Dyslectic and normally-reading children : 1. Exploration of a letter-search test for screening purposes : 2. Follow- up and further exploration in 4 weak and 4 normal readers on letter, word and number recognition

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DYSLECTIC AND NORMALLY-READING CHILDREN
I. EXPLORATION OF A LETTER-SEARCH TEST FOR SCREENING PURPOSES
II. FOLLOW-UP AND FURTHER EXPLORATION IN 4 WEAK AND 4 NORMAL READERS ON LETTER, WORD AND NUMBER RECOGNITION

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INTRODUCTION

The results obtained last year from the examination of 20 dyslectic and 20 normally reading children (Bouma, Legein & Van Rens, 1974; Bouma & Legein, 1976) encouraged us to continue this study into two directions.

Firstly a follow-up study of all 40 subjects to get an idea of the course of these perceptual processes. Secondly a further exploration of possible defective processes in visual recognition. This paper will report both on the follow-up study and on the further exploration in four dyslectic and four normally reading children selected from the above mentioned groups.

Partly summarizing last year's results we found:

1. A backwardness in reading-level for all dyslectic children by at least two years;
2. in the tachistoscopic experiments a significantly lower recognition-score for the dyslectic group with reference to embedded letters and for words especially in parafoveal presentation.

LETTER-SEARCH TEST

For the purpose of bridging the gap between tachistoscopic recognition and ordinary reading we developed a search experiment in which letters e (target letters) within words or letterstrings of 8 letters had to be marked.

As to the number of errors, the dyslectic group missed twice as much target-letters as the control-group and both groups missed more target-letters in the words than in the letter strings (Table 1).

When scoring the errors it was striking to see in the dyslectic group how

Table 1. Percent error-scores in letter search test. Large scores: total errors; small scores: after correction for skipped lines.

	dysl.		contr.	
words	36	*23*	14	*13*
strings	26	*15*	12	*9*

many lines occurred in which not a single target letter was marked. This could be an indication that they just skipped full lines probably due to an insufficient control of the eye-movement towards the new line. We made a correction for these, probably not inspected, lines, also indicated in Table 1.

The general tendency is that more target-letters are missed in the second part of the words and letterstrings; and that the first, fourth and fifth letter-position are at an advantage. Many errors are made at the last few letter-positions in the letterstrings by both groups, and also in words by the dyslectic group.

Since both groups made more errors in the word-test than in the string-test this is indicative of them using knowledge of wordforms to a certain extent. The specificity of this knowledge has not yet been investigated. In conclusion this test puts attention to a probably insufficient eyecontrol on the part of dyslectic children which, together with strong parafoveal interference effects influences their scores. A new version of the test might separate these effects.

FOLLOW-UP

In the tachistoscopic part of the examination there was hardly any change in the high foveal recognition scores of both groups (Table 2). In parafoveal scores, however, there was a definite improvement in particular for words in the dyslectic group.

Table 2. 1975 Average correct recognition-scores (%) of single letters /a/; embedded letters /xax/; words /wrd/. Between brackets are the 1974 scores of the same children.

	foveal		parafoveal	
	dysl.	contr.	dysl.	contr.
/a/	96 (96)	94 (99)	91 (81)	98 (98)
/xax/	72 (68)	94 (95)	28 (19)	53 (54)
/wrd/	78 (73)	100 (100)	54 (38)	71 (69)

As to the reading-level of the eight subjects (Fig. 1) we conclude that the dyslectic children especially made progress and for them a fair correlation between improved reading level and better parafoveal recognition of words is shown (Fig. 2).

FURTHER EXPLORATION

Further exploration was done on foveal recognition of common words (frequency of usage in printed Dutch about 1 : 10,000) of larger lengths (l = 6, 7 and 8). Six words of each length were presented (exposure-time 100 msec). In the dyslectic group the scores for these long words are definitely lower than for the shorter words, whereas for the normal groups the scores remained perfect. The scores for word lengths l = 3–5 of these subjects have also been included (Table 3).

Table 3. Correct foveal word recognition scores for various wordlengths.

	dysl.	contr.
$\ell = 3$	77	100
$\ell = 4$	77	100
$\ell = 5$	80	100
$\ell = 6$	42	100
$\ell = 7$	38	100
$\ell = 8$	33	96

Forty, randomly composed, digit strings (length l = 1, 2, 3, 4) were foveally presented (100 msec exposure time). Table 4 gives the results for both groups and it is obvious that, as from l = 3, dyslectics have far more difficulties than children which read normally. We tested numers of two digits parafoveally (eccentricity = 1°) and found that both groups had rather high scores: dyslectics 82% and controls 94%. A foveal recognition experiment of numbers was also done using both a normal (100 msec) and a prolonged presentation time (500 msec). Table 4 shows an increase of correct scores. This probably indicates that the short-term memory capacity is not an essential limiting factor in these experiments.

