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Relative Importance of Informational Units and Their Role in Long-Term Recall by Closed-Head-Injured Patients and Control Groups

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The purpose of this study was to apply qualitative analysis to the information recalled by control Ss and closed-head-injured (CHI) patients. The Logical Memory subtest of the Wechsler Memory Scale (Wechsler, 1945) was administered to 40 CHI and 40 control Ss. Recall was tested immediately after administration, 40 min later, and 24 hr later. The analysis took into account the importance of recalled information as determined by a prior rating according to 3 levels of importance. Results suggest that CHI patients have difficulty selectively retrieving the most important information after a long delay.

Memory deficits are among the most frequent sequelae of closed head injury (CHI) because of vulnerability of the temporal lobes. Memory dysfunction has a significant impact on rehabilitation, namely, social integration, vocation, and education. This emphasizes the importance of adequate memory assessment. The Logical Memory (LM) subtest of the Wechsler Memory Scale (WMS; Wechsler, 1945), is widely used as a measure of verbal-auditory memory. Despite its wide use, many clinicians and researchers have expressed dissatisfaction with the scoring criteria of the LM (Prigatano, 1978). Moreover, one serious defect in memory tests in general, and in the LM in particular, is that they focus on quantity (i.e., the number of units of recalled information) and fail to consider the quality (content) of the information. It is quite surprising that little, if any, reported research has explored this issue, which seems to us to be very fundamental to memory assessment. This seems particularly important in light of Butters and Cermack's (1974) notion of "depth of processing," which pointed out that amnesiacs tend to process information shallowly, yielding a lack of differentiation among more and less important aspects of the information presented. Models of text comprehension by normal subjects assume that a schema relative to hierarchical representation of the gist of the text is used, with those propositions that are more important earning precedence in long-term storage (Bourne, Dominowski, Loftus, & Healy, 1986). Thus, the purpose of this study was to compare the performance of CHI patients with that of control subjects, using the LM and a scoring system that weighs story ideas according to their importance. It was hypothesized that the control group would selectively store over time the most important information, whereas the CHI group would show a lesser degree of selective storage. This difference between the two groups would be magnified in the delayed recalls.

Method

Phase 1

A Hebrew version of LM stories A and B (Form 1) of the WMS was given to 50 undergraduate students from the Department of Psychology of Bar-Ilan University. Each story, typed as a single paragraph, was presented on a separate sheet of paper, and the subjects were asked to read the story. The subjects were then given another page with the ideas (as determined in the WMS manual) of the story listed vertically, one by one. The subjects were asked to rank the importance of each idea in the story using a 3-point score (1 point for the *least important*, 2 points for the *important*, and 3 points for the *most important*). Each subject's ranking for each idea was summed, and the ideas were ranked according to the number of points reached. The list of ideas was divided into three thirds: the eight ideas of each story that attained the highest sum of scores were considered the *most important*, the eight second-highest ranked ideas were considered *important*, and the eight lowest ranked ideas were considered the *least important*.

Phase 2

In the next phase, 80 subjects participated. Forty CHI patients were chosen from among patients referred to the National Institute for Rehabilitation of the Brain Injured, Tel Aviv, Israel. They were on average 4 years older than they were at the time of damage, and none of them were diagnosed as aphasic. Their ages ranged from 18 to 48 years (M = 30). The patients had received 8 to 15 years of formal education (M = 11). The control group consisted of 40 subjects, ranging in age from 19 to 35 years (M = 25). They had between 12 and 19 years of formal education (M = 14). The same A and B stories of the LM used in Phase 1 were administered in standard fashion, as prescribed by the manual. In addition, recall of the LM stories was requested twice more to test for delayed recall, once after 40 min and then again after 24 hr. The

