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ABSTRACT

This report deals with sporadic observations on the glottal stop in the English spoken by Finns. The data were collected in connection with two separate studies. An attempt is made to give a description of the factors which may explain the occurrence of glottalization and to outline the method by which the phenomenon will be approached in greater detail in the future. It is felt that the key to the difficulties connected with glottalization is the difference between the Finnish and English concept of the morphophonological word, or, more precisely, the different role assigned to glottalization in these languages. Three groups of 15- and 16-year-old Finnish students of various dialect backgrounds were tested for their pronunciation of Finnish and English. Irrespective of dialect, glottalization was more evident in English than in Finnish. A second test was based on the pronunciation of test sentences by 24 ninth grade pupils from the Ostrobothnian dialect area. From these tests, it may be concluded that: (1) erroneous word-boundary signalling exists with pupils who do well in their language studies as well as those who do not; (2) some students retain features of interference from native language pronunciation even after long exposure to a foreign language; and (3) possibly a student's word-boundary signalling pattern can be attributed to teacher pronunciation. (AM)

# SIGNALLING OF MORPHOPHONOLOGICAL BOUNDARIES BY FINNISH SPEAKERS OF ENGLISH: PRELIMINARY FINDINGS

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This report deals with sporadic observations on the glottal stop in the English spoken by Finns collected in connection with two separate studies. An attempt will be made to give a description of the factors which may explain the occurrence of glottalization, and to outline the method by which the phenomenon will be approached in greater detail in the future. The data available at present seem to indicate that

- at word boundaries in front of words beginning with a vowel, glottalization is far more frequent in the pronunciation of English by Finns than in standard English pronunciation;
- glottalization is even more frequent in English utterances produced by Finns than in their mother tongue utterances at boundaries of similar structure;
- in English utterances Finns use linking more often in the early part of the utterance than towards its end where glottalization or pauses assume the place which linking would have taken in normal pronunciation;
- variation in the assignment of linking, glottalization and pauses in the pronunciation of English test sentences by Finns does not correlate with the constituent structure of English in such a way that a phonetic break, i.e. glottalization or pauses, would be more common or more probable at strong syntactic boundaries and linking more usual at immediate constituent boundaries as is normally the case in English;
- glottalization can be explained by means of sentence stress in the way that the signalling of word boundaries by glottalization takes place somewhat more often in front of stressed than unstressed syntactic elements;[1]
- the choice made by Finns between glottalization and linking can be explained in part by observing the phonetic structure of the word string:

glottalization is more common after obstruents, i.e. plosives and fricatives, whereas linking is more frequent at word boundaries between vowel segments. In this respect the Finnish pronunciation of English is similar to Finnish pronunciation.

2

Both spoken standard Finnish and English have the glottal stop or 'glottal catch'; its phonological status is similar in both languages. The glottal stop is not generally included in the segments of word-level phonology in either language. In both languages the glottal stop is a phonetic boundary segment but the essential distinction is that, in English, glottalization may occur both word-initially or word-medially in front of a syllable beginning with a vowel, whereas in Finnish it is possible only at a morphotactic word boundary. We feel that the difficulties connected with glottalization are ultimately linked to the fact that the category of the word in Finnish differs morphophonematically from that in English (see Karlsson 1977:67 in this volume). Although various function words (prepositions, articles, etc.) are free morphemes preceding their head words in English, the corresponding elements in Finnish are suffixed to the head words. Thus the semantic content of a *morphophonological word* differs considerably in the two languages. Accordingly, it is very likely that the need for signalling word boundaries is different since the concept of the word differs in the linguistic competence of speakers of Finnish from that of speakers of English.

As regards the role of word boundaries, the meaning and the information content of a word differ in Finnish from those of English. In the Finnish language, glottalization is used above all to signal boundaries of words beginning with a vowel. It may be assumed that a Finn's use of glottalization instead of linking at word boundaries of English words beginning with a vowel reflects the Finnish speaker-hearer's way of abstracting, in both production and in reception, the information carried in English into morphophonological-lexical units by strings of sounds.

[1] We think that such a tendency is universal and is also found in normal English pronunciation. Stress is only a phonetic reflection of the thematic and rhythmic structure of a sentence. Therefore, glottalization is more likely to occur in front of a lexical word, which carries a more essential meaning in a sentence, than in front of a function word, which has a less important role in the information content in a sentence.

