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ABSTRACT

After it had been determined that reaction time (RT) was a sensitive measure of hemispheric dominance in a verbal task performed by normal adult readers, the reaction times of three groups of subjects (20 normal reading college students, 12 normal reading third graders and 11 poor reading grade school students) were compared. Ss were exposed to tachistoscopically presented slides with stimulus words across both visual fields and probe words presented to either the right or left visual fields. Both groups of normal readers exhibited superior right visual field RT while the poor readers failed to display such a superiority. Findings suggested that verbal RT may be a useful screening technique to identify potential problem readers. (Author/CL)

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VERBAL PROCESSING REACTION TIMES IN "NORMAL" AND "POOR" READERS

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Three groups of subjects, twenty "normal" reading college students, twelve "normal" reading third graders, and eleven "poor" reading grade-school students were exposed to a series of tachistoscopically presented slides with stimulus words presented across both visual fields and probe words presented to either the right or left visual fields. Both groups of "normal" readers exhibited superior right visual field reaction times while the "poor" readers failed to display such a superiority.

The issue of hemispheric specialization may be related to the development of important verbal skills involved in the reading process. The dominance of the left cerebral hemisphere in verbal tasks has been demonstrated by the superiority of recognition accuracy for verbal stimuli presented tachistoscopically to the right visual field (Mishkins & Forgays, 1951). This finding was originally interpreted as evidence for the importance of the left to right visual scanning pattern used in reading English. This interpretation was shown to be incorrect when Barton, Goodglass and Shai (1965) found the same left cerebral dominance using Hebrew words which are read from right to left. From such studies a model of cerebral dominance has emerged in which the left hemisphere of the brain has been associated with "verbal" processes and the right hemisphere with "spatial" processes.

One important implication of the hemispheric specialization model is that verbal processing disorders (e.g., reading disabilities) may be related to a lack of left hemispheric dominance. Two possible approaches for investigating this implication are either a comparison of the accuracy or a comparison of the speed of the hemispheres in processing verbal information presented to "normal" and "poor" readers. Accuracy measures have been employed by Katz and his associates to investigate laterality effects in "normal" and "poor" readers (e.g., Marcel, Katz & Smith, 1974). The present experiments were undertaken to investigate laterality effects using a speed index, reaction time (RT).

Experiment I was carried out to determine whether RT is a sensitive measure of hemispheric dominance in a verbal task performed by "normal" adult readers. Experiment II utilized RT to investigate hemispheric specialization in "normal" and "poor" third grade readers.

EXPERIMENT I

METHOD

SUBJECTS. Twenty right-handed undergraduate students, ten male and ten female from Edinboro State College served as volunteer Ss. Median age of the Ss was 19 years.

APPARATUS. The stimuli were made up of 256 most frequently found four letter nouns in the Thorndike-Lorge word count. All nouns were carbon typed on acetate in capital letters and mounted for slide presentation. Combinations of the stimulus word and the probe were randomly chosen as well as presentation order. Combinations that happened to have obvious associations were excluded. Words were never used more than once, except in the case where a positive stimulus match with the probe was presented. Stimulus words which filled the screen subtended a visual angle of 15 degrees. Probe word length subtended a visual angle of 3.3 degrees and was always presented so that the nearest letter was 1.0 degree to the left or the right of 0.2 degree fixation point. All slides were presented on a 3" x 5" rear projection screen using a Gerbrands tachistoscopic shutter and a Kodak Carousel projector. Lehigh Valley solid state modules were programmed to control the temporal intervals and an Automated Data Systems counter/time measured the reaction time (RT) in milliseconds.

PROCEDURE. The Ss were instructed to sit 18 in. away from and directly in front of the screen. The room was dark except for the screen light. First a stimulus word was presented which extended across the width of the screen which enabled viewing in both right and left visual fields for three seconds. Next, the fixation point, a dot of light on a black background, appeared for one second. The third slide then displayed the probe word to either the left

or right visual field for 40 milliseconds. The Ss were to respond to the probe word as to whether it was the same as or different from the stimulus word by pressing either a "yes" button with their index finger or a "no" button with their middle finger of their right hand. RT was measured and recorded.

The temporal interval between each slide in a trial was 0.7 seconds and the intertrial interval was 2.0 seconds in duration. The 112 presentations including 12 practice trials, were broken into 6 segments. All Ss received the same fixed random order.

RESULTS

Probe responses were analyzed for errors and all incorrect responses were disregarded. No one S exceeded a 10% error rate. In 19 of 20 cases, a S's right visual field reaction time was more rapid than the S's left visual field reaction time.

A two-way ANOVA was carried out on the reaction time data. The F-ratio for the visual fields treatment was significant at .01 level, indicating that there was a reliable difference between probes presented to the right or left visual field, with a longer RT found for the left field ($F = 8.66$, $df = 1/19$, $p > .01$). The F - ratio calculated for probe type was not significant ($F = 1.11$, $df = 1/19$, $p > .05$). The F - ratio done for the interaction between visual fields and probe type was not significant also ($F = 2.29$, $df = 1/19$, $p > .05$).

EXPERIMENT II

METHOD

SUBJECTS. Two groups of Ss were utilized in this experiment. "Normal" readers (NR), composed of 12, third grade students, (6 male and 6 female) from the Edinboro State College Campus School were chosen (based on teacher recommendation and their reading scores from the Metropolitan Achievement Test, Primary II Level, Form G). All were reading at the third grade level according to both sources and were therefore classified as normal readers. "Poor" readers (PR) composed of 11 students (7male and 4 female) obtained from the Reading Clinic at Edinboro State College, where they had been referred because of chronic reading problems.

APPARATUS. Same as Experiment I.

PROCEDURE. Same as Experiment I except that only 60 presentations were made, including 12 practice trials, and were broken into 3 segments. These modifications were effected so as not to exceed the younger S's attention span.

RESULTS

Probe responses were analyzed for errors and all incorrect responses were disregarded. No S used in the experiment exceeded a 10% error rate.

An examination of the NR S's right and left visual field reaction times revealed that in every case, a S's right visual field reaction time is faster than his left visual field reaction time. Examination of the comparable PR's data revealed an obscuring of the previously clear right visual field superiority, with left visual field superiority or no clear visual field superiority being shown in 6 of 11 cases.

A three-way ANOVA carried out on the effects of the three main variable, (reading ability, visual field and probe type) and their interactions, revealed a significant visual field main effect and significant interactions of reading ability x visual field and reading ability x probe type. The remaining main effect, and interactions, proved to be non-significant.

DISCUSSION

The results of Experiment I clearly indicate that RT is a sensitive measure of hemispheric efficiency in that the left hemisphere was shown to be superior in verbal processing. Experiment II demonstrates that Ss experiencing reading difficulties fail to uniformly demonstrate left hemispheric superiority. These findings suggest that verbal RT may well be a useful screening technique that could identify potential problem readers. The presently undertaken, more detailed examination of the relationship between specific characteristics of poor readers (e.g., I.Q., subtest scores, sex, etc.) and relative amounts hemispheric dominance may further refine the usefulness of RT as a screening device.

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