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### **Research on Dyslexia in Hungary**

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The Hungarian language is spoken by some 8 million Hungarians in Hungary, and a further 2 million outside Hungary, mostly in Romania. Whilst there has been a long tradition of research in psychology, it has tended to be published in Hungarian, or occasionally the other language used by Hungarian academics, German. There has not been a large amount of research into reading and writing difficulties, largely because many feel the Ranschburg answered most of the difficulties as early as 1916 through a psycholinguistic perspective. This chapter attempts to convey his findings, as well as more recent work in other areas which related to reading and writing difficulties in this transparent language.

There has been an increased interest in dyslexia in Hungary since the seventies and eighties. Mainly speech-therapists have been dealing with the treatment of dyslexia, but also psychophysicologists, psychologists and linguistics have taken part in the research. In this study those researches are reviewed, that made more understanding of the role of the Hungarian language in reading difficulties.

### **Hungarian language**

Hungarian language is a phonetic, transparent language of the Finno-Urgic group of which Finnish is said to be the closest relative. Consequently it is not difficult for dyslexics, yet there are many features of the language that cause serious difficulties.

Hungarian is an agglutinative language: prepositions do not stand alone but are simply added to the end of the noun, which gets bigger and bigger with the complexity of the concept being expressed, and any single word may have several morphemes. For example if you want to say "for your children", it is one word in Hungarian: *gyermeketeknek*. If English were suddenly to be transformed into such an agglutinative language, words like "antidisestablishmentarianism" would become the rule rather than exception.

In the Hungarian language the word-order is not fixed, the suffixes sign the construction of the sentence. Thus suffixes are of a greater importance in the understanding of the sentence.

The letters of the Hungarian language can be classified in three groups:

1. Only standard characters, which can be vowels and consonants alike, e.g. *a, o, b, m*.
2. Standard character and accent mark, which can be only vowels, e.g. *á, é, ő, ű*.
3. Combination of the standard characters, they are only consonants, e.g. *sz, zs, ny, ty, gy*.

Their relative incidence is approximately 70-20-10 from 100 letters (Gósy, 1999). It means that most of the letters are easily identifiable, but letters with accent mark and combined letters are always a challenge for dyslexic children.

### **Studies of Hungarian language and dyslexia**

Ranschburg Pál was the first Hungarian researcher who dealt with the disturbances of the spoken and written language on the basis of its principles. In his works he described and analyzed dyslexia already at the beginning of the 20<sup>th</sup> century. Ranschburg (1939) tried to understand the linguistic functioning on a broader biological, physiological and psychological base.

No matter how diversified the languages are and how much they are changing through the centuries their development and further formation is influenced by physiological, neuropsychological and psychological laws. These laws play govern role in the development of every language, however, their sensitivity to these laws is different.

1. The first law is the **law of the economy**. It says that occurrences follow the line of least resistance (Hamilton's law). Its manifestation in phonetics is to the advantage of stronger sounds and of those sounds which are easier identifiable and phonetically feasible. Thus voiceless consonants (e.g. *f, k, s, sz, t*) have advantage over voiced consonants (e.g. *v, g, zs, z, d*), the more closed *m* over the *n*. The vowel-like soft *l* and *r* never assimilate. Furthermore *l* before a consonant is dropped often in running speech in Hungarian, e.g. *boldog* (happy) pronounced *bo:dog*. (The same in the English 'palm'). Dyslexics find great difficulty with this concept.

In many languages, eg Hungarian, mostly the voiceless are in advantage, because they are produced with less effort. Thus many words sound differently in Hungarian in spite of its phonetic nature, e.g. *fogta* (took) written as it is pronounced: *fokta*.

Avoidance of the consonant clusters also helps simplification, too. The Hungarian language strongly endeavours to simplify the speech by inserting vowels, e.g. Turkish - török. An original Hungarian word never starts with two consonants, and consonants within the words merge in pronouncing.

