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THEORETICAL LINGUISTICS PROGRAMME, BUDAPEST UNIVERSITY (ELTE)

**CROSS LANGUAGE ANALYSIS OF  
GERMAN- AND HUNGARIAN-SPEAKING  
BROCA'S APHASICS' PROCESSING OF  
SELECTED MORPHONOLOGICAL AND  
MORPHOLOGICAL FEATURES:  
A PILOT STUDY**

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**WORKING PAPERS IN THE THEORY OF GRAMMAR, VOL. 3, NO. 1**

**RECEIVED: FEBRUARY 1996**



MTA Nyelvtudományi Intézet Könyvtára



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SUPPORTED BY THE HUNGARIAN NATIONAL RESEARCH FUND (OTKA)

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Leletári szám:

26 963/96



## A. Introduction\*\*

Linguistic analysis of an aphasic's language processing abilities and deficits provides information on the structure of the functional subcomponents, separate 'units' or 'modules' according to which language is processed by speakers of a particular language. Until recently studies of language breakdown have been based primarily on data or corpora from a single 'homogeneous' language. Depending on the degree of sophistication of the applied language tasks — global quantitative measures and/or detailed qualitative analysis — the results obtained from such investigations provide crucial information on the functional subcomponents of a specific language. This is a first step in addressing the issue of 'which of the distinctions within language appear to be relevant to the brain'. Under this 'monolanguage' approach it is not possible to provide ultimate answers to such a universal issue, namely *how language is processed by the brain*.

Using data from a **single** language is too restrictive for determining psycholinguistic or cognitive strategies involved in language processing, in that not all possible structural distinctions are present in a single language. Valid language-specific aspects of language processing can be obtained from such studies, however, in order to arrive at an answer to the question how language is organized in the brain, it is necessary to compare language breakdown across languages with regard to subjects' performance on tasks which can be considered to tap parallel **relevant** features and the interactions among the features in the languages under investigation. Cross-linguistic comparison of aphasics' language processing abilities allows a differentiation of language-specific aspects of processing, i.e. aspects which are determined by the structure of the particular single language, from more universal, i.e. shared properties of language processing which correlate with specific structures in the various languages (cf. Bates et al. 1991).

The aim of this pilot study is to examine the performance of agrammatic German- and Hungarian-speaking Broca's aphasics with regard to various aspects of morphological, morphonological and morphosyntactic processing. In particular we are interested in the relationship between inflectional and word formation morphological processes in German- and Hungarian-speaking aphasics. These components or subcomponents or 'modules' are more similar to each other in (predominantly agglutinating) Hungarian than in (predominantly inflecting) German. Within morphonology (cf. Dressler 1985a), vowel harmony processes are characteristic of Hungarian, umlaut (metaphony) processes of German. The ultimate goal was to arrive at adequate means — parallel tasks, structures, etc. — for comparing the



performance of the subjects speaking the different languages on comparable language-specific features serving similar functions in the languages. The pilot study nature of this paper must be stressed: the methods are highly exploratory and the results are tentative.

## **Background — Morphological Framework**

The departure point for this study is the framework of Natural Morphology (cf. Dressler, Mayerthaler, Panagl & Wurzel 1987). The theory of Natural Morphology consists of three subtheories:

- 1) universal markedness theory,
- 2) theory of typological adequacy, and
- 3) theory of language-specific system adequacy.

The main tenet of the first subtheory is the search for universally preferred principles and operations which apply independent of language-specific 'rules' and thus can account for the distribution of particular structures within and across languages. The preference for a particular form or forms stems from a combination of factors — neurophysiological, biological, semiotic, cognitive, etc. — which must be considered when putting forward a hierarchy based on the determined preferences.

The second subtheory deals with typological aspects in the choice of options on the universal preference parameters, e.g. of vowel harmony as adequate for agglutinating languages or of morphological modifications such as umlaut for inflecting languages.

The third subtheory deals with language-specific morphological systems, e.g. with the structure of inflectional paradigms, since it is underdetermined by universal preferences and type adequacy. For example, it is type adequate for Hungarian to have more case categories than German, and for German to have much case syncretism (vs. the near-absence in Hungarian), but generalizations about the exact structure of case forms and case syncretisms belong to language-specific system adequacy (more in Dressler et al. 1995).

Two distinct 'modules' are hypothesized with regard to inflection and word formation. The system of inflection is the set of all paradigms formed from bases belonging to the same word class. Thus, there is a system of inflection of nouns and one for verbs. A crucial concept for morphology and which is relevant to the present study is 'productivity'. Productivity refers to the capability of using rules with new words: 1) loan-words; 2) indigenous neologisms and, 3) class change from unproductive to productive class. Productive classes are central for morphology, whereas unproductive ones are marginal. Productivity is to be seen rather as a gradient concept from productive to unproductive. The same holds for the distinctions compounding — derivation and inflection — derivation.

Morphonological and similar allomorphic rules, such as German umlaut, diminish naturalness on several universal parameters of morphological naturalness (notably morphotactic transparency and constructional diagrammaticity) and thus make morphological processing more difficult, also for aphasics. This holds for Hungarian morphonological and



similar allomorphic rules as well. However in Hungarian palatal vs. velar vowel harmony has also the specific function to indicate which syllables belong to the same word.

The idea behind carrying out a crosslinguistic study is to analyze features which can be considered comparable — in terms of the functions they serve in the respective languages and of their formal structure. For this pilot study the German umlaut and the Hungarian vowel harmony were selected as the main morphonological targets. As to morphology in general, corresponding categories were selected such as nominal plural formation, noun compounding, and the derivational categories agent formation, diminutive formation, etc.

## B. German

German inflection is characterized by the importance of article inflection. This dimension, however, was eliminated from this study, because, here, Hungarian is quite different from German: it has no indefinite article, and its definite article is indeclinable (as is the case in English). Moreover, Hungarian has no gender distinction whereas German has three genders (masculine and neuter are more similar to each other in inflection than to the feminine).

The second-most important inflectional category is plural formation, where the choice of a particular plural suffix is correlated with the choice of singular case forms, in contrast to the unique Hungarian plural suffix which triggers morphonological and allomorphic rules. In general, these also apply in the oblique cases of the singular. The two most productive German plural suffixes are 1) the -s suffix, which notably is preferred with loan-words and vowel-final nouns, 2) the -n suffix, which is very productive with feminine nouns. The suffix -e with or without umlaut has a very limited productivity with very few subclasses of paradigms, whereas the -er suffix (with and without umlaut) and the umlaut-only plural are unproductive; finally the zero-plural is morphologically and phonologically rigorously restricted (cf. Köpcke 1993).