The fact that a Finn tends to single out every unit of an utterance effectively impairs the intelligibility of the message on the part of the native listener. When elements which belong together syntactically, such as prepositions or determiners, situated in front of their head words, are separated from their heads by means of glottalization, the native listener may identify the glottalization with pauses, breaks, interruptions, etc., and thus interpret the constituent structure of the sentence in a way which is different from what was originally intended by the speaker.

Glottalization is not a problem for Finnish students of English alone. As Jones (1967:151) notes, "most foreign people, and more particularly Germans, have a tendency to insert the sound ʔ at the beginning of all words which ought to begin with vowels. Thus they will pronounce *it was all our own fault* as [it wəz ʔɔ:l 'ʔauə 'ʔoun,'fɔ:lt]". According to Jones, "the mistake is one which will effectually spoil what is otherwise a good pronunciation, and it is one which often necessitates a great deal of practice on the part of the learner. It must be remembered that in normal English there is no break between consecutive words which are closely connected by the sense".

In word-level phonology, glottalization is not usually classified among the phonological segments of Finnish (Karlsson 1969:351, Lehtonen 1970:24; cf. Wiik 1967:47-48). The phonological status of glottalization is somewhat ambiguous in standard Finnish. On the one hand, standard Finnish has glottalization as an initial segment in words beginning with a vowel on certain conditions; on the other hand, in descriptions of the Finnish sound pattern, glottalization is encountered in connection with the phenomenon called "jäännöslopuke".

An examination of the pronunciation of distinct words supports the argument that in front of a word beginning with a vowel there is, in standard Finnish, a certain type of abrupt onset (coup de glotte, Einsatz) or 'hard attack' in contrast to a fricative-like vowel initiation, which appears in pronunciation as a word-initial /h/-fricative. Consider the following examples:

| | |
|---|---|
| [ʔaavaa] 'vast', 'open' (part.sg.) | [haavaa] 'wound', 'cut' (part.sg.) |
| [ʔakkaa] 'old woman' (part.sg.) | [hakkaa] 'cut', 'chop', 'hew' (3rd person present tense indicative) |

| | | | |
|---|---|---|---|
| [ʔiili] | 'leech' (nom.sg.) | [hiili] | 'coal', 'carbon' (nom.sg.) |
| [ʔintoja] | 'zeals' (part.pl.) | [hintoja] | 'prices' (part.pl.) |
| [ʔilkka] | Ilkka (man's name) | [hilkka] | Hilkka (woman's name) |
| [ʔirviä] | 'sneer', 'poke fun' (infinitive) | [hirviä] | 'deer' (part.pl.) |

In pairs of this kind it is not, however, necessary to abstract the onset of the word-initial vowel as a phonological segment. It is not phonologically commutable and its distribution is restricted to the word-initial position.

The use of glottalization at boundaries with words beginning with a vowel varies in Finnish according to the geographical dialect areas. For instance, glottalization is found to be more frequent in the eastern and Ostrobotnian dialects than in the south-western and south-eastern dialects.

This phenomenon of the Finnish sound pattern is not, however, generally that referred to by *glottalization* or the *glottal plosive* in Finnish grammars. Finnish grammarians describe glottalization or the glottal stop as a phenomenon appearing after a number of morphologically marked words and grammatical forms; it is considered to be a special case of the doubling of the first segment of the subsequent word, appearing in the form of a glottal plosive in front of words beginning with a vowel. Consider the following examples:

<anna pois!> [annap pois] '(go ahead and) give it', 'give it away' (imperative), <päästä sisään!> [päästäs·sisään] 'let (sb. go) in' (imperative); and accordingly <anna ottaa!> [anna?: ottaa] 'let (sb.) take (it), 'let (sb.) have (it)' (imperative), <päästä ulos!> [päästä?: ulos] 'let (sb. go) out' (imperative).[1]

[1] In examples like these the traditional interpretation of the glottal segment at the word boundary is that the abrupt onset (coupe de glotte, 'hard attack') of the initial vowel of the next word geminates and produces a phonologically doubled glottal stop (for further discussion, see Karlsson and Lehtonen 1977:55ff.). According to the most recent interpretation (Karlsson and Lehtonen 1977), this glottal boundary segment, which comes after certain marked morphemes only, is neither geminate nor an independent segmental phoneme; it is a segmental juncture marker, which possesses the special feature of being morphologically conditioned.

