing. Whether all metamemory processes (e.g., judgements of confidence, feeling of knowing; Nelson & Narens, 1990; 1994) are equally affected is still a matter of debate (Souchay & Isingrini, 2012).

The feeling of knowing (FOK) metamemory paradigm can be used to examine peoples' ability to predict future recognition for both semantic and episodic items, and so is a useful tool to explore age effects on both types of memory awareness. In this procedure, participants are asked to estimate the likelihood that they will recognise a piece of information they have failed to recall earlier, either from semantic memory (Hart, 1965; Nelson & Narens, 1990), or from episodic memory (Schacter, 1983; Souchay, Isingrini, & Espagnet, 2000). Thus, FOK judgements are predictions about material that participants failed to retrieve and, although not perfect, these judgements have been found to be relatively accurate in young adults (Gruneberg & Monks, 1974; Kelemen, Frost, & Weaver, 2000; Nelson, Gerler, & Narens, 1984; Schacter, 1983).

In the ageing metamemory literature, results are consistent with the memory literature in that no age effect is observed on semantic FOK judgements. Butterfield, Nelson, and Peck (1988), Lachman, Lachman, and Thronesbery (1979), Bäckman and Karlsson (1985) and Marquié and Huet (2000) all used a general knowledge task similar to that of the original Hart (1965) task. Participants were asked to recall answers to a series of general knowledge questions and, upon failure to recall, to give a prediction about how likely they were to recognise the correct answer if shown it, i.e., the FOK judgement. This could be in the form of a simple binary FOK (Yes I will recognise or No I will not recognise), as a percentage rating of the likelihood of recognition, or through a series of relative judgements for each unrecalled item. Whether using a binary FOK (Butterfield et al., 1988), a rating scale FOK (Lachman et al., 1979; Marquié & Huet, 2000), or relative FOK judgements (Butterfield et al., 1988) no differences were observed in the predictive accuracy of young and older adult judgements for future recognition. Likewise, Allen-Burge and Storandt (2000) examined semantic memory and FOKs for rare word definitions, again finding similar levels of predictive accuracy of FOK judgements in young and older adults. The preservation

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of semantic memory processes in ageing would thus appear to extend to memory monitoring processes of semantic memory.

When considering episodic FOK accuracy, the effect of ageing is an issue of some debate. In agreement with the findings of the memory literature, Perrotin, Isingrini, Souchay, Clarys, and Taconnat (2006), Souchay et al. (2000), and Thomas, Bulevich, and Dubois (2011) have all observed deficits in episodic FOK accuracy in older adults for word pair learning. However, Eakin and Hertzog (2012), Hertzog, Dunlosky, and Sinclair (2010) and MacLaverty and Hertzog (2009) failed to find an episodic FOK deficit. Although a comparable word pair learning paradigm was used, older adults in these studies were able to predict their future recognition with a similar level of accuracy to that of young adult participants. Several hypotheses have been proposed to explain potential age differences on episodic FOK, such as a deficit in executive functioning (Souchay et al., 2000) or a deficit in recollection (Souchay, Moulin, Clarys, Taconnat, & Isingrini, 2007). More recently, Hertzog et al. (2010) suggested that impoverished memory representation of the items due to deficient encoding in older adults could explain the age-effect observed on episodic FOK in some studies. This *memory constraint hypothesis* (MCH; Hertzog et al., 2010) proposes that FOK accuracy is primarily dependent on the quality of the underlying memory processes during learning. If encoding is impaired in some way, then insufficient or incorrect partial information will be accessed during the failed recall attempt. Subsequently, the FOK judgement will be based on these flawed details, leading to lower predictive accuracy (Koriat, 1993, 1997). As episodic memory is impaired in ageing, the FOK deficit observed in some studies may simply be due to a lack of sufficient encoding to allow diagnostic partial information to be available to the participant as opposed to a deficit in metacognitive ability (see Perfect & Stollery, 1993 for a similar argument). Indeed, by equating young and older adults' memory performance using variable delays, Hertzog et al. (2010) were able to demonstrate equivalent levels of episodic FOK accuracy in the two age groups. However, although some of the studies that have found age effects on FOK do also show age effects on memory performance (Perrotin et al., 2006; Souchay et al., 2000, 2007), not all of them do. For all three experiments reported by Thomas et al. (2011), memory performance on the cued recall aspect of the task was comparable between the young and older adult participants. Despite this, older adults consistently demonstrated a deficit in episodic FOK accuracy.