All the word-formation rules involved in this study have productive nuclei: noun-noun compounding, diminutive formation (with the suffixes -chen, -lein, regional -erl), deverbal agent noun formation (with suffix -er), denominal adjective formation (with suffixes -ig, -lich, -isch), denominal abstract noun formation (with suffix -schaft), but regularity, transparency and productivity may be diminished by interfixes ("Fugenelemente") in compounds and by umlaut in suffixation.

The German Umlaut serves the following functions: 1) It contrasts a singular from a plural form with nouns either as a secondary or as the only morphological or morphosyntactic marker which distinguishes the plural from the singular forms (see Types 4 and 7 below). 2) It is also common in derived forms, e.g.: Gefahr ('danger', noun) → gefährlich ('dangerous', adjective); and 3) the umlaut is used in the conjugational system for verbs, namely for the second and third person singular forms, e.g.: ich trage — du trägst — er trägt ('I carry — you carry — he carries').



## Methods

Following the selection of the features to be investigated in each language, tasks were designed for each language.

The following tasks were chosen: confrontation naming to drawings; plural formation to pictorially depicted material, lexical decision tasks using auditorily presented stimuli and visual presentation of stimuli (words and nonwords); word repetition task; reading aloud of single words, reactive naming tasks to elicit specific morphological forms: diminutives, derived forms from stimuli from the same or a different word class.

Due to the exploratory nature of this pilot study several tasks were designed consisting of only a small number of items. However, an attempt was made to design subtests parallel in structure in order to tap the aphasics' abilities across modalities and to compare their performance on the various tasks.

### German:

Crucial variables tested for in the German language tasks of confrontation naming, repetition, reading aloud task included the following differentiations:

#### I) Types of plural formation (according to Wurzel 1984)

- 1) Vowel# + -s (e.g. Kino-s 'cinema-s'; Auto-s 'car-s'),
- 2) der (masc.) X + -n (e.g. Hase-n 'rabbit-s'; Affe-n 'monkey-s')
- 3) die (fem.) X + -n (e.g. Straße-n 'street-s'; Brille-n 'eyeglasses')
- 4) Umlaut (") + -e (e.g. Wolf/Wölfe 'wolf/wolves'; Korb / Körbe 'basket(-s)')
- 5) X + -e (e.g. Hund-e 'dog-s'; Tisch-e 'table-s')
- 6) Umlaut (") + -er (e.g. Mann/Männer 'man/men'; Feld-er 'field-s, where umlaut is not applicable)
- 7) X = singular and plural (e.g. Fenster 'window(-s)'; Spiegel 'mirror(-s)')
- 8) Umlaut (e.g. Mutter/Mütter 'mother(-s)'; Vogel/Vögel 'bird(-s)')

Types 1 to 5 are productive, types 6 to 8 unproductive.

- |                   |             |
|-------------------|-------------|
| II) Type of word: | a) simple   |
|                   | b) compound |
|                   | c) derived  |

In selecting items for the variables I) and II), the following variables were considered:

#### III) degree of productivity



IV) degree of morphotactic opacity/transparency

V) concrete versus abstract

The reactive naming tasks included subtests on:

- a) deriving adjectives from nouns, e.g.: Eifer ('eagerness') → eifrig ('eager'); Kind ('child') → kindisch ('childish');
- b) deriving nouns (Nomina Agentis) from verbs, e.g.: backen ('bake') → Bäcker ('baker'); jagen ('hunt') → Jäger ('hunter');
- c) deriving a diminutive (-chen, -lein, -erl) from a presented stimulus word, e.g.: 'What do you call a little house?' (German: kleines Haus → Häuschen);
- d) deriving a noun + suffix (-schaft = E.'-ity, -ship') from a noun, e.g.: Freund ('friend') → Freundschaft ('friendship'); Feind ('enemy') → Feindschaft ('enmity').

The stimuli for the lexical decision tasks were the words from the lists from the other tasks. Each list was copied and different items were changed on each list so that an item was a correct stimulus on one list and on the other the same item was made into a nonword, e.g.:

#### List 1

Sturm 'storm'

\*stürmig ('storm' + incorrect suffix)

stürmisch 'stormy'

#### List 2

\*Stürm (umlaut without suffix)

Sturm 'storm'

\*stürmlich ('storm' + incorrect suffix)

The word lists for lexical decision tasks consisted of correct words, foils chosen according to the aforementioned criteria, i.e. with incorrect plural forms or incorrect morphemes in the form of incorrect suffixes (e.g. -ig, -isch, -lich, -chen/-lein, e.g. \*kindig instead of kindisch 'childish' or \*Wolfe instead of Wölfe 'wolves' and non-morphological foils consisting of an exchange in one phoneme or one letter in the auditory and visual presentation, respectively.

## Subjects

Two subjects with Broca's aphasia were selected for each language. A standardized aphasia examination was given to all subjects to determine the type of aphasia and the degree of severity. The Aachen Aphasia Test (AAT) was given to the German-speaking subjects and the Western Aphasia Battery (WAB) to the Hungarian-speaking subjects. Analysis of the test results revealed Broca's aphasia for all subjects.



### German-speaking:

**H.R.** is a 58-year old righthanded female who suffered a stroke at the age of 45. She received 12 years of schooling and worked in a secretarial position prior to the birth of her three children. At the time she suffered her stroke she was a housewife. Initially she also revealed global aphasia which recovered into a mild to moderate Broca's aphasia. CT examination revealed a lesion in the left pre- and postcentral region which extended into the basal ganglia.

**H.P.D.** is a 52-year old righthanded male, with 12 years of schooling who was an electrician prior to his stroke at the age of 45. H.P.D. was tested for this pilot study 5-6 years post onset of the aphasia. Initially he had severe global aphasia which showed a slow, however steady recovery to a Broca's aphasia with a moderate to severe degree of impairment. He suffered an occlusion of the left cerebral artery resulting in global aphasia and with brachofacial hemisympomatic signs. CT examination reveals a large left hemisphere lesion from frontal to occipital areas.

### Overall German Results

The results for the various tasks are presented for each language separately. In the discussion section we contrast our preliminary results.