The essential difference in the occurrence of glottalization in English and in Finnish is, thus, the fact that English glottalization is a phonetic means connected with syllable boundaries and emphasis and not an unambiguous marker at word boundaries. In Finnish, glottalization can never be used word-medially to mark a syllable boundary beginning with a vowel. For example, pronunciations like **kau'an, *kiu'as, *leu'assa, *te'os, *ha'ussa, *ruo'on,* and **re'aktio, *ko'operaatio, *ge'ometria* (cf. English <reaction> [rɪ''ækʃn], <co-operate> [kəʊ''ɔpəreɪt], <geometry> [dʒɪ''ɔmətrɪ]), in which the glottal segment is inserted into a word-medial syllable boundary, are not acceptable in standard Finnish.

Because glottalization is only possible, though not obligatory, between words in Finnish, its occurrence in a flow of speech is a strong cue for a Finn to identify a word boundary and thus split up the string of speech sounds into word-size units and identify the perceptual patterns (Gestalt) of words.

In English, the role of glottalization differs from that of Finnish. As Gimson (1970:167) says, "the glottal plosive is not a significant sound in the RP system. It serves regularly for many RP speakers as a syllable boundary marker, when the initial sound of the second syllable is a vowel. Thus, a hiatus of vowels belonging to different syllables (especially when the second vowel is accented), may in careful speech be separated by ʔ instead of being joined by a vocalic glide, and even when the second vowel is weakly accented, e.g. *day after day* ['deɪ ʔɑ:ftə 'deɪ]". For the speaker of English, glottalization is one of the factors which may indicate the prominence of a stressed syllable, which somehow gathers the word unit around itself. But the glottal segment does not automatically mark the boundary of words in the flow of speech, and it is used much less frequently than in Finnish or in the English pronounced by Finns.

In the 1248 instances of word boundaries in the present study in which the preceding word ended with a plosive, the initial vowel of the following word was realized with glottalization by more than 50 per cent of the Finnish pupils, while the corresponding percentage in the pronunciation of a control group of native speakers of English (5 university lecturers) was only 2 per cent. In the group of boundaries of fricative + vowel, the corresponding figures were 60 and 4 per cent respectively; in the group of word-final resonants, the number of glottalized boundaries was

45 per cent with the Finnish speakers but only 3 in the pronunciation of native speakers, and in the vowel + vowel instances the amount of glottalization was 14 per cent in the Finnish group but zero in the English one.

3

*The first test.* – To assess the influence of a Finnish speaker's dialectal background on the processing of word boundaries in English, three groups of schoolchildren studying English were chosen in different dialectal areas: the town of Kuopio in eastern Finland, the town of Turku in south-western Finland, and Haapamäki, a locality in central Finland. Each student (age c. 15-16 years) participating in the test had studied English for at least five years at secondary school; at the time of the test they were attending the first grade of the gymnasium.

The material used in the test was very rudimentary. The test itself originated from another test, which was carried out to examine how Finns signal word boundaries in Finnish. The pupils were tested for their pronunciation in Finnish and English.[1] The results for each group of the test population are presented in Table 1. In the table the realization of each juncture is given in percentage.

The percentages in Table 1 indicate that to a certain extent glottalization and linking correlate to the variation in terms of the students' dialectal background. For instance, in the Turku group C+V position, the amount of linking in English is 26 per cent and that in Finnish 19 per cent, while in the Kuopio group, the percentage of linking is 11 per cent in English and 4 per cent in Finnish. Irrespective of their native dialect, Finnish speakers resort to glottalization or pauses at word boundaries much more often when speaking English than when speaking Finnish.

The way in which each pupil produced junctures in English and in Finnish seems rather inconsistent and unstable. Some pupils used linking frequently both in Finnish and English test sentences, others showed very frequent use of linking in Finnish but preferred glottalization in English.

[1] For a more detailed presentation of the results with regard to Finnish pronunciation and word boundary signalling, see Karlsson and Lehtonen 1977.