2. The second law is the **principle of homogenous inhibition** (the Ra-effect named after its describer, Ranschburg) It says that the more different the adjoining contents and processes of the mind are, the least they interfere with each other's development. This phenomenon operates in other areas, in our perception, speech and in our memory errors. An example would be the neighbourhood effects (Brown, 1995)

As a result, the similar sounds lost their distinctive features in running speech and utterances easily unite. In Hungarian many consonants have similar formation and acoustic appearance definitely distinguished in the written language. For example *sz* and *s* in *egészség* (health) is written as it is pronounced: *egésség*, or *z* and *sz* in *házszám* (street number) is written as it is pronounced: *hászszám*. Dyslexics have trouble in identifying the graphemes in these cases.

However very different sounds exist in running speech in spite of the economy law. Thus sounds *g* and *d* in e.g. *vagdal* (chop), *t* and *k* in e.g. *vétkes* (guilty) etc. keep their distinctive features, when they meet. That way they provide the unbroken pronouncing of the word, its perspicuity, namely the task of the speech and language, while other mechanisms provide the economical functioning (Ranschburg, 1939).

According to Ranschburg (1939) in Hungarian the different types of errors in writing and reading can be traced back to the above described two laws. These are:

I. Mergerence of homogenous elements, elimination of one of the alike letters:

1. 74 percent of the letters merged or lost are vowels. For instance the adjective *meleg* (warm) as an adverb is *melegen* (warmly). It is written often incorrectly: *melgen*). The reason for this is that there are very few vowels, and that way there are more possibilities for uniformity and similarity. In the Hungarian language an only vowel defines the nature of a longer word to some extent making the vocals

homogenous - low or high. Thus there are more possibilities for the formation of uniformity and similarity, which is a cause of many spelling mistakes.

2. In the 79 percent of the cases from two or more alike sounds the second one dissolves into the first one differently from the rules of the mergerence in aloud speech, because the actual is identified at the prospective's expense.
3. In the cases of uniformity the milder element dissolves, and it will be omitted.

II. Mistakes originated from the prohibitory effect of the homogeneity:

1. Phoneme substitution: The phoneme is replaced with a similar phoneme, e.g. *jön* (come), written incorrectly *jöm*. There are numerous double consonants in the Hungarian language. It is a characteristic mistake, when the child dissociates them, e.g. *arany* (gold) written incorrectly: *aranj*.
2. Similarity mistakes: Similar sounds near to each other cause inhibition, thus omission or transformation will happen, e.g. *mind* (all) written incorrectly: *mid*; *macska csengő* (cat bell) written incorrectly: *macska csenkő*.

III. Permutation: It happens, when there are visually, auditively and/or motorically homogenous engrams of double graphemes, e.g. *cserép* (tile) written incorrectly: *scerép*; *ponty* (carp) written incorrectly: *ponyt*.

IV. Contamination: There are word and letter contaminations. It happens, when a new joint formation originates through the bridge of two similar sounding words or similar featured letter, e.g. *asztal* (table) written incorrectly *asztal*.

V. Repetitive augmentation: The previously formed element perseverates, e.g. *szeptember* written incorrectly: *szezptember*.

VI. Quantitative inhibition: It happens, when more consonants congest, and one of them drop out, e.g. *ezüst* (silver) written incorrectly: *ezüt*.

As a result of his work, Ranschburg created a school. Recent research and educational methods on dyslexia are mainly based on his results, although after a gap of many decades.

Meixner Ildikó was one of the main Hungarian experts, who started to study dyslexia in the 1960s. She followed Ranschburg's way of looking at the reading difficulties. She built her work mainly on his results and practical observations speech therapists made while correcting speech and language disorders.

Meixner and other experts worked out new reading methods. One of the most important characteristic of these methods was to teach children to analyze and synthesize the words.

In the Hungarian language it often happens that even one letter makes significant changes in the meaning, because single letters at the end of the word (sometimes a little bit hidden among other suffixes) inform for instance about plural or genitive relations. For example see the word “*gyermek*” (child). – *gyermeked* (your child), *gyermekednek* (for your child), *gyermekeidnek* (for your children). Reading non-words helps children to learn to read carefully and analyzing, which is essential in Hungarian language.

