BVRT - Scoring System and Time Delay in the Differentiation of Lateralized Hemispheric Damage

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The Benton Visual Retention Test (BVRT) was administered to 29 subjects, 8 patients with damage to the right cerebral hemisphere (RH), 11 patients to the left hemisphere (LH) and 10 subjects as a control group. Correct and error scores on the immediate and delayed reproduction conditions were analyzed. An overall control group over patient groups advantage emerged in all conditions. In contrast, time delay had a differential effect on the patient groups when measured only by correct scores and not by error scores, despite a significant correlation between the two. The performance of the RH group declined with time, while the LH group's performance improved. These results indicate: 1) The importance of analyzing both correct and error scores. 2) Retention of familiar figures, for a short delay period (15 seconds) is mediated by visual images rather than by verbal codes.

It is well known that verbal memory is affected by a damage to the left cerebral hemisphere (Milner, 1968) while memory of meaningless patterns is affected by a damage to the right cerebral hemisphere (Kimura, 1963). However, the role of localized cerebral functioning in memory processes involving stimuli that can be encoded both verbally and perceptually, such as familiar figures, is less clear. One test of visual memory that largely employs familiar-figures stimuli is the Benton Visual Retention Test (BVRT) (Benton, 1974). Wahler (1956) demonstrated that this test can discriminate between a control group and a group of brain injured patients. Patients with lateralized hemispheric damage were found to be discriminable by the type of errors they made (Pettifor, 1967) but not by their overall performance on administration - A (immediate recall) (Heilbrun, 1956). On the basis of clinical experience, administration - D (Delayed memory) was expected to be more sensitive than administration A to memory deficits. Despite the low correlation between administrations A and D (Benton, 1974), Breidt (1970) found that the decline in the performance level between the two administrations was minimal for both controls and brain injured patients.

Benton (1974) suggested that a possible source of this individual variability is the poor performance of patients with left hemisphere damage on administration - D, since short term memory is believed to be mediated to a large degree by strategies of verbal coding and rehearsal. However, Bencomo and Daniel (1975) found that visual stimuli can be retained as long as 30 seconds as a visual code. Cremonini, DeRenzi and Faglioni (1980) also concluded that long lasting acquisition of a pictorial sequence is mainly mediated through visual images and not through verbal coding. On this ground, contrary to Benton (1974), it might be expected that patients with damage to the right hemisphere would exhibit poorer performance under delayed condition than patients with damage to the left hemisphere.

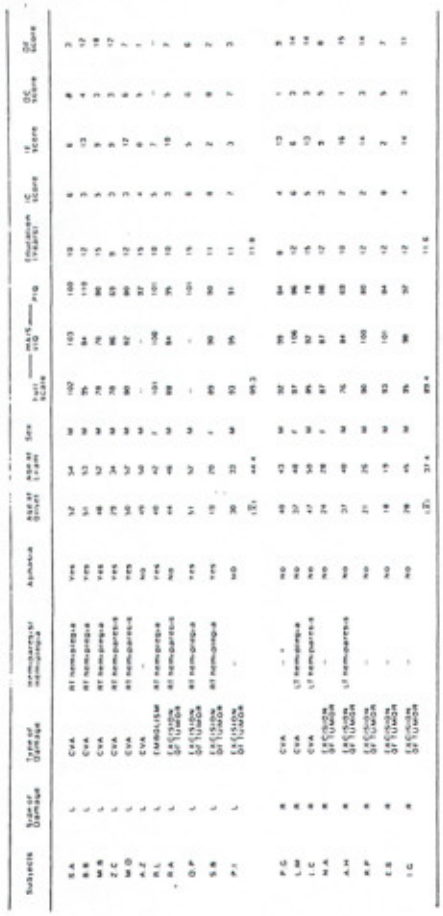
METHOD

Subjects

Twenty-nine adult male and female subjects, ten normal and nineteen with confirmed brain damage either to the left (11) or to the right hemisphere (8), participated in this research. Characteristics of left and right hemispheral lesioned subjects are provided in Table 1. All the brain damaged patients were injured at least one year before their neuropsychological assessment at the National Institute for Rehabilitation of the Brain Injured, Israel. As can be seen in Table 1, the two brain damage groups did not differ significantly on their IQ scores (full WAIS scores). Groups were matched for age and education. Administration C (copy) was used to screen out patients with perceptual problems. No subjects were disqualified by this procedure.

Design and Procedure

Each subject was tested individually on three of the BVRT administrations. Administration A - each design is exposed for 10 seconds followed by immediate reproduction from memory by the subject. Administration C - each design is copied by the subject, with the design remaining in the subject's view. Administration D - each design is exposed for 10 seconds, followed by reproduction from memory by the subject after a delay of 15 seconds. The order of administration and the matched form, were randomly assigned.



RESULTS

The number of correct scores and number of error scores were employed as measures of performance level on the BVRT and were subjected to separate statistical analyses.

Both scores underwent a two-way analysis of variance in which subject group (right vs. left hemisphere damage) and time (immediate vs. delayed reproduction) were the factors analyzed.