Table 1. Realization of word boundary by Finnish schoolchildren with different dialectal backgrounds. L = linking, G = glottal constriction, and GP = glottal plosive (two degrees of boundary segment), and P = pause observed at word boundary.

| structure of boundary | KUOPIO | | | | HAAPAMAKI | | | | TURKU | | | | MEAN | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L | G | GP | P | L | G | GP | P | L | G | GP | P | L | G | GP | P |
| V+V (Fi)[1] e.g. <ei olisi> <saa avata> <radio-ohjelmille> | 31 | 48 | 19 | 2 | 12 | 52 | 33 | 3 | 64 | 20 | 15 | 1 | 36 | 40 | 22 | 2 |
| V+V (E) e.g. <my eyes> <the evening> <to answer> | 56 | 39 | - | 5 | 12 | 85 | - | 3 | 66 | 27 | - | 7 | 45 | 50 | - | 5 |
| C+V (Fi) e.g. <on ostettu> <saat avata> <mies omistaa> | 4 | 95 | - | 1 | 3 | 96,5 | - | 0.5 | 19 | 78 | - | 3 | 9 | 90 | - | 1.5 |
| C+V (E) e.g. <enormous animal> <that is> <an easy (question)> | 11 | 80 | - | 9 | 15 | 83 | - | 2 | 26 | 62 | - | 12 | 17 | 75 | - | 8 |

[1] Word boundary marked by '#'.

The following sentences give an account of the use of linking at given boundaries; the numerical values in percentage are from the top: Kuopio, Haapamaki and Turku (ø = no instance with linking):

ø ø 5 27 ø
This ø enormous ø animal 12 is 20 an 12 elephant.
18 18 9 36 9

5 46 3
I'm 12 only ø eight years 12 old.
36 27 ø

51 ø
My 12 eyes 4 are blue.
64 18

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 46 | | 57 | | ø | | 57 |
| Can | 56 | I do | 24 | it | ø | in the | 8 evening. |
| | 100 | | 91 | | ø | | 91 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 32[1] | | 16 | | 3 | | 68 |
| That | 68 | is | 4 | an | Ø | easy question to | 16 answer. |
| | 82 | | ø | | 9 | | 55 |

[1] Either *that is* or *that's*.

The figures show unexpected variation between the three dialectal groups. Interference from the pupils' native dialect cannot alone account for it. Some variation was also caused by the teachers' pronunciation in each group and by the amount of attention paid to the fluency of speech in the classroom. Linking also seems to be more frequent at boundaries between familiar words and in familiar phrases.

4

*The second test.* — The second test was also of a preliminary nature. The test was based on the pronunciation of test sentences read by pupils at Töysän peruskoulu (9th grade, Ostrobothnian dialect area). It was part of a larger series of tests designed to study the perception and production of English speech sounds by Finnish schoolchildren. The results of the entire test will be published in Jyväskylä Contrastive Studies later.

The test sentences containing word boundaries with initial vowels were gathered from a larger body of material read by 24 pupils. The material consisted of isolated short sentences of the type *He is interested in sports, This is your will, isn't it?, It is a name, It was at our house, Tom doesn't understand his friends at all, Look at those bees in your garden, Where is your glass?*. The total number of the sentences was 86.

The number of the boundaries examined totalled 3,120; there were 2,568 C+V positions and 552 *N*+V positions. A twofold method of examination was applied: (1) the sentences were transcribed and analyzed perceptually; (2) oscillograms were made of the sentences to make sure that the results conformed with the actual data and to check up whether the boundary contained glottalization. Instrumental analysis was necessary because it is very difficult for people to hear phenomena such as glottalization at word boundaries in their own language. Table 2 presents the results of the test.

Table 2. Background information of the students and distribution of manifestation of word boundary in juncture categories. The symbols used in the table are as follows : D stands for (the score in a separate test measuring) discrimination, I for (the score in a separate test measuring) identification; E and M stand for the informat's school mark in English and music respectively; L, G, P and F, given in percentages, stand for linking, glottalization, pause and 'faulty pronunciation' respectively.

