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A Comparison of Recall and Recognition Memory in Adults with Learning Disabilities and Acquired Brain Injured

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Abstract

Objectives: This research investigated the relationship between recognition and recall of auditory information in people who were either learning disabled (LD) or who had suffered Acquired brain injury (ABI).

Methods: Data collected from 77 adults were separated into an ABI group and an LD group. These data were then analyzed using a multivariate analysis of variance (MANOVA) in order to determine differences in recognition and recall between the LD and ABI groups.

Results: Results did not indicate any differences between these two groups on measures of recognition and recall. The analysis did, however, identified three common patterns of memory functioning resulting from LD or ABI: 1) Over half (56%) of the sample had difficulty recalling and recognizing the test materials; 2) 33% could recall and recognize the materials; and 3) 11% could recognize but not recall the materials. No participant demonstrated recall in the absence of recognition.

Conclusions: These data indicate that recall and recognition deficits are not markedly different in individuals with ABI or LD. The results suggest that recognition precedes recall in participants with ABI or LD. The results also suggest several possible therapies for improving memory in persons with LD and ABI.

Keywords: Recognition; Recall; Auditory learning; Learning disability; Traumatic brain injury; Memory deficit.

Introduction

Both brain injury and developmental delays affect memory [1 - 6]. Brain injuries are unique; because no two brain injuries are the same, different types of cognitive impairments result from a wide variety of axonal damage [6], including deficits in memory, learning, attention, and difficulties in executive functions [5, 7]. However, it is unclear which cognitive abilities or aspects of memory are affected by an acquired brain injury, and whether or not these deficits are similar to learning disabilities. Generally, both LD and ABI result in working memory deficits [1, 8].

Both brain injury and developmental delays affect memory [1 - 6]. Brain injuries are unique; because no two brain injuries are the same; different types of cognitive impairments result from a wide variety of axonal damage [6], including deficits in memory, learning, attention, and difficulties in executive functions [5, 7]. Although both LD and ABI result in working memory and attention deficits [1, 8], it is unclear if persons with LD or ABI differ in terms these cognitive skills. Both ABI and LD individuals demonstrate similar deficits in two aspects of memory: 1) recognition - a situation in which an individual identifies stimuli as having been experienced before; and 2) recall - a situation in which an individual reproduces the information previously presented [6, 8-11]. The present study assessed memory deficits in recall and recognition memory in these two diagnostic groups.

Early research concerning differences between recall and recognition suggested that these types of memory are unrelated or separate processes. Kintsch [12] showed that organization improved recall, but had relatively little effect on recognition. Other studies supported this conclusion [13–16, 20-21]. In contrast, studies by Tulving and Osler [17] and Tulving and Thompson [18] found that recall without recognition is possible. Its occurrence depends on *encoding specificity*; that is, the way new information is presented and stored in memory. Still other researchers propose that recognition memory precedes recall. Evidence for this order of processing comes from Baddeley [1] and Robinson and Johnson [19] who demonstrated that individuals first recognize sounds and visual cues, and then subsequently recall context and meaning associated with the stimuli.

A few studies that investigated recall and recognition in ABI children have been published. Neuropsychological deficits in children with ABI are similar to those seen in adults with ABI; however, children with ABI may have long-lasting cognitive deficits throughout the course of development [5, 22]. Jaffe et al. [23] and Yeates, Blumenstein, Patterson, and Delis [24] found that children who sustained severe ABI presented deficits primarily in recall; while Roman et al. [11] found that young children with severe ABI showed similar impairments in immediate recall, delayed recall, and recognition.

Based on this limited knowledge base, the following experiment investigated three issues: First, do survivors of ABI and those diagnosed with LD differ in terms of their ability recall and to recognize novel information? Second, are recall and recognition in these two diagnostic groups correlated or independent processes? Third, can recall occur without recognition?

Method

Participants

The present study examined data from 77 adults. Approximately two thirds of the sample was male. Participants had been diagnosed either with a learning disability (Reading Disorder – DSM5: 315.00-F81.0, Arithmetic Disorder – DSM5: 315.10-F81.2 and, or, Expressive Writing Disorder – DSM5: 315.2-F81.81), or an ABI. Several of the cases received multiple LD diagnoses. Forty-one of the participants were diagnosed with Acquired Brain Injury secondary to a concussive injury that had resulted in at least a seven-day coma. Participants who had both an LD and ABI diagnoses were excluded from the data set.