### Confrontation naming to picture material

	Total No. of words	Correct response	Semantic errors or Circumlocutory responses
H.P.D.	176	149	27
H.R.	173	168	5

### Plural formation:

	Total No. of Words	Correct Plural	Incorrect Plural Form Affecting			
			Type 4	Type 7	Type 1	Other Types
H.P.D.	210	156	13	9	9	25
H.R.	173	161	0	1	3	8

Six of the errors made by subject H.P.D. are umlaut errors, which are included in the other error type category:



Target	Response
Nase-n ('noses', Sg. Nase)	→ *Näse, *Näser
Jacke-n ('jackets', Sg. Jacke)	→ *Jäcken
Wasserhähn-e ('water-taps', Sg. Wasserhahn)	→ *Wässerhahne

For 10 items subject H.P.D. produced a plural instead of the singular form of the noun.

Characteristic examples of H.P.D.'s processing difficulties regarding the formation of plural forms are:

Target	Response
<b>Simple:</b>	
Kamera-s	→ 1-2 Kamera
Radio-s	→ *Radioe, 1-2 Radio
Kino-s ('cinemas')	→ 1-2 Kino ('1-2 cinema')
Baby-s	→ 1-2 Baby
Bäckerei-en ('bakeries')	→ 1-2 Bäckerei ('1-2 bakery')
Album-s	→ Albume
Hähn-e ('roosters', Sg. Hahn)	→ Hennen, Hahne ('hens, rooster')

**Compound:**

Einkaufskorb-e ('shopping baskets')	→ Korbe ('basket-s', without umlaut)
Glatzköpf-e ('bald-headed persons')	→ 1-2 Glatzkopf ('1-2 bald-headed person')
Spazierstöck-e ('walking sticks')	→ 1-2 Spazierstock ('1-2 walking stick')
Schneemänn-er ('snow men', Sg. Schneemann)	→ 1-2 Schneemann ('1-2 snow man')
Hotelgäst-e ('hotel guests')	→ 1-2 Hotels ('1-2 hotels')
Laubwäld-er ('green forests')	→ Wälder ('forests')
Strohhüt-e ('straw hats')	→ Strohhut 1-2, Hüte, Strohhut 1-2 ( 'straw hat 1-2, hats)

Thus subject H.P.D. circumvents his difficulties often by enumerating numbers preceding or following the noun (in the singular) for which a plural form is to be produced. This strategy is commonly used by H.P.D. also in natural conversation. (cf. Ahlsén et al. in press).

Subject H.R. is less impaired with regard to the formation of plural forms. Characteristic examples of her difficulties with the formation of the plural are:



**Simple:**

Kino-s ('cinemas')	→	Kino ('cinema')
Sofa-s	→	Sofa
Anzüge-e ('suits')	→	*Anzüge (no umlaut)
Form-en ('forms')	→	*Förmer (*" + er instead of -en)
Scheck-s ('checks')	→	*Schecke

**Compound:**

Reisescheck-s ('travellers' checks')	→	*Reiseschecke
Gastwirt-e ('innkeepers')	→	*Gastwirten
Schäferhund-e ('German shepherds')	→	*Schäferhunde (perseveration of umlaut)
Radiergummi-s ('rubber erasers')	→	Radiergummi

**Lexical Decision Tasks**

The lexical decision tasks are first analyzed in terms of broad categories followed by a finer breakdown.

The response categories for the lexical decision tasks are:

- 1 — a (real/correct) word is judged as such, i.e. correct
- 2 — a (real/correct) word is judged as false/incorrect, i.e. as a nonword
- 3 — a nonword is judged to be a nonword
- 4 — a nonword is judged to be a (real/correct) word

Response categories type 2 and 4 are errors and categories 1 and 3 reflect correct judgments.

**a) Lexical decision to auditorily presented stimuli — items read aloud :**

		Response categories			
	Total No. of stimuli	1	2	3	4
H.P.D.	573	335	6	216	5
H.R.	1034 <sup>+</sup>	706	4	319	8

<sup>+</sup> It was possible to present more stimuli to subject H.R. because she is less impaired. Both subjects show a good performance in judging whether a stimulus item is a word or not when the stimuli are presented orally.



## b) Lexical decision to visually presented stimuli — written items:

		Response categories			
		1	2	3	4
Total No. of stimuli					
H.P.D.	815	415	90	191	119
H.R.	1201	785	23	324	75

The results for the visual presentation of the stimuli, i.e. written words, the subjects show a diverging pattern of performance. Both subjects have more difficulty with this mode of stimulus presentation. Subject H.P.D. reveals a greater impairment in deciding whether a written stimulus is a word or not. In addition to his aphasia, subject H.P.D. also has a reading impairment which can be best characterized as deep dyslexia. Subject H.P.D. judged more (real/correct) words to be nonwords and he also tended to make real words out of nonwords, due to his inability to read nonwords — which is a characteristic symptom of deep dyslexia: subjects with this impairment cannot read nonwords. Either, they give no response for such items, *or* they make a real word out of a nonword stimulus.

Since Subject H.P.D. showed a greater impairment on the written version of this task we present a more detailed analysis of only his responses in terms of the form of the stimulus items. The stimuli included in this analysis are those which can be characterized in terms of the eight response categories given in the following tables. Non-word stimuli which were constructed by changing a single letter are excluded from this analysis, e.g.: *\*Bülle* which is derived from the real word stimulus *Bälle* 'balls'.

The stimuli (all nouns) are described and illustrated in terms of the following categories (S = simple, C = compound):

- 1 = real words (S, C) without umlaut, e.g. Kirchen 'churches', judged as correct, i.e. real words.
- 2 = real words (S, C) without umlaut, e.g. Kinos 'cinemas', judged as nonwords, as being incorrect.
- 3 = real words (S, C) with umlaut, e.g. Züge 'trains', judged as correct, i.e. real words.
- 4 = real words (S, C) with umlaut, e.g. Mäntel 'coats', judged as nonwords, as being incorrect.
- 5 = nonwords with umlaut, e.g. *\*Hünde* (correct: Hunde 'dogs'), incorrectly judged as being correct, i.e. real words.
- 6 = nonwords with umlaut, e.g. Oränge (correct: Orange-n, 'oranges'), correctly judged as nonwords, as being incorrect.
- 7 = nonwords without umlaut, e.g. *\*Traume* (correct: Träume 'dreams'), incorrectly judged as being correct, i.e. real words.
- 8 = nonwords without umlaut, e.g. *\*Sturme* (correct: Stürme 'storms'), correctly judged as nonwords, as being incorrect.