| informant no. | | | school mark | | manifestation of word boundary in percentage | | | |
|---|---|---|---|---|---|---|---|---|
| | D | I | E | M | L | G | P | F |
| 1 | 39 | 54 | 5 | 8 | 45 | 36 | 17 | 2 |
| 2 | 37 | 60 | 5 | 8 | 29 | 53 | 8 | 10 |
| 3 | 41 | 69 | 9 | 8 | 65 | 26 | 5 | 3 |
| 4 | 41 | 59 | 8 | 5 | 40 | 51 | 8 | 1 |
| 5 | 43 | 69 | 7 | 8 | 25 | 69 | 5 | 1 |
| 6 | 36 | 70 | 8 | 8 | 39 | 49 | 10 | 2 |
| 7 | 43 | 63 | 8 | 9 | 27 | 62 | 7 | 4 |
| 8 | 36 | 62 | 7 | 5 | 13 | 53 | 22 | 12 |
| 9 | 44 | 97 | 9 | 9 | 60 | 26 | 9 | 5 |
| 10 | 31 | 67 | 8 | 9 | 37 | 45 | 6 | 12 |
| 11 | 46 | 72 | 9 | 9 | 45 | 38 | 8 | 9 |
| 12 | 33 | 69 | 7 | 8 | 33 | 55 | 7 | 5 |
| 13 | 35 | 67 | 8 | 9 | 68 | 25 | 2 | 5 |
| 14 | 40 | 74 | 9 | 9 | 58 | 35 | 2 | 5 |
| 15 | 33 | 47 | 9 | 7 | 32 | 42 | 18 | 7 |
| 16 | 39 | 75 | 8 | 8 | 32 | 58 | 2 | 8 |
| 17 | 38 | 62 | 6 | 6 | 23 | 62 | 3 | 12 |
| 18 | 36 | 52 | 5 | 8 | 24 | 34 | 22 | 20 |
| 19 | 49 | 58 | 7 | 7 | 10 | 76 | 12 | 2 |
| 20 | 45 | 74 | 8 | 8 | 46 | 45 | 3 | 5 |
| 21 | 30 | 73 | 8 | 7 | 26 | 47 | 12 | 15 |
| 22 | 38 | 53 | 9 | 7 | 51 | 42 | 5 | 2 |
| 23 | 47 | 60 | 7 | 8 | 50 | 43 | 2 | 5 |
| 24 | 35 | 60 | 6 | 8 | 18 | 52 | 11 | 19 |
| | | | | | 37 | 47 | 9 | 7 |

X

Linking and glottalization were correlated with various school marks. There is a fairly good correlation between linking and the student's mark in both English and music. Preference of linking to glottalization seems to correlate with the pupil's mark in music to some extent; the correlation was 0.48. This may be interpreted as an indication that the same skills which comprise the pupil's talent for music and have their effect on his music mark at school contribute to his ability to abstract a foreign language auditively and to produce its idiomatic structures.

Furthermore, a comparison was made between the scores of linking and glottalization in this test and the scores in another test which studied the same pupils' ability to discriminate and identify English sound patterns. There is a fairly strong correlation between the pupil's mark in English and his score in the identification test while the score in the discrimination test does not correlate with the pupil's mark in English. The correlation between linking and the pupil's mark in both English and music is fairly good. As for the whole group of 24 pupils who took part in the test, the correlation between the pupils' English marks and linking was 0.52.

A conclusion can now be drawn to serve as a preliminary hypothesis erroneous word-boundary signalling exists both with pupils who have done well in their language studies and with those who have not.

According to literature, one of the functions of glottalization is to give prominence to the word juncture in ambivalent pairs of words, e.g. *a name an aim*. The way in which the Finnish schoolchildren produced contrast pairs of sentences with distinctive word junctures (*a name/an aim, the meat/them eat, princess/prince's, grey tie/great eye, that's sour/that's our, a tower/at our, free Danny/freed Annie*) does not differ significantly from the signalling of the other word boundaries. In the C+V position for all instances (totalling 2,568) in the test, the percentage of glottalization is 54 and the respective percentage in the ambivalent pairs of the type C+V (168 instances) is 64. A Finn does not seem to be able to make use of glottalization as a special cue for the boundary. he produces all boundaries beginning with a vowel by means of glottalization.

The preliminary results seem to indicate that language learners have at least two distinct strategies in the learning of the phonetic patterns of a foreign language. Some learners automatically attain reasonable pro-

nunciation skills at a fairly early stage of language learning, whereas some may retain features of pronunciation characteristic of interference from the native-language pronunciation habits even after a long exposure to the foreign language.

