

THE INTERACTION OF SPEECH PERCEPTION AND READING ABILITY

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ABSTRACT

The preliminary hypothesis of this paper is that there should exist a close interaction between speech perception performance and reading ability which might result in the predictability of future reading acquisition. A tracking experiment has been carried out to support this assumption. Two classes of first-graders were examined by the GMP test-package. Data concerning their speech perception level were compared to their reading performance. Both the interaction between speech perception and reading, and the predictability of reading acquisition were confirmed.

1. INTRODUCTION

During the past few years an increasing number of children have been judged "dyslexics" because of their reading and writing difficulties, in Hungary as well as in many other countries all over the world. Experts of the problem of reading and dyslexia claim that any component of the language faculty - i.e. any of the several autonomous subsystems: phonology, syntax, or semantics - and the processing system, as well as the working memories might be the source(s) of reading difficulties [5]. As a conclusion, it has been suggested that all deficits clearly tend to co-occur (though not necessarily all), however, *poor performance in terms of speech perception and understanding* can al-

ways be found with poor readers. Phonetic speech perception deficits were found with American dyslexic children who had problems in the identification of places of articulation of stops and the quality of vowels. The authors' conclusion is that the deficiency is, in fact, not auditory, but a perceptual problem suggesting genetic transmission [4]. Cerebral dominance seems also to be a factor contributing to correct linguistic operations. It is likely that mixed handers might have deviations also in their language processing with regard to that of clearly right or left handers. The difference between right or left vs. the mixed handers is that the latter's two hemispheres are equally involved in linguistic behaviour. On the basis of the assumed close interaction between the speech perception/understanding process and reading ability, our hypothesis is that reading performance is predictable.

2. PROCEDURE

At the Phonetics Laboratory in Budapest a special test-package (GMP) has been set up in order to detect children's ability for actual reading and for future reading acquisition [2]. In compiling the test-package, efforts have also been made to obtain information on the operations of each hypothetical level of the speech perception process quasi-separately, i.e. to detect which (if any) of the decisions the understanding

mechanism has to perform are mistaken or incorrect.

The GMP test-package consists of 14 subtests; their naturally announced and artificially generated synthesized speech material varies from isolated words through sentences up to a longer text. These speech materials have been manipulated by various methods (such as masking by white noise, speeding up, and frequency filtration). Some of the listening tests have been administered to the subjects through headphones, others through a loudspeaker in a silent room. The subtests measure both peripheral and central hearing, acoustic, phonetic, phonological levels of speech perception, visual and verbal short-term memory performance, lip-reading ability, handedness, directions, repetition ability of speech rhythm, word-completion skill, and text-comprehension.

500 normal hearing children (ages between 3 and 8) have been examined with the test-package in order to define age-specific values for normal performance. Figure 1 shows the developmental results of the GMP subtests. The examination with the GMP test-package takes about 30 minutes, both the (kindergarten/school) teachers and the speech therapists can use it easily. 150 children suffering from reading difficulties were also examined by means of the GMP. On the basis of the results the reason(s) of their reading difficulties could be detected on the one hand, and a corrective therapy could be proposed on the other. The re-examinations confirmed that the diagnosis was correct.

3. RESULTS

A tracking experiment has been carried out to support the *predictability* of somebody being a poor reader. 37 first-graders (21 girls and 16 boys) participated in this experiment who learned

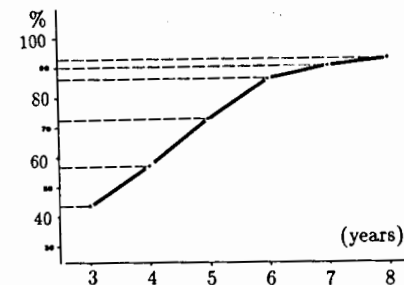


Figure 1.
Performance of children

in the same school but in two separate classes. (Their sociological background was very similar.) The children have been examined by the GMP test-package at the beginning of their first school-year and they have been re-examined after 4 months. During this time they were taught by the same teaching method, books etc. (Efforts have been made to choose similar personalities as their teachers.) By the end of this 4-month period the children had to know all Hungarian letters (both in reading and writing) and had to be able to read simple sentences correctly. At the end of this period, the same Reading Assessment Test (RAT) has been carried out with the children in order to check their reading level. There was no significant difference in the GMP results of the two classes at the first examination (Table 1) while there were highly significant differences among the children ($p < 0.01$).