Analysis of H.P.D.'s performance with regard to these 8 categories reveals the following tendencies:

### Inflection:

Stimuli without an umlaut				Stimuli with an umlaut				Overproduction of umlaut		No Umlaut in stimuli requiring it	
1	2			3	4			5	6	7	8
+	-			+	-			+	-	+	-
S	C	S	C	S	C	S	C				
165	101	10	6	57	39	10	3	7	21	29	6

### Word Formation:

Stimuli without umlaut		Stimuli with umlaut		Overproduction of umlaut		No umlaut in stimuli requiring it	
1	2	3	4	5	6	7	8
+	-	+	-	+	-	+	-
68	20	96	36	18	10	33	16

Other stimuli from the word formation categories pertaining to the forms included in the derivational tasks (not involving umlaut) reveal the following pattern of distribution:

Correct stimulus judged as correct	Correct stimulus judged as nonword	Nonword stimulus judged as nonword	Nonword stimulus judged as correct
(a)	(b)	(c)	(d)
71	47	32	49

Examples of the stimuli include:

- (a) and (b): ehr+lich 'honest'; prakt+isch 'practical'; Vergangen+heit 'past';  
 (c) and (d): \*traur+isch (correct: traur+ig 'sad'); \*Offen+keit (correct: Offen+heit 'openness'); \*höf+ig (correct: höf+lich 'polite').

Another category not included in the above examples is one which we can best characterized as incorrect nonword plural forms, e.g.: \*Mäus+er (Sg. Maus, Pl. Mäus+e'):

Plural nonwords considered as correct forms	Plural nonwords considered as nonwords
51	9



In this group — as well as in the preceding word-formation group — the error affects the suffix or more accurately the last few letters.

Subject H.R.'s performance contains much fewer errors than H.P.D.'. It reveals a similar distribution of errors for the inflectional and the word formation stimuli. Incorrect judgments were made on the following types of stimuli:

Inflection: She considered stimuli lacking — but correctly requiring — an umlaut as correct and she also considered several of the incorrect plural forms correct.

Word formation: H.R. judged several of the correct and incorrect forms with a -keit/-heit suffix to be incorrect and correct respectively. She also had difficulties judging the incorrectness of the adjectives with an incorrect suffix, e.g. in the distribution of -isch/-ig/-lich.

For the various lists of visually presented stimuli H.R. showed an overall tendency (with regard to the inflection categories) to consider more nonword stimuli as real words, i.e. as correct forms. With regard to the word formation stimuli, H.R. judged more correct items to be nonwords than for the inflection stimuli.

### Reactive Naming:

The data obtained from the subjects on these tasks are more difficult to analyze for two reasons: 1) the tasks consisted of fewer items and 2) they were also more difficult to carry out in general. Subject H.P.D. had great difficulty *either* understanding exactly what was required of him *and/or* responding to the task items for the tasks a, c and d.

Several attempts resulted in discontinuing of the task during the trial examples. Subject H.R. understood the task instructions, however she tended to persevere particular forms within a task, particularly on the tasks of deriving adjectives from nouns.

#### a) Deriving adjectives from nouns (not only first response counted):

	No. of Items tested	Correct	Other suffix	Semantically related	No Response
H.R.	74	44	24	11	7
H.P.D.	44	9	1	24	7

More details:

- 1) Among the correct responses, there are more morphotactically transparent ones (i.e. without umlauting) than opaque ones (with suffix plus umlaut): H.R.: 29 vs. 15; H.P.D.: 6 vs. 3.
- 2) Although derivations with all the three suffixes -ig, -lich, -isch had approximately the same percentage of correct responses, shifts among suffixes (only H.R.) were asymmetrical: -ig was clearly preferred: -ig → -lich: 6 vs. -lich → -ig: 0; -isch → -lich: 2 vs. -lich → -isch: 1; -ig → -isch: 1 vs. -ig → -isch: 1.



- 3) Another type of morphological errors was replacement of -ig suffixations with more transparent compounds or prefixoids (H.R. 3 times, H.P.D once), e.g. Würde 'dignity' → würde-voll instead of würd-ig.
- 4) Another type of morphological errors consisted in excessive derivation (only H.R.), i.e. in the production of a noun derived from the target adjective (H.R. 10 times), e.g. Anstand 'decency' → Anständ-ig-keit instead of anständ-ig. This preference for noun responses appears also in repetition of the simplex noun (H.R. 3 times, H.P.D. twice) and in the production of semantically related nouns (H.R. 4 of 10 substitutions, but H.P.D. only 1 of 24).
- 5) A final type of morphological errors consisted in the avoidance of opacifying allomorphic or suppletive modifications (only H.R.), e.g. Patriarch → \*patriarch-isch instead of patriarch-al-isch (H.R. 5 times).

**b) Deriving nouns (Nomina Agentis) from verbs:**

	No. of items tested	Correct	No Response (+incomplete)	Semantically Related	affix omitted	other errors
H.R.:	27	25	1	1	-	-
H.P.D.	27	9 (+3 in self-correction)	1 (+ 1)	6	2	5

Examples of semantically related words produced by H.P.D. are: Kläger 'prosecutor' → Richter 'judge'; Treiber 'beater (in hunting)' → Bub und Feld 'boy and field' & Aufsichtsperson 'supervisor'; Jäger 'hunter' → Förster 'forest ranger'.