However the new teaching have broken off with the traditional syllabification methods, and the newly developed methods have, step by step, turned to be more whole word approach. Children had to recognize the meaning from the printed form at once, which increased the reading difficulties.

Increased incidence of the syndrome led to increased interest in the topic. Though many researchers turned to psychophysiological studies, there are also significant works on the psycholinguistic side.

In that time one of the most important dyslexia models has been developed by Subosits. Subosits (1989) suggested that those suffering from deep dyslexia are unable to dismantle the whole word images, as they don't possess the phonological module, which is required for the analysis of the words. In case of surface dyslexia only the phonological system is used, the person can identify the letters, but can't form words.

In his reading model Subosits (1989) described reading analyzed as a system process. The blocks of the process are the followings:

1. Block of lexemes: word inventory to store the images of the words.
2. Block of optical perception: it is responsible for the perception and processing of the shape of the word.
3. Semantic block: it contains the mental images which are the bases of the meaning of the words.
4. Block of syntax: it contains the grammatical rules.
5. Acoustic-motor block: it is the output, it performs the neurophysiological organization of the reading.

Blocks are in star like connection with each other. The block of lexemes is in the middle of the star. It receives information from the semantical and syntactical blocks for the processing, and the result is transferred to the acoustic-motor block, which accomplishes the reading

Disturbed reading is the result of any breaking or disturbances in the above mentioned connections. Reading mistakes can be grouped according the nature of the error.

Types of reading errors:

- **Optical mistakes** origin from the misperception of the shape of the word. There are more forms of this kind of mistakes:

1. **Confusion**, when the child mixes the similar letters, e.g. *forma-torma* (shape-horse-radish), *láda-lába* (box-his leg), *ülök-ölök* (I sit-I kill). There is an important role of the accent marks in the Hungarian language. Similar accents indicate similar sounding and similarly produced sounds. Vowels with accents are special challenge for dyslexics. For example, adult dyslexics confuse the *ö* and *ü* characters. It is a great problem to write correctly words, where there are such sounds in the same word, such as in the word *különböző* (different).
2. **Reading in unit (conflation)**: when the child reads together the near by letters, e.g. *vágja-vágya* (cut-his desire), *éjnek-épek* (of the night-they are intact).
3. **Metastasis**: When the child inverts the near by letters, e.g. *korsó-kosró* (jug-non-word), *zsúr-szúr* (party-sting). There are numerous double letters in the Hungarian, and the reverse of the letter *sz* signs another sound. In that case reversal can happen easier.

#### **Acoustic-motor mistakes**

1. **Repetitions** are the mistakes, when the child repeats the first syllable of the word. (Certainly dysphemia has to be differentiated from this phenomenon.)
2. The reversal of a syllable we call **metathesis**, e.g. *korom-komor* (soot-morose), *temet-tetem* (bury-corpse).
3. **Shortening, resection** is when the child omits the end of the word, e.g. *monda-mond* (myth-says), *kereset-keres* (salary-seek), or leaves out letters from the word. Sometimes the child not only omits letters, but also adds to it. There are additions, when the child inserts groups of words that don't belong there, e.g. *korsó-koporsó* (jug-coffin).
4. **Assimilation** is when the child reads a letter, as it were the previous or following one, e.g. *közút-között* (public road-between).

The optical and acoustic-motor mistakes belong to the surface dyslexia, because they origin from the afferent and efferent branches of the neurolinguistic system.

The following semantical and grammatical mistakes designate the deep dyslexia.

- In case of semantic mistakes it is suggested that the lexemes or the semantical block are processed inefficiently. The reader exteriorizes inner images because of figural or semantical interferences. Figural interference is a misreading like *szolid* instead of *szelíd* (steady-gentle), or semantical interference e.g. *halad-szalad* (go-run).

- The grammatical mistakes are hardly differentiable from the optical mistakes because of the agglutinal character of the Hungarian language. The several postpositions makes the words very long and less analyzable. There are two groups of the grammatical mistakes:

1. Mixing up similar shaped or similarly sounding suffixes is e.g. *tálba-tálban* (into the bowl-in the bowl), *erdőből-erdőtől* (out of the forest-from the forest).
2. Misreading of verbs is, when the child reads the tense incorrectly, or reads declarative verb instead of imperative verb, or vice versa, e.g. *örül-örült* (is glad-was glad) and *örül-örülj* (is glad-be glad).