15 children (7 from Class A and 8 from Class B) have been found pronouncing metatheses while repeating the meaningless sound sequences, and 18 children (8 from Class A and 10 from Class B) suffering from direction disturbances. Left-ear-advantage was found with two children. There were 11 children (5 from Class A and

6 from Class B) who had both problems: metatheses and disturbed directions. 4 children could not correctly repeat rhythmic sentences. 5 boys and 3 girls of the total 37 had articulation problems (generally mispronunciation of sibilants). The majority of children were right-handers: 21 of the two

Table 1

Results of speech perception/comprehension examinations		
GMP-subtests	Children's perform.	
	Class A	
(examinations)	1st	2nd
lip-reading	40%	50%
word-completion	3.8	4.5
visual memory	5.6	5.6
verbal memory	4.7	4.7
nonsense words	84.1%	95%
speeded-up sent.s	71.2%	90%
noisy sent.s	88.2%	100%
noisy words	88.8%	100%
filtered sent.s	100%	100%
natural sent.s	100%	100%
text-compr.	60%	80%
Average	79%	89.3%
GMP-subtests	Children's perform.	
	Class B	
(examinations)	1st	2nd
lip-reading	28%	30%
word-completion	3.6	4.0
visual memory	5.6	5.6
verbal memory	4.5	4.5
nonsense words	86%	90%
speeded-up sent.s	65.3%	70%
noisy sent.s	86.5%	90%
noisy words	83.4%	90%
filtered sent.s	100%	100%
natural sent.s	100%	100%
text-compr.	53.5%	70%
Average	75.3%	80%

classes, while 8 (5 from Class A and 3 from Class B) were left-handers and another 8 children had no dominant hand (6 of them used their right hands for drawing and eating).

The children's data show various co-occurrences of problems as shown by the GMP-subtests, such as a mixed-hander pronouncing metatheses, having problems in identifying the speeded-up sentences, or a right-hander with no articulation problem, normal speech perception performance but poor verbal short-term memory and poor text-comprehension. Which of these co-occurrences can significantly predict the poor reading performance? Our basic hypothesis is that those children should be judged as possible poor readers who (i) show a poorer performance in (almost) every subtest of the GMP than it is required for their age level, (ii) have poorer performance in more than two subtests, and (iii) have an extremely poor performance in one of the subtests, particularly in the identification of fast sentences. On the basis of their GMP results which were significantly poorer than that of others ($p < 0.001$), 12 children (5 from Class A and 7 from Class B) were predicted to have difficulties in reading acquisition.

For the sake of the experiment, the children's GMP results were disclosed only to one of the two teachers, the one who taught in Class A. Moreover, some corrective exercises were proposed to this teacher to be used in the classroom in order to: (i) stabilize the children's directions and hand dominance (where this was necessary), (ii) improve their speech perception performance and general language skill, and (iii) extend their own vocabulary. The results of the re-examination 4 months later confirmed the usefulness of these corrective exercises in teaching reading. The children's performance in a Reading Assessment Test at the end of the 4-month period supported our hypothesis referred to above. This test contains 6 subtests: a letter identification task, word reading controlled by pictures, words containing a missing

letter, isolated sentence understanding controlled by a drawing task, reading text comprehension controlled by questions for words and sentences. The maximum score was: 100 points. Table 2 shows the data of the Reading Assessment Test.

Table 2

Interrelation of the children's GMP results and their reading performance		
Classes	Average performance in	
	GMP (1st/2nd) test	reading test understanding of reading
A	79/89.3%	97.41 points
B	75.3/80%	87.5 points
		93.5 points
		79.2 points

The children's performance with the GMP test-package shows significant difference between the two classes at the second examination, similarly to reading performance ($p < 0.05$). The results are significantly better in Class A where the special corrective course was performed. Data obtained in subtests for understanding of reading show a larger difference between the two classes ($p < 0.01$). Table 3 contains our predictions concerning children's expected reading acquisition level and their confirmation in terms of RAT results.

The distribution of children in terms of RAT performance shows greater diversity in Class B where no corrective course was conducted than in Class A (Table 4).

Table 3

Predictions and supporting data on reading ability		
Predicted	Average GMP results (%)	Perform. in RAT (points)
'good'	88.6	95-100
'poor'	65.1	90-96*
'poor'	66.3	65-85**

* (after corrective course)
** (without corrective course)

Table 4
Distribution of children according to their results in reading test
Points Distribution of children according to RAT results (%)

Points	Class A	Class B
100	53.1	35
95-99	29.5	10
90-94	17.4	20
85-89	-	5
80-84	-	10
75-79	-	5
70-74	-	10
65-69	-	5

Two important conclusions can be briefly drawn.

1. *Speech perception and comprehension performance shows a very close interaction with reading ability.* It is not only the operations at the hypothetical levels of the speech understanding mechanism that should be taken into consideration, but also the concomitant abilities and capabilities of children. There is a high correlation between their performance in these tasks and their reading performance.

2. Reading ability can be assessed before the children begin to learn reading and writing, i.e. *reading performance is predictable.* The majority of children's problems in relation to language and particularly speech perception should be compensated for in a preschool age. This offers a good prognosis for successful reading acquisition.

6. REFERENCES

- [1] GÓSY, M. (1989), "Beszédészlelés/Speech perception". Budapest: MTA.
- [2] LIEBERMAN, Ph. et al. (1985), "Phonetic speech perception deficits in dyslexia", *JSHR* 28, 480-486.
- [3] SHANKWEILER, D., CRAIN, S. (1986), "Language mechanisms and reading disorder: A modular approach", *Haskins Laboratories, SR*, 173-197.