The data were tabulated from de-identified archival files (all personal identifying fields removed). Each person was tested by a licensed psychologist and no identifying information was collected during the data tabulation process nor was any included in the database. The age of the participants ranged between 16 and 35 (M = 30.37). There were 36 participants diagnosed with LD, and 41 participants who had sustained an ABI. Learning disability was defined as having: (1) a documented LD diagnosis, (2) an individualized educational plan (IEP) while in elementary and high school, and (3) reading or mathematics or expressive writing standard scores below the 95% confidence interval computed around the participant's IQ. ABI was defined as: (1) having been hospitalized in a comatose state after a documented brain injury for at least one week, and (2) a score of at least .6 or higher out of a possible 1.0 on the Halstead-Reitan Neuropsychological Assessment Battery [25]. The LD group participants' average Full Scale Intelligence Quotient (FSIQ) score was 83 with a standard deviation of 21 points. The ABI group averaged a FSIQ score of 77 with a standard deviation of 27 points.

Materials

Each participant was administered the Wechsler Memory Scale and the Wechsler Adult Intelligence Scale (WMS-III & WAIS-III; [26]) by a licensed psychologist as part of a psychological evaluation. These tests permitted comparison and correlation of Full-Scale IQ (FSIQ), Logical Memory I (LMI) and II (LMII), Thematic Memory I (TMI) and II (TMII), Visual Reproduction I (VRI) and II (VRII), Verbal Recognition (VrbRec), and Visual Recognition (VisRec).

Design and Analysis

The experimental design was a two group comparison with multiple dependent measures. A multivariate analysis of variance (MANOVA) evaluated differences between recognition and recall scores in the ABI and LD groups. Higher scores indicated better performance on all measures except VrbRec, where a high score indicated a large number of items incorrect. Correlation coefficients were computed among the FSIQ, LMI, LMII, TMI, TMII, VRI, VRII, VrbRec, and VisRec to assess the relationship between the recall and recognition measures.

Results

A MANOVA using all 77 participants did not reveal any significant differences in recognition and recall between the LD and ABI groups (p>.05) on any of the measures.However, there were significant correlations between the visual recall and recognition scores (VRI and VRII; for the LD, r (75) = .574, p < .05 and ABI,r (75) = .523, p < .05, groups respectively. There were also significant correlations among the FSIQ, LMI, LMII, TMI, TMII, and the VrbRec scores, ranging between r (75) = -.352 to -.582, p < .05. The correlations between VrbRec and the LMI, LMII, TMI, TMII, VRI, and VRII variables are negative because VrbRec is a measure of error. These results are presented in Table 1. These results indicate that recall and recognition were correlated processes with this group of ABI and LD participants.

Table 1: Correlation Matrix of Various Recognition and Recall Measures for Learning Disabled Participants and Traumatic Brain Injured Participants[a]

	Group	FSIQ	LMI	LMII	TMI	TMII	VRI	VRII	VrbRec	VisRec
Group	1.00	.070	.140	-.025	.185	.087	-.096	-.151	.038	.031
FSIQ		1.00	.687**	.541**	.589**	.441**	.488**	.487**	-.352**	.474**
LMI			1.00	.789**	.842**	.733**	.416**	.354**	-.528**	.317**
LMII				1.00	.567**	.842**	.340**	.321**	-.462**	.373**
TMI					1.00	.588**	.408**	.305**	-.359**	.235*
TMII						1.00	.301**	.247*	-.365**	.226*
VRI							1.00	.663**	-.161	.574**
VRII								1.00	-.172	.523**
VrbRec									1.00	-.168
VisRec										1.00

Note. Negative correlations in the VrbRec category reflect the fact that this subtest assessed the number of items incorrect.

[a] *n* = 77

* *p*< .05. ** *p*< .01

The question of whether recognition precedes recall in LD and ABI individuals, involved a cross- tabulation analysis that assessed the frequency of participants who demonstrated above or below average recall and recognition. Ten percent of the sample had average recognition but below average recall. Fifty-six percent of the sample had below average recall and below average recognition. Thirty-four percent of the sample had average recognition and average recall. Zero percent of the sample had average recall but below average recognition. This analysis suggests that in this sample, recognition did occur without recall; however, recall did not occur without recognition. This same pattern of performance occurred with both the verbal and visual tasks.

