

NOTE

CLUSTERING BY ALCOHOLIC KORSAKOFF PATIENTS

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Abstract—Twelve alcoholic Korsakoff patients and 12 alcoholic controls recalled two clusterable lists, and two nonclusterable lists. Korsakoff patients recalled more from the clusterable than the nonclusterable lists. Detailed analysis of the Korsakoff results indicate that while some forms of semantic organization are impaired, the ability to use associative structure remains intact.

THE MEMORY deficit of alcoholic Korsakoff patients appears fairly specific. First, it affects material that can be verbally coded to a much greater extent than material which cannot be verbally coded, regardless of whether the material is presented in the auditory, visual or tactile mode [1]. Second, while many aspects of verbal memory demonstrate deficits, the main loss is in the ability to spontaneously organize material semantically [2-5]. While Korsakoff patients show deficits in the spontaneous use of semantic encoding, they show little or no deficit in their ability to use associations among items to aid their recall [4]. Semantic, or Bousfield, clustering among items in free recall was studied because it can either be a sign of hierarchical organization [6] or associations among items [7]. That is, if the words cotton, wool and silk were recalled together it could either be evidence of the use of a hierarchical organization under the heading types of cloth or evidence of the use of the high associations among the three words. While either process could lead to the increased recall shown by Korsakoff patients on clusterable as opposed to random lists [5] detailed analysis of the recall protocols should be able to separate the two processes.

METHOD

Subjects

Twelve clinically diagnosed alcoholic Korsakoff patients and their 12 alcoholic controls took part in the investigation. The Korsakoff patients all had severe memory defects as assessed by clinical method; however, none showed evidence of dementia: their average IQ based on the WAIS was 101 (range 91-116). The control group consisted of 12 hospitalized alcoholics without clinical memory defects. The average ages of the Korsakoff patients and alcoholic controls were 60 (range of 48 to 68) and 52 (range of 45 to 64), respectively.

Materials

Two 15 item clusterable lists and two 15 item nonclusterable lists were used. Each clusterable list was formed by choosing the five most commonly given instances of three categories [8]. Each nonclusterable list was formed by choosing the third most commonly given instance of 15 categories from those norms. The words used in the two clusterable lists were:

- (1) cotton, wool, silk, rayon, nylon; apple, orange, pear, banana, peach; car, bus, airplane, train, truck; and
- (2) aluminium, copper, gold, iron, steel; cat, cow, dog, horse, lion; clarinet, drum, piano, trumpet, violin.

The words used in the two nonclusterable lists were:

- (1) bed, cardinal, carnation, dimes, emerald, inch, nails, newspaper, pants, pine, robbery, temple, tent, sugar, water; and
- (2) basketball, coal, corn, father, green, head, rain, rifle, roof, Russia, second, senator, sergeant, teacher, valley.

The order of the presentation of the lists and of the words within the lists were randomized with the restriction that in the clusterable list no words from the same category were adjacent.

Procedure

All subjects were tested individually. The sessions were taped and transcripts used in the scoring of the recalls. Words were read to the subjects at a rate of one every 2 sec. At the end of each list the subjects were asked to recall as many words as possible. A 5 min break followed the recall of each list. Twelve different random orders of presentation of the lists and words within the lists were used: one for Korsakoff patient. The same 12 random orders were used for the alcoholic controls. Verbatim recall was required for the lists.

RESULTS

Figure 1 presents the amount recalled by Korsakoff and alcoholic control subjects for clusterable and nonclusterable lists as a function of serial position. Data from each 3 adjacent serial positions were grouped together to form the 5 data points presented on each curve. An analysis of variance was run using these same groupings. The effect of the type of list and subject group were significant [$F(1, 22) = 29.01, P < 0.001, \text{min } F'(1, 80) = 8.60, P < 0.005$, and $F(1, 22) = 21.23, P < 0.001, \text{min } F'(1, 44) = 14.32, P < 0.001$, respectively] [9] but their interaction was not [$F(1, 22) = 0.21, \text{min } F'(1, 69) = 0.09, P's > 0.50$]. The effect of serial position was also significant [$F(4, 88) = 22.21, P < 0.001, F'$ could not be calculated due to the random assignment of words to serial position]. A special contrast planned to mimic a U-shaped serial position (3, -2, -2, -2, 3) accounted for 64.77 of the total 66.55 sums of squares attributable to serial position. Thus this study, as well as other studies with alcoholic Korsakoff patients [10], does not support BADDELEY and WARRINGTON's [11] finding of normal recency (and therefore normal short-term memory) with suppressed primacy (and therefore less than normal transfer to long-term memory) in amnesic patients, although differences in procedure could account for differences in the results themselves.

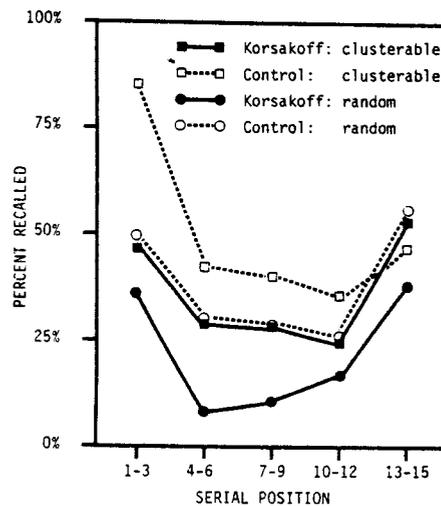


FIG. 1. Serial position curves.