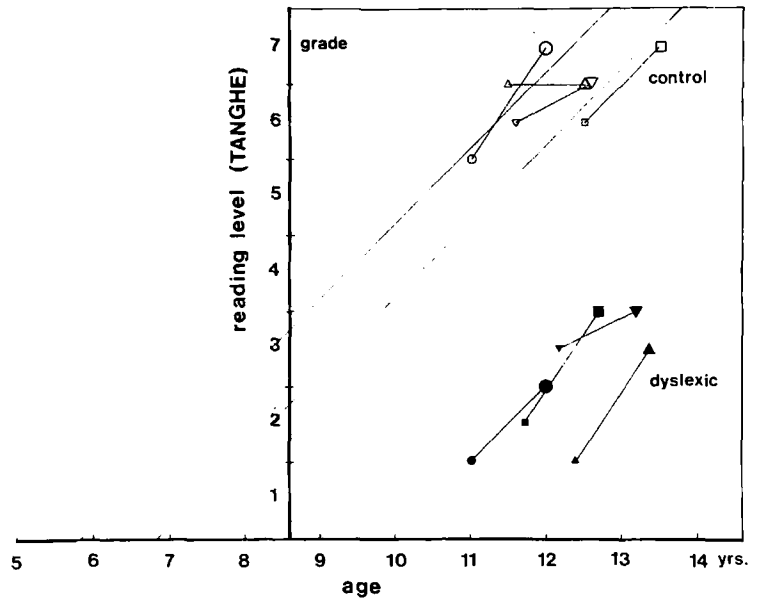

Fig. 1. Follow-up of reading level 1974 (small symbols)–1975 (large symbols).

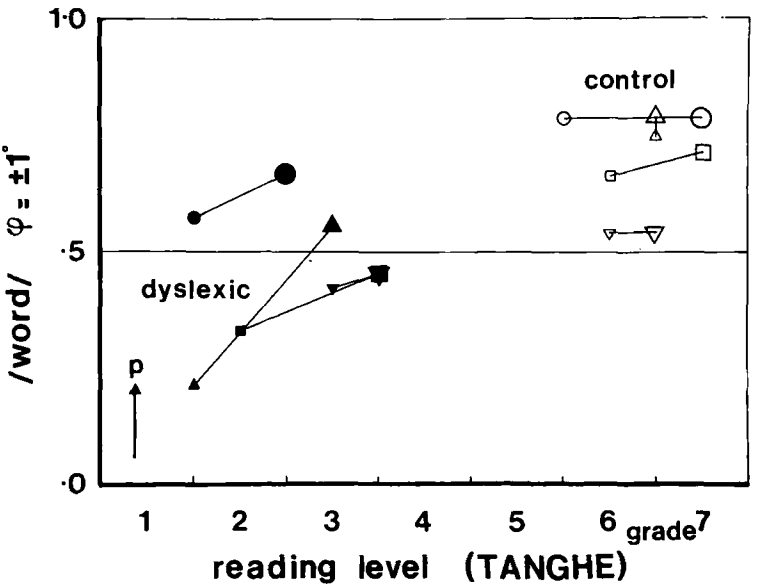

Fig. 2. Follow-up of parafoveal word-recognition and of reading level 1974 (small symbols)–1975 (large symbols).

Table 4. Correct foveal number scores for various lengths (l) at two stimulus durations.

	dysl.		contr.	
	100 ms	500 ms	100 ms	500 ms
$\ell = 1$	95	–	100	–
$\ell = 2$	95	–	100	–
$\ell = 3$	68	91	95	100
$\ell = 4$	38	70	98	92
$\ell = 5$	–	30	–	65

Nevertheless the short term memory function (rehearsal) seems worse in the dyslectic group as is indicated by testing this function as well by auditory presentation of digit-strings (l = 3,4,5) with a pronounciating speed of 2 numbers per second. Table 5 shows the results and indicates a low score for the dyslectic group in repeating long digit-strings (l = 5). In conclusion the lower scores obtained in visual presentation of numbers then seem due to perceptual factors rather than to short-term memory dysfunction.

Table 5. Auditory presentation of digit-strings. Correct scores for various lengths.

	dysl.	contr.
$\ell = 3$	100	100
$\ell = 4$	80	88
$\ell = 5$	42	80

CONCLUSION

As to the research on dyslexia the conclusion then seems to be that eye control, perception and recognition of letters and words, and storage processes should be studied not just in isolation but also in their mutual dependence on one another. This conclusion links up with the notion that dyslexia stems from many different adverse factors.

But it is not just the causitive factors which are found to be manyfold,

the resulting difficulties are moreover not confined to the reading of text, but are clearly present in the recognition of numbers. Indeed, dyslexia is a syndrome. We have hopes that the understanding of the underlaying phenomena of dyslexia may proceed equally fast as the understanding of normal reading processes, which, in the literature as well as at IPO (Institute for Perception Research), is a subject of renewed interest.

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