When considering whether age does lead to a selective impairment in episodic FOK accuracy it is important to consider one key limitation of the studies discussed so far. Examination of semantic and episodic FOK accuracy has typically been conducted in isolation, therefore the accuracy of each of these processes has been established in different participant samples and then compared. To the best of our knowledge only two studies have examined both semantic and episodic FOK accuracy within the same group of participants, and these studies have revealed contrasting findings. Souchay et al. (2007) asked participants to complete both a general knowledge task and a word pair learning task, thereby allowing them to directly compare accuracy in the two tasks. In addition, the same target items were used in each task, allowing a further level of control in the study. For example, in the semantic task the question may have been 'What was the subject of Magritte's famous surrealist painting La Trahison?', the answer being 'Pipe'. In the episodic task, an unrelated cue word would be paired with the same item, e.g., Birthday — Pipe. The intrinsic properties of target words, such as frequency, can have an impact on the FOK judgement (Koriat, 1993). By using the same target items, and by counterbalancing task order, Souchay et al. (2007) were able to match the properties of the required target in the semantic and episodic tasks. For the semantic task, as in previous research, comparable performance was observed between young and older adults: both groups were able to accurately predict future recognition accuracy for unrecalled items. When examining performance on the episodic task, the accuracy of both young and older adults' FOK judgements were above chance, indicating that both age groups were able to predict their performance to a certain extent. However, the accuracy of the older adult group was shown to be significantly below that of the young adult group. Despite exhibiting some ability to judge their recognition of unrecalled items, older adults were unable to do this to the same level of accuracy as young adults. This would therefore support previous findings observing a selective episodic FOK deficit in older adults (Perrotin et al., 2006; Souchay et al., 2000; Thomas et al., 2011).

Although Souchay et al. (2007) ensured the target items were identical in the semantic and episodic task, thus removing target characteristics as a potential confound on FOK accuracy, task characteristics could still be a factor. The prompt used to elicit the recall attempt in each task is different, with the semantic task involving a more conceptual cue whereas the episodic task involves a more contextual cue (Koriat, 1997; Perfect & Hollins, 1999). This may influence the strategies used at the recall attempt, thereby helping to determine the quality and quantity of information accessed on which the FOK judgement will be based. To remedy this methodological issue, Eakin, Hertzog, and Harris (2014) recently presented a new experimental paradigm in which they adopted a face–name associative task to equate the method of cueing for both episodic and semantic tasks. For both tasks, participants were presented with a picture of a face as a cue, a famous face for the semantic task and a non-famous face for the episodic task, and asked to provide the name. Results showed a significant age by memory task interaction, with older adults showing poorer performance in the episodic condition for both recall and recognition tasks. Furthermore, no group differences were observed on the semantic condition. However, unlike Souchay et al. (2007), this study did not reveal any age effect on FOK accuracy for the episodic FOK or the semantic FOK. Discrepancies between this study and Souchay et al. (2007) are difficult to explain. As suggested by Eakin et al. (2014), the lack of age effect observed in their study on episodic FOK accuracy could be related to the material used. Indeed, older adults may do well when *visual cues* are used to make FOK judgements, as they may be able to retrieve sufficient information to inform their judgement. However, whether or not discrepancies between the two studies are due to differences in material used is difficult to ascertain considering the methodological issues in Souchay et al. (2007).

Therefore, the present study aims to remove the possible influence of task characteristics on Souchay et al. (2007) findings by utilising a general knowledge task for both the semantic and episodic FOK tasks. To do so, a classical FOK semantic task was conducted first by presenting participants' general knowledge items, with participants asked to make FOK judgements on questions they do not know the answer for. The novelty of this design is to use the unknown items from the semantic FOK task as targets in the episodic FOK task. Thus, for the episodic condition, answers which are not known will subsequently be learned. The unknown general knowledge questions become the episodic version of the task, thereby ensuring that the same cues are used for both tasks, removing this as a possible confound. Episodic FOK judgements will then be made on answers that participants cannot recall.

2. Method

2.1. Participants

Thirty five undergraduate students (age range 18 to 29, $M = 20.23$, $SD = 2.89$; nine males) from the University of Leeds participated in the study in return for course credit. The older adult group consisted of 21 people aged between 60 and 85 ($M = 69.86$, $SD = 8.00$; three males) recruited from the local community. Both groups reported a similar number of years of education (young adults $M = 15.69$, $SD = 2.46$; older adults $M = 14.10$, $SD = 3.35$; $t(54) = 1.89$, $p = .067$). All older adults obtained scores on the Mini Mental State Examination (MMSE; Folstein, Folstein, & McHugh, 1975) above the cutoff of 27 ($M = 28.79$, $SD = 1.44$) and were not taking medication which would affect cognitive function. The research received approval