A significant subject group by time interaction ($F(1,17) = 4.49$, $p<.05$) and main effect for subject group ($F(1,17) = 29.10$, $p<.05$) emerged. The interaction indicates that right hemisphere damaged patients' correct scores decreased from 4.25 in the immediate condition to 3.0 in the delayed condition, while the left hemisphere damaged patients scores increased from 4.81 correct scores in the immediate condition to 5.50 in the delayed condition. The normal subjects maintain the same level in both conditions 8.1 - 8.2 respectively (see Figure 1).

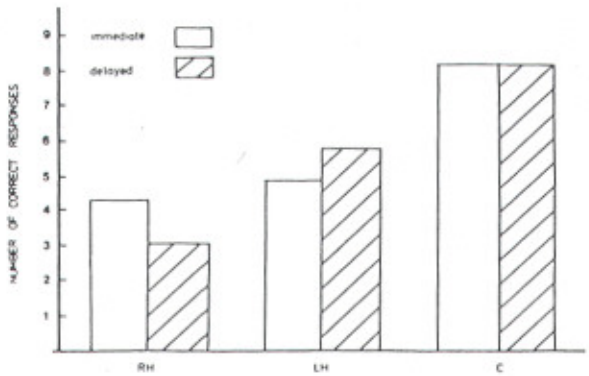


Figure 1 - BVRT correct scores for immediate and delayed conditions of left, right and control groups.
RH - right hemisphere damaged group
LH - left hemisphere damaged group
C - control group

Duncan test indicated that the normal group had significantly higher correct scores (8.18), than each one of the brain damaged groups, and that the group with left hemisphere damage had significantly higher correct scores (5.14) than group with right hemisphere damage 3.62). The results of the two way analysis of variance for error scores do not reveal any significant effect except for subject group main effect (F;(1,17) = 4.80, $p<.05$) which indicated that the control group had over all significantly lower number of errors (2.27) than the left brain damaged group (7.38) or the right brain damaged group (11.19). There was no significant difference between the two brain damaged groups (see Figure 2).

As can be seen on Table 2 significant correlations were found between the correct and error scores in the immediate and delayed conditions in the brain damaged groups.

DISCUSSION

These research findings justify the use of two scoring systems (correct and error scores),

despite the fact that they were found in this research to be highly intercorrelated, as was also reported by Benton (1974).

TABLE 2

INTERCORRELATIONS BETWEEN THE DIFFERENT BVRT SCORES, FOR THE BRAIN INJURED GROUPS (N=18)

	IC	IE	DC	DE
IC	1.000	-.859 *	.538 *	-.492
IE	-.859 *	1.000	-.719 *	.645 *
DC	.538 *	-.719 *	1.000	-.855 *
DE	.492	.645 *	-.855 *	1.000

* P < 0.1

IC = Immediate correct, IE = Immediate error

DC = Delay correct, DE = Delay error

When immediate memory was tested, correct and error scores differentiated between the control group and the patient groups, but the two patient groups did not differ on either of the scores.

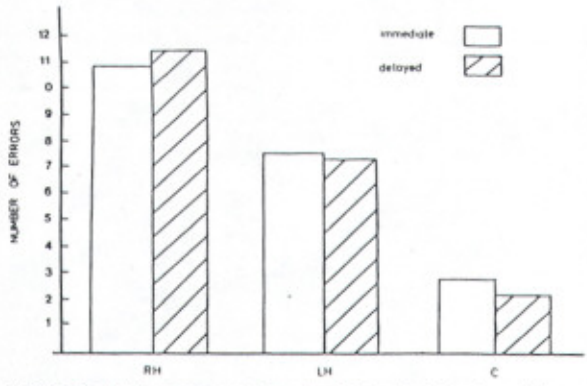


Figure 2 - BVRT error scores for immediate and delayed conditions of left, right and control groups.
RH - right hemisphere damaged group
LH - left hemisphere damaged group
C - control group

When delayed memory was tested, correct and error scores differentiated between the control group and the patient groups, but only the correct scores revealed a significant disadvantage of the RH patient group over the LH group. These results are with disagreement with Wahlers' findings, that these two scoring systems do not differ significantly in their ability to discriminate between a control group and a group of brain injured patients (Wahler, 1956). It is important to note that a time lapse between exposure and reproduction had a differential effect on the two patient groups, while the RH group performance declined the LH group improved slightly (See Figure 2).

These results are in agreement with DeRenzi, Faglioni & Previdi (1977) who compared different patient groups on a visual memory task and found that they did not differ on the immediate condition, however on the delay condition (15 seconds) right hemisphere lesioned patients were significantly more impaired than the left hemisphere lesioned group. This further emphasizes the importance of using delay memory tests to differentiate between right and left hemispheric lesion.

The results are also consistent with the findings of Cremonini et al. (1980), and of Bencomo & Daniel (1975) although contrary to Benton's (1974) prediction. One can infer from this research that memory of familiar figures for short-delay periods (15 seconds), is probably mediated by visual images rather than by verbal codes. A more detailed analysis is needed to determine whether one can clinically identify different memory systems by varying the duration of the delay period.

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AUTHOR NOTES

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