**c) Deriving a diminutive form from a presented stimulus word (S = standard suffixes -chen/-lein, R = regional -erl/-i):**

	No. of items tested	Correct		Wrong				No Response
		no umlaut		with umlaut		no umlaut		
		S	R	S	R	S	R	
H.R.	41	10	2	26	1	8	-	-
H.P.D.	27	7	2	1		1	1	13

No excessive umlaut was produced. The opacifying umlaut was not produced in 10 of 40 instance, e.g. Blume 'flower' → \*Blum-chen instead of Blüm-chen. Since the regional variants are much less umlaut-triggering than the standard ones, H.D.P.'s preference for the regional variants is also significant, e.g. Katze 'cat' → Katz-erl instead of Kätz-chen.



d) Deriving a noun + suffix ('-schaft') from a noun:

	No. of Items tested	Correct	No Response	Inadequate or Incomplete response
H.R.	17	11	2	4
H.P.D.	17	6	1	10

Examples produced by H.R include the following:

Kundschaft 'customership'	→	Mitgliedschaft 'membership'
Hochschülerschaft 'student body'	→	Hochschulschaft (without umlaut and interfix)
Gesellschaft 'society'	→	Gesellenschaft 'apprenticeship'

H.P.D. produced the following responses:

Verwandtschaft 'kinship'	→	Freundschaft 'friendship'
Gemeinschaft 'community'	→	Freundschaft
Mannschaft 'team'	→	Arbeitsgemeinschaft 'working group'
Gesellschaft 'society'	→	Clan
Mitgliedschaft 'membership'	→	Eintrittskarte 'entrance ticket'

### Word repetition

Both subjects showed minimal articulatory difficulties in repeating the stimuli from the various word lists. Multisyllabic, multimorphemic items resulted in more self-corrections. H.P.D. showed a tendency to omit prefixes in repetition tasks parallel to his impairment in reading aloud, e.g. ver-sprechen 'to promise' → sprechen 'to speak' (with omission of inseparable verb prefix).

### Word Reading — Reading aloud

Subject H.R. had minimal difficulties reading aloud the stimulus items. These difficulties were due to the phonological structure of the stimulus items — multisyllabic, multimorphemic, stimuli were more difficult for subject H.R. to read without minor articulatory difficulties. Subject H.P.D.'s reading impairment — deep dyslexia — will be discussed in detail in a forthcoming paper on a corpus of 6,000 words. For the present study, H.P.D.'s difficulties in reading aloud words can be summarized as follows:

a) monomorphemic concrete words were read relatively well by H.P.D. The errors with these stimuli consisted in the production of a semantically related target word.



b) H.P.D. could not read aloud nonwords; nonwords were produced as, i.e. were changed into, real words, e.g.: \*Schune → Schuhe 'shoes'.

c) prefixes and suffixes were omitted in multisyllabic, multimorphemic items, e.g. Entschuld-ig-ung 'excuse' → Schuld 'guilt'.

## C. Hungarian

Since main properties of Hungarian morphology already have been confronted with German morphology in the beginning of section B, we start immediately with a description of those features of Hungarian morphology (cf. Abondolo 1988, Pléh 1992, 1994):

### Tested Features of Hungarian Morphology

#### I. Types of Plural Formation:

The nouns belonged to three maximally distinct groups (of five), i.e. I—III—V. The three groups exhibit the following properties:

group I: singular:	[stem] [patkó] 'horseshoe'	plural:	[stem] + [K] [patkó-k]
group III: singular:	[stem] [virág] 'flower'	plural:	[stem] + [epenthetic vowel + K] [virág-ok]
group V: singular:	[stem] [eper] 'strawberry'	plural:	[bound stem] + [epent.v + K] [epr-ek]

#### II. Derivational Morphology:

The suffixes -os/-es/-ös/-s; -ság/-ség; -i; -ó; -i (diminutive) were examined:

The **suffix -os/-es/-ös/-s** (lexical variant **-as**) is multifunctional: it may be used as a **denominal noun suffix** to express names of professions (1), collective nouns (2), names of numerals (3):

- |     |                  |   |                           |
|-----|------------------|---|---------------------------|
| (1) | bolt 'shop'      | → | bolt-os 'shopkeeper'      |
| (2) | gyümölcs 'fruit' | → | gyümölcs-ös 'fruitgarden' |
| (3) | négy 'four'      | → | négy-es 'number four'     |

Used as a **denominal adjectival suffix** it forms an adjective from a noun. This is the function that was examined. The derivative expresses the meaning: "Sg. supplied with the object that the noun denotes":



felt 'patch'	→	felt-os 'patched'
kerék 'wheel'	→	kerek-es 'supplied with wheels'
hó 'snow'	→	hav-as 'snowy'

The suffix **-ság/-ség** as a **deverbal suffix** is rare but some examples can be found. The derivative is an abstract term:

fárad 'to tire'	→	fárad-ság 'tiredness'
siet 'to hurry'	→	siet-ség 'hurry'

As a **denominal suffix** the suffix is frequent and productive. It appears with numerals, adjectives and nouns which are suitable to express abstract terms or properties:

egy 'one'	→	egy-ség 'oneness'
jó 'good'	→	jó-ság 'goodness'

Added to certain adjectives it expresses a state or a collective noun:

beteg 'sick'	→	beteg-ség 'disease'
fiatal 'young'	→	fiatal-ság 'youth'

The **denominal suffix -i** (with allomorph -csi) has a diminutive sense. It is attached to the truncated or whole nominal stem. The use of this diminutive sense has always a colloquial touch (cf. Dressler & Kiefer, 1990):

óvoda 'kindergarden'	→	ov-i
pulóver 'pullover'	→	pul-csi
sün 'hedgehog'	→	sün-i

The function of the homophonous **suffix -i** is to form an adjective from a noun. In this case the sense of the derivative is "Sg. belongs to Sg." or a "characteristic feature of Sg.". We tested both functions with patients in the experiment:

kert 'garden'	→	kert-i 'garden-'
Amerika 'America'	→	amerika-i 'American'

The **suffix -ó/-ő** forms denominal and deverbal nouns with the meaning "someone or something connected with what the word stem denotes". The deverbal derivatives belong to the class that is termed as "someone or something that performs the activity denoted by the verb". Most of them are of the agentive type. The subject may be animate or inanimate:



---

Agent nouns:	tanít 'he is teaching'	→	tanít-ó 'teacher'
	ír 'he is writing'	→	ír-ó 'writer'
Instruments:	fúr 'he is drilling'	→	fúr-ó 'drill'

While deverbal derivatives are mainly, but not exclusively agents or instruments, in some cases the derivative refers to a place, e.g. ebédl-ő means "the place where normally people eat". These forms are lexicalized.

The basic function of the suffix -ó is to form a participle expressing a continuous state or action as a property of someone or something:

al-szik 'he is sleeping'	→	al-v-ó 'sleeper, sleeping person'
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### **Hungarian-speaking Subjects:**

Two patients were examined in this study. According to the Western Aphasia Battery they were Broca's aphasics.

