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Serial position effects scoring in the assessment of memory in Alzheimer's disease and major depression

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The contribution of list length to the absence of the primacy effect in word recall in dementia of the Alzheimer type

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Abstract

It has repeatedly been demonstrated that patients with dementia of the Alzheimer type (AD) show an absence of the primacy effect when asked to recall a list of items. The results of the present study show that the absence of the primacy effect in AD patients is related to list length but probably in a way that is qualitatively not specific since it follows the same pattern as in normal ageing. It is also demonstrated that AD patients differ in learning style. It is suggested that this indicates a reduced capacity to maintain controlled processing.

Introduction

Since the introduction of the serial position curve of free recall [3] 8 studies have been published using this method to study memory processes of AD patients [4 - 6,10,11,13,14,18]. The method is based on the fact that, when a list of words has to be learned, the last items of the list are most readily recalled (recency effect). Furthermore, while the first and the middle items have a smaller chance of being recalled than the last, the first items are more readily recalled than the middle ones (primacy effect).

Of the 5 studies that used single-trial free recall 3 reported an absence of the primacy effect in all patients [5,11], while in 2 studies [4,14] an absence of the primacy effect was found to be related to the degree of cognitive decline. Of the 3 studies that used multi-trial free recall 2 [6,13] found the absence of the primacy effect only in the moderate and severely impaired group, while in one of them [10] the presence of the primacy effect was found with less as well as with more impaired AD patients.

The authors hypothesized that the absence of the primacy effect would have been found with severely impaired AD patients or if a longer word list had been used. The role of list length is not known. The absence of the primacy effect has been found in connection with lists of 7 words [4], 9 words [13], 10 words [5,6,14] and 12 words [11,18], while the studies that detected the presence of the primacy effect in part or all the patients used a 7- [4] 8- [10], 9- [13] or 10-word list [14]. To evaluate whether the presence of the primacy effect in AD patients is dependent on the list length, patients and controls were subjected to learning lists of different lengths.

Method

Subjects

Ten acute admission AD patients (five males and five females, aged 74.6 ± 5.0 years, with 7.9 ± 2.9 years of education) and 10 normal controls matched by age and level of education (five males and five females, 74.9 ± 5.4 years, 7.6 ± 1.7 years of

education) were tested.

Diagnosis was made according to DSM-III-R criteria (1987) [1] by an experienced psychiatrist, assisted by an internist and neurologist. All the patients met the criteria of primary degenerative dementia of the Alzheimer type, senile onset. They had reached a state of moderate dementia. Patients with other specific causes of dementia, delirium or depressive behaviour were excluded. Neuropsychological assessment of memory disorder and disorders of higher cortical function was undertaken. The duration of onset of illness varied between 1 and 6 years. Patients were tested in the clinic; controls were tested in their own homes.

Design

The auditory verbal learning test [15] was performed with the following amendment. The list of 15 words was split into a 6- and 9- word list. Five trials of the 6- and 9-word list were presented before 5 trials of the link up, i.e. of the 15-word list. The words were presented at a rate of 1½ s/word. Recall was asked immediately after each trial and was broken off if the subject recalled all the words, seemed not know any words, confabulated or remained silent for fifteen seconds.

Results

Serial position curves of the accumulated recall of five trials are depicted in Fig. 1a,b,c. As is evident for the shapes of the curves of AD patients, the primacy effect decreased as the list length increased (see Fig. 1a,b,c). After the 15-word list no primacy effect was found at all.