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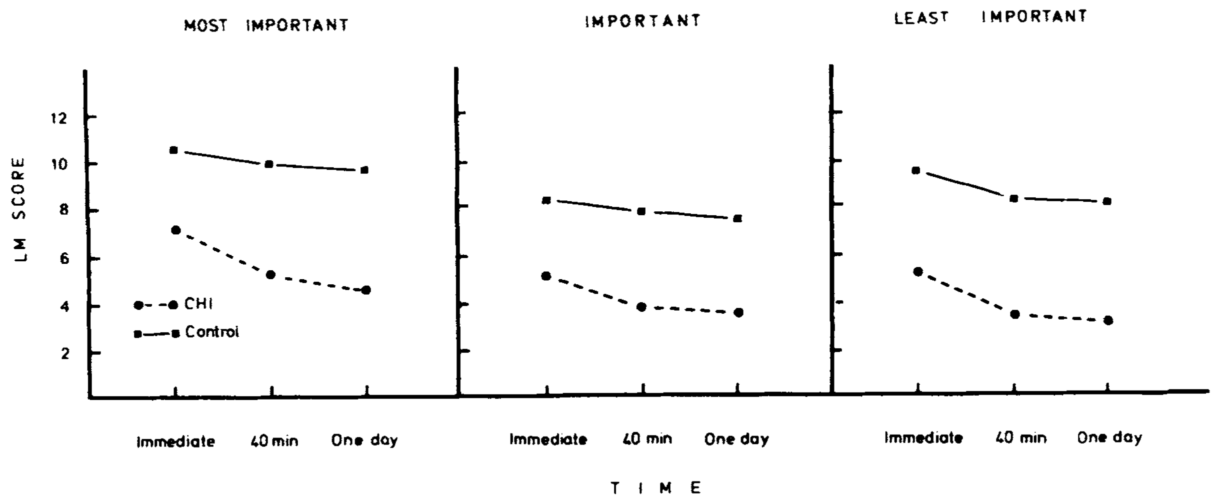

Figure 1. Logical Memory (LM) scores for immediate and delayed recall (after 40 min and after 1 day) for each level of importance of information, for closed-head-injured (CHI) patients and control subjects.

stories were scored as suggested by Power, Logue, McCarty, Rosenstiel, & Ziesat (1979), allowing half a point for partial information. The total score for each story was then broken down into three scores, which expressed the number of ideas recalled at each level of importance, as determined previously. The scores of the two stories were averaged. The LM was administered three times, and each test yielded three scores (one for each importance level), so that nine scores were derived for each subject.

Results and Discussion

Multivariate analyses of variance (MANOVAs) were used to analyze the effects of Group (CHI vs. control) × Delay (immediate, 40 min, and 24 hr) × Importance of Information (most important, important, and least important). The first factor involved a between-subjects comparison, and the last two factors involved a within-subjects comparison. Figure 1 presents the performance of each group, broken down according to importance levels, at the different recall delays.

The three main effects were significant. The control group performed better than the CHI group, $F(1, 78) = 100.01$, $p < .001$. Immediate recall was better than delayed recall, $F(2, 156) = 73.80$, $p < .001$, and, overall, the more important ideas were better recalled than the less important ones, $F(2, 156) = 38.63$, $p < .001$. All the interactions among these factors were also significant. The most important finding was the triple interaction of Group × Delay × Importance of Information, $F(4, 312) = 3.23$, $p = .013$. When the differences in age and education between the groups were added to the analysis as covariates, the pattern of the results did not change significantly. As can be seen in Figure 1, the rate of forgetting less important ideas over time is steeper than the rate of forgetting more important ones. This is true for both groups but more pronounced in the control group. To explain the triple interaction, three 2 (group) × 3 (delay) MANOVAs were conducted separately for each importance level. The results showed an increasing Group × Delay effect for the most important level compared with the least important level: least important, $F(2, 156) = 3.27$, $p = .041$; important, $F(2, 156) = 3.44$, $p = .052$; most important, $F(2, 156) = 16.31$, $p = .000$). This confirmed our earlier interpretation and suggested that the CHI patients did not show a selectivity in retaining the information over time. The fact that on one hand the CHI patients recalled the "most important information" better overall and on the other hand did not selectively retain it over time indicates that two separate processes may be involved. The first is an ability to immediately identify and recall the most important information, and the second is an ability to retrieve this information at a later time. It seems from our results that the second process is the one more vulnerable to CHI. Further research is required to determine the parameters of importance of information and the implications for the understanding of memory processes. Because of their potential diagnostic value, the findings presented and the issues discussed merit further investigation in other groups and with other materials.

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