Discussion:

There are two major findings in these data. First, the data suggest that recall and recognition do not differ markedly in persons who are learning disabled or brain injured. These analyses did not reveal any differences between the LD and ABI populations for any of the recall and recognition measures. Second, the data indicate that recall and recognition are correlated within these two groups; however, the correlation is asymmetrical. Recognition did occur without recall but the reverse did not occur.

The results revealed a correlation between recognition and recall for LD and ABI populations. However, the cross-tabulation data from this study showed that participants could be grouped into four categories: (1) those who could recall and recognize; (2) those who could neither recognize nor recall; (3) those who could recognize but not recall; and (4) a null category in which no participants exhibited recall without recognition.

The cross tabulation results suggest that regardless of whether the memory dysfunction is acquired or developmental, most people either lose or retain both types memory. Relatively few retain the ability to recognize in the absence of recall. This categorical breakdown can be explained by the assumption that recognition precedes recall; that is, a person can recognize but not have a developed set of retrieval cues sufficient to recall the event. Recognition would therefore require less memory strength to elicit a match; whereas recall would require more memory strength to elicit retrieval.

What is the practical significance of these findings? These results may be used diagnostically, to classify the severity of memory impairment. Those who have retained both recall and recognition memory could be classified as mildly impaired or unimpaired. Those who can recognize but not recall would be moderately impaired whereas those unable to recognize or recall could be classified as severely impaired requiring more intense cognitive rehabilitation. Recall without recognition is extremely unlikely to occur in persons with learning disabilities or traumatic brain injuries.

The results suggest several therapeutic interventions that may be effective for improving recall and recognition. For example, it is reasonable to suggest that interventions designed to improve memory in individuals with learning disabilities may also be effective for treating individuals with brain injury [7, 10, 27, 28]. For those individuals who can both recognize and recall, interventions that teach the person to focus on recognition cues may help to generate a context that facilitates retrieval. Asking questions like who, what, when, where, why, and how, may help to generate the recognition cues that are necessary for later recall. These questions force the survivor to evaluate the new learning situations in several ways: Who was involved? What were the circumstances? When did the event occur? Where did it occur? Why did it occur? and How did it occur? When the survivor tries to recall the event, then he or she would simply try to answer these questions and one or more of them would trigger the memory.

For those survivors who can recognize but not recall, mnemonics and imagery training may provide especially effective memory cues. The act of mentally creating an image or the use of mnemonics acts as a retrieval cue that later reinstates the memory [4]. Goal-directed reading is an effective memory strategy to enhance the network of ideas and facts that trigger later recall [7]. This type of reading creates mental representations of the information in the text and relates it to the person's own experiences. Teaching techniques that emphasize structured note taking may also be helpful to anyone in this population who is in an educational setting [9].

Individuals, who have trouble both recognizing and recalling novel information, may require training to use prosthetic devices. . In general, the goal is to obviate the problem rather than to teach strategies that overcome it. Prosthetic aids like digital recorders and calculators are often effective for improving memory and speeding up mathematical calculations. Movement sensors in the home that automatically turn off the lights when there is a lack of movement can greatly reduce electrical bills. Likewise, appliances that automatically shut off when not in use serve the same function. Setting up an automatic bill payment plan with a bank can insure that the person has no late payments. Creating an unchanging work and home environment where the physical layout of the living or workspace does not change much from day to day can improve memory because the individual's environment acts as a memory cue for location of commonly used items. Translating information into motor movements may also improve memory. For example, remembering phone numbers by tapping them out on a cell phone keyboard can establish an effective motor cue for recall [29].

In summary, the current study investigated the relationship between recognition and recall for individuals with LD and ABI. Prior to this study, no published studies documented the degree of correlation between recognition and recall in adult ABI and LD populations. It was also unclear whether recall occurred independently of recognition in persons with brain injuries or developmental delays. Our results suggest that recognition precedes recall in participants with ABI or LD. We also propose several possible therapies for LD and ABI. Recognition memory aids and structured note taking may prove useful for higher functioning individuals. For persons with severe impairments prosthetic devices, may be the most effective therapeutic interventions.

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