**K.L.** is a 28-year old woman, righthanded, left hemisphere lesion; Broca's aphasia; three years past-onset. CT scan shows ischemic infarct in the left temporal lobe. Comprehension of spoken language was intact. In spontaneous speech elicited by an interview about her life and plans she produced non-fluent speech. Reading aloud was examined at word and sentence level. Both levels were severely impaired.

**K.T.** is a 17- year old righthanded man. He was one year post-onset, He left hemisphere lesion. CT scan revealed a tumor in the left parietal and temporal region. His spontaneous speech was non-fluent and agrammatic. Comprehension of spoken language was relatively intact. His reading aloud was impaired at the sentence level.

## **1. Confrontation Picture Naming and Plural Formation Errors**

A picture naming task was applied. Ninety pictures were presented to the patients and they had to name them and form adequate grammatical plural forms. 30 simplex and 60 compound nouns were shown to the patients. There were 10 transparent and 10 opaque ones in all three noun types. When recalling the forms from the mental lexicon by using phonemic cues naming errors were identified.

### **a) Substitution of the plural suffix -ak by the allomorph -ok (wrong epenthetic vowel):**

Most errors were found in the morphotactically less transparent groups III and V. The nouns in group III receive a low-vowel instead of a mid-vowel suffix (and, of course according to Hungarian vowel harmony). Certain stems are marked by the feature [+lowering] in the mental lexicon. These stems get a suffix **-ak** which is the marked case instead of the unmarked case -ok (corresponding to the palatal allomorph -ek). Our patients



exhibited considerable uncertainty in the selection of the suitable suffix. Patients often produce the grammatically marked forms with difficulty and were found to substitute ungrammatically -ak (morphonologically irregular epenthetic vowel /a/) with -ok:

- Sg. kávéház 'coffee house' (Pl. kávéház-**ak**) → \*kávéház-**ok**  
 Sg. tűsarok 'high heel' (Pl. tűsark-**ak**) → \*tűsark-**ok**  
 Sg. cipősarok 'shoe heel' (Pl. cipősark-**ak**) → \*cipősark-**ok**

In the second and third example (which belong to group V) the the root of the second component of the compound sarok (with Pl. -**ak**) is homophonous with the simplex sark 'pole of earth' (e.g. 'south pole') with the Pl. suffix -ok; here the plural of this homophonous root is used instead of the correct one.

#### b) Substitution of the plural suffix by the diminutive suffix -ka/ke:

The patients made no mistakes on the auditory presentation of the plural nouns with regard to their being grammatical or not. Phonological similarity dominated this type of error, insofar as the plural suffix -e/o/ak was substituted by the diminutive suffix -ka/e, as in:

- Sg. gomb 'button' (Pl. gomb-**ok**) → gomb-**ka** 'a little button'  
 Sg. perec 'pretzel' (Pl. perec-**ek**) → perec-**ke** 'a little pretzel'

#### c) Ignoring stem change

We ranged the nouns which undergo stem—shortening (the last stem-vowel is eliminated in plural formation) in group V. One cannot predict stem shortening on the basis of the stem structure, since one finds stems of similar structure with or without stem—shortening in plural formation, as in:

- |  |   |
|--|---|
| sereg 'army' → Pl. sereg- <b>ek</b>    | vs. nyereg 'saddle' → Pl. nyereg- <b>ek</b> |
| gyerek 'child' → Pl. gyerek- <b>ek</b> | vs. berek 'grove' → berk- <b>ek</b>         |

The unmarked case is the [stem + K] form whereas the marked case is the shortened form. In the course of the examination, the patients often regularized the irregular form, i.e. the suffix -ak/-ok/-ek/-ök was attached to the whole stem, without the opacifying operation of final stem-vowel drop, i.e. it was difficult for them to produce the marked, opaque case.

- Sg. eper 'strawberry' (Pl. epr-**ek**) → \*eper-**ek**  
 Sg. kazal 'rick' (Pl. kazl-**ak**) → \*kazal-**ak**

A similar phenomenon can be observed in language acquisition when the child applies a regular rule to an irregular form. The case of aphasic patients also shows that they apply a frequent and regular rule to an irregular and marked case.



It is worth pointing out that most errors were found in group V in the lexical decision task in which the ungrammatical forms were considered to be correct. Plural formation within group I nouns did not cause any problem for the patients, because in this case the suffix is attached to the stem in a morphotactically transparent manner without an epenthetic vowel.

#### d) Reconstruction errors

In this task of producing a Sg. form from the stimulus Pl. form, we found a remarkable phenomenon, namely, that the patients were unable to reconstruct appropriate singular forms from grammatical plural forms, especially in the case of group V nouns. The patients could separate the plural suffix but they did not find the grammatical stem, and the bound stem was used as a free one:

Pl. *körm-ök* (Sg. *köröm* 'nail') → csak nem tudom, hogy ..egy ..egy \**körm* ..*körmök* ..nem ..\**körm* 'I do not know that ..one ..one nail ..nails ..no ..nail'

Pl. *szélmalm-ok* (Sg. *szélmalm-om* 'windmill') → \**szélmalm*...

#### e) Compensation strategies

Different strategies were used to express the suitable content when the patients recognized that the recalled form was inadequate. One of these strategies was the substitution of a plural suffix with a plural possessive ending, as in:

Sg. *földgömb* 'globe' (Pl. *földgömb-ök*) → *földgömb-ei* 'her globes'

Sg. *cipősarok* 'shoe heel' (Pl. (*cipő*)*sark-ak*) → (*cipő*)*sark-ai* 'her heels'

Another strategy was to put an indefinite numeral before a singular noun, as in:

Sg. *patkó* 'horseshoe' (Pl. *patkó-k*) → \**sok patkó* 'lit. a lot of horseshoe'

Sg. *fészek* 'nest' (Pl. *fészek-ek*) → \**sok fészek* 'lit. a lot of nest'

## 2. Semantic errors

As regards the nature of the (confrontation) naming task, also semantic errors were found which occurred already in the initial naming tasks of the singular forms. These errors fall into three classes irrespective of the type of the noun.

a) The patient selects an item from the semantic frame of the target.