Using the modified ratio of repetition [i.e. the number of recalled words followed by a word from the same category/(the number of recalled words - the number of recalled categories)] as a measure of clustering and BOUSFIELD and BOUSFIELD's formula for the number of repetitions expected by chance [12], both groups showed statistically significant clustering [$t(11) = 2.94, P < 0.05$ for the Korsakoff patients and $t(11) = 3.01, P < 0.05$ for the controls]. There was no statistically significant difference in amount of clustering between the two groups. There was, however, a marked difference in the number of categories recalled by alcoholic control and Korsakoff patients. Each clusterable list consisted of five words drawn from each of the three categories. In 23 out of 24 clusterable lists presented to alcoholic control patients, at least one item from all three categories was recalled. This was the case in only 9 out of the 24 clusterable lists presented to the Korsakoff patients. The average number of categories recalled by the alcoholic controls was 2.96 out of 3 compared to 2.33 out of 3 for the Korsakoff patients [$t(22) = 4.64, P < 0.001$; unequal variances do not affect the level when the sample sizes are equal (13)]. Thus, the Korsakoff patients did not treat the list as a hierarchy of one list divided into 3 categories with each category divided into 5 instances. This significant difference is enough to account for the difference in total recall. That is, the number of

items per category recalled by the alcoholic controls and Korsakoff patients was not significantly different [2.53 vs 2.35, $t(22) = 0.78$, $P > 0.20$].

DISCUSSION

Korsakoff patients remembered less of lists than the alcoholic controls did, yet their clustering and increased recall of clusterable lists implies that the Korsakoff patients do use spontaneous semantic encoding to at least a moderate degree. What can account for this intermediate level of semantic encoding?

We know from previous work [2, 3] that Korsakoff patients do not benefit from category cues to the extent that alcoholic controls do, yet they do benefit from associates as cues. Likewise, in a recognition task they show more false recognitions to associates than to synonyms [4]. We know from the current study that Korsakoff patients do remember more from lists that can be clustered, but not because they use the strategy of recalling something from all three categories, as the alcoholic controls do.

This paradox can be understood in the following way. Words drawn from the same semantic category share two properties. First, they occupy a position in a semantic hierarchy. Second, they have higher inter-item associations than randomly selected words. The results reviewed here suggest that alcoholic controls take advantage of both these properties, while Korsakoff patients take advantage of only one. Thus Korsakoff patients learn more from a clusterable list because of the high inter item associations, but do not form the logical hierarchical category names needed to cue themselves to remember all three categories. Similarly, in prompted recall they benefit from associative cues provided by an experimenter, but not from category name cues, and in recognition they produce more associate false recognitions than synonym false recognitions. Thus, support is given to the claim that associative structure can be separated from other forms of semantic processing and that in Korsakoff patients the other forms of semantic processing, not the associative structure, suffer the severest deficits.

These findings can be organized in a slightly different manner by considering strategies as being responsible for the flexibility shown in normal human behavior [14]. The findings reviewed here support the hypothesis that much of the Korsakoff patient's semantic deficit is due to a failure to spontaneously organize and rehearse items together [4]. Thus, for example, when Korsakoff patients were

- (1) explicitly told that a list would consist of words from three categories,
- (2) given the names of the three categories before being read the list, and
- (3) later prompted by the three category names, their delayed prompted recall improved significantly over their free recall [4].

Similarly, while controls rehearse several related items together, Korsakoff patients spontaneously rehearse only one item at a time—the last item presented [5]. In the present study it was noted that while Korsakoff patients did remember more from clusterable than from random lists they did not do so by using a strategy of recalling items from each of the three categories. It has also been noted that for connected discourse, where the process of encoding, itself, imposed organization on the words, the Korsakoff patients tended to recall the same items as their controls [15]. Thus, Korsakoff patients may be considered to have the basic language processing and associative abilities, but lack the ability to formulate and use organizing strategies in order of facilitate recall.

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Résumé :

12 malades Korsakoviens alcooliques et 12 contrôles alcooliques devaient procéder au rappel de 2 listes de mots pouvant être regroupées et de 2 listes de mots sans possibilité de regroupement. Un rappel des Korsakoviens comportait plus de mots des listes regroupables que des listes sans regroupement. L'analyse détaillée des résultats des Korsakoviens indique que malgré l'atteinte de quelques aspects de l'organisation sémantique, la capacité à utiliser la structure associative reste intacte.

Zusammenfassung

Zwölf Patienten mit alkoholischer Korsakoffkrankheit und 12 alkoholische Kontrollpersonen erinnerten zwei gruppierbare und zwei nicht gruppierbare Listen. Korsakoffpatienten erinnerten mehr aus den gruppierbaren als den nicht gruppierbaren Listen. Genauere Analyse der Ergebnisse der Korsakoffpatienten zeigt, daß zwar einige Arten der semantischen Organisation beeinträchtigt sind, die Fähigkeit, assoziative Strukturen zu gebrauchen, aber intakt bleibt.