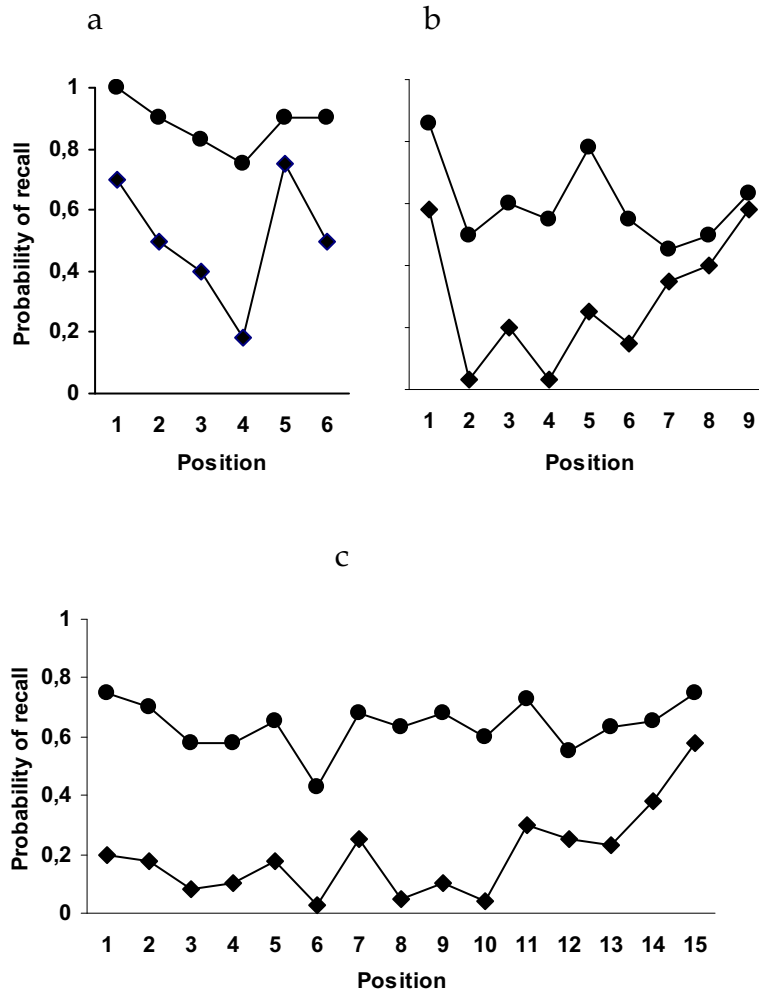


Fig 1 a,b,c. Serial position curves of multi-trial free recall of 6, 9 and 15 words; ●—●, normal ; ◆—◆ AD patients.

Two-way ANOVAs showed significant ($P < 0.001$) group differences for the 6-, 9- and 15-word list, significant ($P < 0.001$) differences of the serial positions of the 6-word list, the first six positions of the 9-word list and the complete 15-word list ($P < 0.0025$), but no significant group \times serial position interaction.

Learning curves of the 6-, 9- and 15-word list are depicted in Fig. 2a,b,c. Two-way ANOVAs showed significant ($P < 0.001$) group differences for the 6-, 9- and 15-word list, significant ($P < 0.001$) trial differences for the 6-word list and the last four trials of the 9-word list. Furthermore, significant ($P < 0.025$) group \times trial interactions were found for the last three trials of the 6-word list and the last four trials of the 9-word

list.

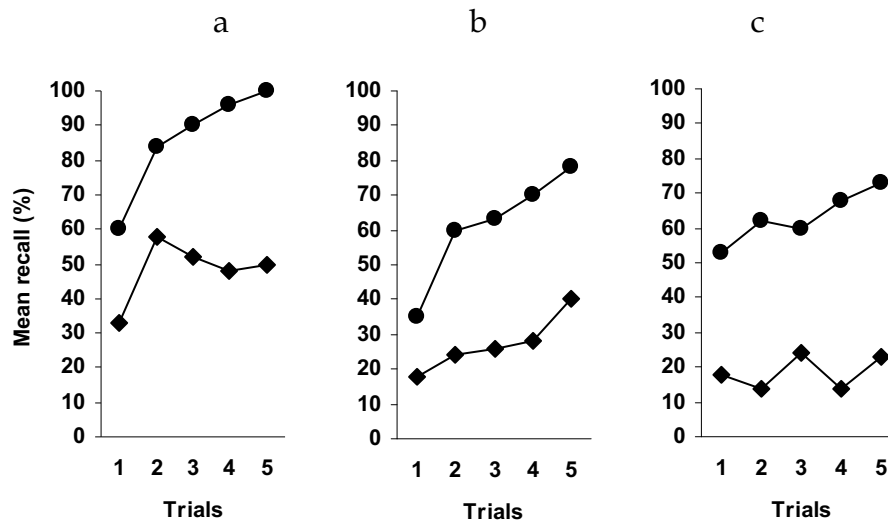


Fig. 2a,b,c. Learning curves of the 6-, 9- and 15-word curves. a, 6 words; b, 9 words; c, 15 words. •—•, normal ; ♦—♦ AD patients.

Discussion

The results of the present study demonstrate that the manifestation of the primacy effect in a free recall task is dependent on the list length in AD patients. This implies that if the primacy effect is not found, the use of a shorter list will demonstrate that this typical characteristic of the recall performance is not lost. Since no significant group \times serial position interaction was found, as in previous multi-trial free recall studies [10,13], the reduced recall performance in AD patients is probably not qualitatively specific and follows the same pattern as that in normal ageing.

The results of the present study also demonstrate that AD patients differ both quantitatively and qualitatively in their learning behaviour from their aged controls. The qualitative different behaviour emerges in the last 3 trials of the 6-word list and the last 4 trials of the 9-word list. Within the theoretical framework of automatic and controlled processing [7,17], it has been argued that controlled processing declines in early AD while automatic processing is well maintained until late in the disorder [8].

Our group of AD patients was in a moderate stage of cognitive decline. We assume that the learning curves of the AD group (see Fig. 2a,b) reflect the different styles employed and that after trial 2 in the 6-word list and trial 1 in the 9-word list additional learning via controlled processing is abandoned.

Recently controlled processing has also been linked to the manifestation of the primacy effect [9]. Judging from the amount of primacy effect present in Fig. 1a,b, AD patients were still able to demonstrate controlled information processing when learning the 6- and 9-word list.

In general, the primacy effect is assumed to be the result from extra rehearsal of the early items of the list [16]. Absence of the primacy effect has also been demonstrated with adult normals when asked to use one-item rehearsal [2] and children under the age of nine who use one-item rehearsal spontaneously [12]. As one-item rehearsal results in the loss of the primacy effect, the so-called controlled processing could be strongly dependent on the arrangement of serial grouping of information.

In conclusion, the results of the study show that the absence of the primacy effect with AD patients is related to list length but is probably not qualitatively specific since it follows the same pattern as in normal ageing. It also demonstrated that AD patients differ in their learning style. It is suggested that this indicates a reduced capacity to maintain controlled processing.

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