Subosits placed the mistakes of dyslexics in a slightly different system than Ranschburg, however the described types of mistakes can be identified and matched to Ranschburg's types of mistakes.

Based on years long researches the optimal model of reading for Hungarian language was established by Gósy (1999). The model consists of three phases. The preparation is to make the child conscious of the sound-letter connection, to understand that the graphemes represent the phonemes. This is the phase, when the child learns the traditional direction of the written language, as well. In the second phase the child learns to connect the sounds to the letters, the pronounced words to the printed words, and learns to decode the words with the help of syllabification. In the third phase the process has to become automatic, the child looks at the word, and understands the meaning at once (Adamikné Jászó, 1993).

Gósy (1999) found the perception and comprehension of the speech a crucial factor in the reading. Deficits in the processing of the speech can lead to reading difficulties later.

The way of understanding a sentence is language specific. Processing a Hungarian sentence requires a more local decision because of the unfixed word order. Deciding

the function of a given word in the sentence you have to rely on the endings of the words. Gósy (1988) found in her experiment that longer words with suffixes are more understandable than sentences consisting one-syllable words. Though also the later is grammatically correct, the words don't give the usual information of the whole sentence as it is customary in the Hungarian language. That way the suffixes carry more information in Hungarian than for example in English. The misreading of the endings of the words causes greater misunderstanding for the dyslexic person in Hungarian language.

### **Cognitive processing**

There is a relative scarcity of research on the association between cognitive deficits and difficulties in the acquisition of literacy skills in the Hungarian language (see discussions in Gyarmathy and Smythe 2001). Gyarmathy and Smythe (in preparation) found that 8 year old good and poor spellers (matched for age, gender, teaching environment and Ravens matrices) are differentiated by auditory factors (ie, non-word repetition and, to a lesser extent, sound discrimination) and speed of processing (ie, number naming and, to a lesser extent, object naming), together with the potential effects of phonological factors (ie, rhyme).

### *Spelling*

In a regression analysis Smythe et al (in preparation) found measures of alliteration skills accounted for 34% of the variance in spelling for poor spellers, but only 11% for good readers. However a further 32% was predicted by sound discrimination in the good spellers. These results, supported by similar results for non-word spelling, suggests that once the preliminary skills of segmentation are acquired, it is the ability to discriminate between sounds and hold them in memory that is important.

### *Reading*

For discrepant, reading speed was found to be strongly predicted by rapid naming of numbers, a task that accesses on orthographic rather than a semantic/visual representation, whereas for controls, the main predictor was alliteration skills.

Results suggested that these Hungarian children with poor reading skills are constructing the words item by item, holding the intermediate construction in the phonological loop. However, for the controls, the predictor is rapid naming, which may be a reflection of the ability to perform the graphemic to phonological representation fast enough to provide a 'word' as opposed to a string of dissociated phonemes.



One possible explanation proposed by Smythe et al (in preparation) is that in the Hungarian language the poor reader is constantly trying to build up each word on a letter by letter basis, and therefore will require repeated access to the orthographic lexicon, as indicated by the rapid naming of numbers task. Such individual letter access may be slower than that for the controls and, consequently, the discrepant reading. However, the good reader may use an alternative strategy related to the ability to segment words, and use analogies.

### **Spelling errors**

Smythe et al (in preparation a) found that phonological segmentation and assembly skills are less important than in an opaque language (eg English) for controls though moderately predictive for discrepant. However, auditory tasks, such as sound discrimination and auditory memory are significant predictors for the control group in spelling tasks.

In an investigation into spelling Smythe et al (in preparation b) suggest that there are differences in the types of errors made. An analysis of spelling errors suggest that differently from the real words, where the usual errors, especially the lack of accent marks were found, in the case of the non-words mainly sound discrimination caused problem. Poor spellers could not find the right graphemes and their right order in the lack of meaning when non-words had to be written.