álarc 'mask'	→	álarcosbál 'masked/fancy-dress ball'
torony 'tower'	→	toronydaru 'tower crane'

The patient may also decompose the meaning of the target irrespective of whether the target is transparent or opaque, as in:

gólyafészek 'stork nest'	→	egy kelep, gólya, annak is a kölyke 'one clatter (non-existent deverbial noun), a stork, its young one'
csalétek 'lure'	→	kenyér 'bread', horog 'hook'
tanterem 'school'	→	iskola, gyerek, tanár tanul 'school, child, teacher, he is learning'

b) In the case of a compound, the first constituent recalled is not necessarily the first one in order. The choice cannot be predicted from the structure of the compound, it seems to depend on saliency (e.g. frequency), although also some counter-examples were found. If only one of the constituents is produced instead of the whole compound, there is no preference for the head:

szemét-lapát 'dust pan'	→	seprűk 'brooms', szemét 'dirt'
ház-tető 'house-roof'	→	ház 'house'
lámpa-ernyő 'lampshade'	→	lámpa 'lamp'
gólya-fészek 'stork nest'	→	gólya 'stork'
kocka-cukor 'cube sugar'	→	cukor 'sugar'
szél-malom 'windmill'	→	malom 'mill'

### 3. Analysis of word-formation processes (derivational morphology):

#### Derivational task

The derivational task consisted of sentence completion with derived forms. The underived forms were given to patients as stimuli, and they had to produce the target derived forms (all to be formed with the suffixes described above) and to complete an incomplete sentence with these derivatives. The total number of target forms was 67 of which 60 were morphosemantically transparent and 7 opaque. In the case of the diminutive suffix *-i*, patients had to form the diminutive form of nouns.

Much fewer errors were found in the production of derivatives than in plural formation. One of the possible explanations is that in this kind of task the processing of (lexical) semantic information, too, is necessary while in plural formation it is syntactic information that is needed. The damage of the latter is primary in the case of our patients. This is supported by their spontaneous speech analysis, where a lot of ungrammatical syntactic



structures were found. Their accomplishment in the derivation task may be influenced by the fact that the category of the nouns changed during the process (with the exception of morphosemantically transparent diminutives) and so the derivative is also represented as an independent, single lexical item. In many cases, e.g. in deverbal nominalization (derivation of *Nomina Agentis*), the derivatives have unpredictable word meanings in respect to their bases, e.g. 'writer, teacher' vs. "one who habitually/typically writes/teaches", thus their meaning is lexicalized. As a result, recalling these whole derived word forms is easier than recalling the complete inflected forms, which are produced by the operation of a morphosemantically transparent inflectional rule. Furthermore it was easier to produce morphotactically more transparent complex words than more opaque ones. The morphological errors were similar to the errors found in the case of plural forms.

### 1) Types of morphotactic errors:

Wrong epenthetic vowels were produced in marked cases (similar to plural formation), as in:

stimulus: vonal 'line', target vonal-as 'lined' → \*vonal-os

In the case of vowel alternating stems, the suffix was attached to the stem without stem alternation (final vowel lengthening), as in:

mazsola 'raisin', target adjective: mazsolás → \*mazsola-s

A characteristic error of irregular (weakly suppletive) derivation is that the marked forms are substituted with unmarked ones, derived through a productive rule, as in:

hó 'snow', target adjective: hav-as 'snowy' → \*hó-s

tó 'lake', target adjective: tav-as → \*tó-s

We did not find substitutions with another suffix, but it happened that a suffix was omitted or that an idiom was used instead of the target adjective, as in:

por 'dust', target adj.: por-os 'dusty' → por 'dust'

falt 'patch', target adj.: falt-os 'patched' → falt hátán falt 'patch everywhere patch'

### 2) Types of semantic errors

2a) The patient selects an item from the semantic frame of the target. In such cases the suffix often corresponds to the suffix of the target:

hegy 'mountain', target: hegy-ség 'mountain range' → domb-ság 'hill range'

bíró 'judge', target: bíróság 'court of justice' → tárgyal-ás 'trial'



rendőr 'police-man', target: rendőr-ség 'police'	→	börtön 'prison'
rab 'captive', target: rab-ság 'captivity'	→	munka 'work'
toll 'feather', target: toll-as 'feathery'	→	kár (sound produced by a car)

2b) In some cases negations were used to express, by way of a circumlocution, the adequate meaning of the target:

vonat 'line', target: vonat-as 'lined'	→	nem kockás 'not squared'
logika 'logics', target: logika-i 'logical'	→	nem logikátlan 'not illogical'
hegy 'point', target: hegy-es 'pointed'	→	nem gömb 'not (a) ball'

2c) A synonym of the target was used in two cases, as in:

izom 'muscle', target: izm-os 'muscular'	→	erős 'strong'
--	---	---------------

2d) The patient decomposes the semantic content, as in:

ló 'horse', target: lov-as 'on horseback'	→	ló, ember 'horse, man'
---	---	------------------------

### 3) Errors with diminutive suffix:

With the diminutive suffix -i we found several interesting ungrammatical forms, such as:

óvoda 'kindergarten', dim. target: ov-i	→	*óvod-i
sündisznó 'hedgehog', dim. target: süni-i	→	*sündiszn-i, *sünci
fej 'head', dim. target: fej-ecske	→	*fej-i
tej 'milk', dim. target: tej-ecske	→	*tej-i

There are two suffixes -i in Hungarian: (i) one suffix forms adjectives from nouns, e.g. ház → ház-i 'home → home-made', in which case it expresses "Sg. belongs to Sg.";

(ii) there is a homophonous diminutive and hypocoristic suffix, as in Pál 'Paul' → Pál-i. In its diminutive function, its morphosemantic meaning is synonymous with that of other diminutives such as -csi in pulóver 'pullover' → pulcsi or -ecske/-acska.

The first case is a prototypical derivational suffix, it is productive and is added, in the unmarked case, to the full base word. The second case, the homophonous diminutive suffix, is a non-prototypical suffix, because it involves (not fully predictable) truncation of its base (for further reasons, why it is non-prototypical, see Dressler & Kiefer 1990, Dressler & Merlini Barbaresi 1994). In the case of \*sündiszn-i and \*óvod-i, the patient did not truncate sufficiently. The two other instances cited above are ungrammatical, because the nouns fej and tej cannot be affixed with -i, but only with the diminutive suffix -ecske/-acska, which is more prototypical than the former and is attached to the full base form. The above errors



indicate that the patients are moving along a typicality scale while they were applying, within a test of derivational morphology, the more prototypical derivational operations.