Classification of the boundaries manifested by more than 2/3 of the pupils by means of linking gives the following rank list of linking: In the group of the V+V boundaries, the linked pairs of words are *they are* (6 instances in different sentences), *he is* (4), *she is* (2), *try it* (1), *dry it* (1), and *we asked* (1); 15 instances altogether. Pupils who did not favour linking produced the boundaries with glottalization; only three informants had a pause instead. There were 12 instances of the type C+V: *it is* (3), *when I* (2), *where is* (2), *this is* (2), *look at* (1), *fill it* (1), and *hill is* (1). Here a pause was found at the boundary in 10 cases only, while glottalization was used in 59 and linking in 434 individual productions.

The remaining boundaries (103 instances) in our material manifested more than a third of glottalization, in 62 cases more than 2/3. All of the glottals cannot be regarded as erroneous, however. In some sentences, a glottal segment or a pause is acceptable in standard English pronunciation as a signal of syntactic boundary, for instance *this is your will/isn't it?; you have writings/on your bag*. Nevertheless, some of the boundaries where a native speaker would more probably have linking were produced with glottalization or a pause by more than 2/3 of the pupils, e.g. <I know the way to/cut it>, <*flying aeroplanes* can be dangerous>, <Tom *doesn't understand* his friends at all>.

Some instances reflect a feature which in itself is not solely connected with the occurrence of the glottal stop or with the difficulties in its use but with the way in which the Finnish student phonetically produces syntactic structures in English. A typical error in the phonetic production is that pauses and word-boundary signalling break up the normal constituent structure in English. For instance, in the sentence *Tom does not understand his friends at all*, the boundary between the immediate constituents of *at all* were often produced with a glottal segment or a pause, while *friends* was linked with *at*. Analytic pronunciation of this type may affect the comprehensibility of the utterance especially in cases where some of the morpheme boundaries in the string of words are signalled with a pause or glottalization but others with linking irrespective of the syntactic 'strength' of each boundary.

The choice which the student makes between linking, glottalization or a pause is not necessarily consistent with the structure of the English sentence but is more or less sporadic. For instance, a boundary which is phonetically easy for a Finn may be produced with linking but the ensuing boundary which may form a boundary between immediate constituents is produced with glottalization or a pause. Factors like this also seem to reflect indirectly how the Finnish student tries to abstract in perception the phonetic flow of speech of an English utterance into semantic units. The Finn's expectations in terms of sentence-phonetic cues are erroneous and the fact that he produces word boundaries and sentence stress in an erroneous way reflects his inadequate perceptual-phonetic skills.

In the majority of word boundaries produced by the pupils, the reason for signalling the word boundary with glottalization could not, however, be specified unambiguously. The features which seem to favour glottalization at a word boundary include the quality of the final segment of the first word, the stress level of the second word, and the syntactic position of the word boundary. Final plosives, strong stress, and a strong constituent boundary seem to contribute to the increased occurrence of glottalization. Yet examination of the instances in their original sentence frames, paying attention to each pupil's individual performance did not, in most cases, attest any direct connection between the factors which were assumed to explain the existence of glottalization and the variations in the pupils' actual production. However, the present tests were not designed for the analysis of boundary signals, and therefore certain factors accounting for glottalization may have been overlooked and a number of others given too much emphasis.

°5

The role of the teacher's pattern of pronunciation as compared with the direct NL transfer is one of the interesting factors from the point of view of the contrastive hypothesis. To what extent can the word-boundary signalling be attributed to the pupil's own transfer from the mother tongue and to what extent does the pupil only faithfully repeat the model given by his teacher's pronunciation?

Unexpected variation between dialectal groups in the use of linking at various word boundaries seems to support the hypothesis that what the teacher does and how he behaves is of great importance. If it is possible

to divide the students into two groups in terms of their learning strategies and their capacity of perceiving the phonetic parameters of speech (i.e. phonetically accurate and inaccurate groups), some attention should be paid to this distinction in language teaching and in teacher training. Students who want to become teachers and have difficulties in abstracting such higher-level feature structures as boundary signals should be made aware of this and particular attention should be paid to their difficulties. If the hypothesis holds true, school instruction will have to be reorganized to meet the requirements of the pupil's individual learning strategies.

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