### **Morphology**

The cognitive profiling research does not include a measure of morphological knowledge. However Hungarian provides good testing grounds to study some of the basic issues in lexical access and morphological decomposition in processing and representation. With its rich agglutinative structure accompanied with more or less productive allomorphy patterns it offers ample opportunities to raise and test quite straightforwardly some of the issues that are central in the contemporary literature on morphology processing.

Pléh et al (Pléh, 1990; Gergely and Pléh, 1994) started an ambitious programme to investigate such issues as how morphemes are integrated over a time scale during understanding, they are looking for representation differences between different morphemes both as a function of linear position and morpheme type.

One of the basic issues in their studies is to see how differentially is morphological decomposition prevalent with different types of affixes, and whether there are signs of

preferential processing orders in suffixes. Hungarian word formation rules allow to study affixes that differ both positionally (prefixes and ordered suffixes), and functionally (derivational suffixes, plural and possessive markers, and case markers).

Their studies showed that in an agglutinative language if lexical decisions involve both search and grammatical-semantic combinations reaction times become extremely slow. It is apparent that in these cases one can only study secondary representation processes rather than lexical access itself and the role of morphological parsing in it.

### **Psychophysiology**

Csépe et al investigate the psychophysiological side of dyslexia. The aim is to assess whether dyslexic children can be separated from controls of a high variability of acoustic and phonetic discrimination performance by measuring the mismatch negativity (MMN) component of event-related potentials (Csépe et al, 2000, 2001).

In a recent study (Csépe, Szűcs and Osman-Sági, 2000) the MMN elicited by pith, vowel and consonant-vowel (CV) contrasts was measured in dyslexics of 9 years of age and in two groups of age matched controls. The most reliable MMN difference between dyslexics and controls were found in the CV condition where voicing and place of articulation were used as contrasting features. Furthermore, the MMN to CV contrasts recorded in dyslexics was found to be different when it was compared to the MMN recorded in controls of poor phoneme discrimination performance. Based on the MMN results their suggestion and further research hypothesis is that the speech sound representation of dyslexics and children of developmental lag is different.

### **Summary**

Challenges of the Hungarian language for dyslexics:

- Dyslexic children forget to use accent marks, some of them don't uses these marks at all, though in Hungarian they have real significance in understanding ("sor" means row, "sör" is beer).
- The similar looking and sounding ö and ü are very often mixed even by adult dyslexics.
- Dyslexic children use false accent marks which change emphasis or even the sound ("ö" is a short vowel, "ó" is a long one, or "a" is pronounced like "run", "á" is like "rasp". You can make serious misunderstandings, as for instance "bal" means left, "bál" means ball, dance, "szél" is wind, "szel" means cut, "túr" is dig, "túr" is endure, etc.)

- Dyslexic children cannot use properly the sign of the past at the end of the verbs (in Hungarian signs are put to the end of the words whether it is a preposition or time of a verb (except future). In case a the verb ends with a vowel or a vowel was put to the end of the verb to help the pronunciation "tt" should be used, if the consonant remains, then "t" is correct.
- There are some double consonants as "ny" (pronounced like the first sound of "new"), or "gy" (the first sound from the Russian "Ded Maroz") and "ty" which are very similar. These combined consonants can be mixed easily.
- Use of double consonants as "sz" (s) and "zs" (similar to the first sound from the French word "jour") is confusing too.
- There are two equally pronounced consonants: "j" and "ly". They are pronounced like the start of the English word you. These letters are often mixed.
- Suffixes and postpositions cause many mistakes. Suffixes should be written together with the basic word, but postpositions should be written separately. As both stand at the end of the word, the child should differentiate whether it is a suffix or a postposition, e.g.
- Words can be very long and complex because Hungarian is an agglutinative language.
- As the word-order is not fixed suffixes carry more information for the meaning of the whole sentence, than in languages, where the position of the word shows its function. Thus the misreading of these (sometimes only one- or two-letter) endings might hinder the understanding of the sentence.

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