#### 4. Analysis of the results of the lexical decision task

Both grammatical and ungrammatical plural and derived forms were mixed in this task (the total number was 344, of which 172 were ungrammatical and 172 grammatical). The stimuli were presented auditorily to the subjects, and they had to state whether the stimulus was grammatical or not. The stimuli were presented only auditorily because they both suffered from a severe reading impairment.

##### Types of ungrammatical forms:

simplex base	ungrammatical derived form	grammatical derived form
<b>a) Ignoring stem-final vowel drop:</b>		
alkalom 'occasion'	*alkalom-i	alkalm-i 'occasional'
<b>b) Ignoring stem alternation:</b>		
hó 'snow'	*hó-s	hav-as 'snowy'
<b>c) vowel harmony errors:</b>		
katona 'soldier'	*katona-ség	katona-ság 'armed forces'
<b>d) Insertion of an extra epenthetic vowel:</b>		
patkó 'horseshoe'	*patkó-ak	Pl. patkó-k
<b>e) Omission of an epenthetic vowel:</b>		
perec 'pretzel'	*perec-k	Pl. perec-ek
<b>f) Errors in the choice of the epenthetic vowel of the suffix:</b>		
kávéház 'coffee house'	*kávéház-ok	Pl. kávéház-ak



### Actual errors in the lexical decision task:

#### 1. The ungrammatical form is regarded as grammatical:

singular	accepted ungrammatical plural	correct plural form
oroszlánkölyök 'lion cub'	*oroszlánkölyök-ök	oroszlánkölyk-ök
étterem 'restaurant'	*étterem-ek	étterm-ek
ököl 'fist'	*ököl-ök	ökl-ök
selyem 'silk'	*selyem-ek	selym-ek
zsebkendő 'handkerchief'	*zsebkendő-ek	zsebkendő-k
patkó 'horseshoe'	*patkó-ak	patkó-k
base	accepted ungrammatical derivation	correct derived form
korom 'smut'	*korom-os	korm-os 'smutty'
gyapjú 'wool'	*gyapjú-s	gyapj-as 'wooly'
szorgalom 'assiduity'	*szorgalom-i	szorgalm-i 'voluntary (task)'
forgalom 'traffic'	*forgalom-i	forgalm-i 'traffic (jam)'
lakodalom 'wedding'	*lakodalom-i	lakodalm-i 'bride procession'

#### 2. The grammatical form is regarded as ungrammatical:

singular	grammatical plural
csalétek 'bait'	csalétk-ek
szénakazal 'haystack'	szénakazl-ak
zsiráf 'giraffe'	zsiráf-ok
base	grammatical derivation
falt 'spot'	falt-os 'spotted'

Eleven ungrammatical plural forms were accepted as correct forms: 5 of these belong to group V, 2 to group I. The patients accepted those forms in which the base was kept in a morphotactically transparent ways, i.e. either where it was not shortened (vowel drop) or where the epenthetic vowels in the -ok/-ak suffix were even added after base-final vowels. Decisions regarding ungrammatical derivations were analogous.



## D. Conclusions

As stressed in the introduction, the data discussed in this paper stem from a pilot study. Therefore, our conclusions will be brief. Although the comparative results must remain tentative, the following points merit discussion and will undergo a more indepth investigation. These include in regard to the theory of Natural Morphology, specifically to its two subtheories of universal markedness theory and typological adequacy:

1) As seen in earlier studies (e.g. Dressler & Stark 1988), the most natural options on the universal preference parameters of constructional diagrammaticity, morphotactic and morphosemantic transparency explain the error patterns of both the Hungarian and the Austrian aphasics investigated. They make less errors with morphotactically fully transparent concatenative morphology than with allomorphs involving less diagrammatic operations of modification and morphotactic opacity (such as German umlaut or Hungarian vowel drop). And the prevailing direction of errors is from morphotactically less transparent towards more transparent forms. Selection errors are, predictably, easier in morphosemantically more transparent inflection than in morphosemantically more opaque derivational morphology.

2) Where the universal preference for constructional diagrammaticity and morphotactic transparency is reflected by language-specific patterns of system-adequacy, i.e. where the most diagrammatic and transparent rules are also the most regular and productive ones, the same argumentation can be made for the importance of language-specific markedness: unmarked rules are better handled than marked ones, and marked morphological constructions are much more often replaced by unmarked ones than vice-versa. So far we have found no clear cases where the predictions of universal and language-specific markedness diverge — with the exception of Hungarian vowel harmony, our next point.

3) Whereas morphotactic opacity renders morphological constructions, in all types of tasks, more difficult to both Austrian and Hungarian aphasics (see above), morphonological and thus morphotactically opacifying vowel harmony appears to pose no problem to Hungarian aphasics: in fact, our two Hungarian patients made no errors with regard to vowel harmony. The important difference between vowel harmony and all other types of less diagrammatic and morphotactically opacifying operations in Hungarian and German consists in the typological property that Hungarian is an agglutinating language and that vowel harmony is type adequate in agglutinating languages in its culminative function of indicating the domain of a word.

4) Our two Austrian aphasics made relatively more errors in the area of derivational morphology than our two Hungarian aphasics. This is compatible with the property of agglutinating languages that their derivational morphology is more natural on the above-cited three universal preference parameters than is the case in the inflecting-fusional language type to which German belongs predominately.

5) Both in German and Hungarian, our aphasics made more errors with diminutives, a non-prototypical category of derivational morphology, than in the investigated areas of more prototypical derivational morphology. This fits to the, partially, transitional character of diminutive formation between derivation and inflection and to the above-cited greater susceptibility to impairment of inflection than derivation, at least in Broca's aphasia.

These tentative linguistic conclusions need solid embedding in psycholinguistic and particularly neuropsycholinguistic theory and methodology. We must leave this implicit here, both for reasons of space and because our pilot study has shown many problems in the



elaboration and application of test designs to the effect that the results of our pilot study have not yet achieved the goals of optimal crosslinguistic comparability and statistical significance. In the current continuation of our East-West project we hope to be able to achieve much more solid results.

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**Note:**

**\*\*** We would like to express our thanks to the Austrian Academy of Sciences and the Austrian Ministry of Science and Research (Vienna) for funding the research carried out for this pilot study. (East-West Project No. 062). We would also like to thank the Hungarian Academy of Sciences (Department of Linguistics, Budapest) and the Department of Psychology, in particular Dr. Csaba Pléh.



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