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PHONOLOGY IN AXIOMATIC FUNCTIONALISM

In a paper published in this journal (Bičan 2006) I introduced readers to a linguistic approach developed by Jan W. F. Mulder and Sándor G. J. Hervej and known as Axiomatic Functionalism (henceforth: AF); I made a presentation of one of its components, the theory of sign. In this paper I want to continue with an exposition of the approach, focusing on another of its components: phonology. The structure of phonology in AF will be illustrated on a description of present standard Czech. It should be stressed that the following is an interpretation of the present writer which may differ from views of other axiomatic functionalists. Readers are encouraged to consult original works on phonology in AF (in particular Mulder 1968 and 1989).

Introduction

Phonology is probably the most developed sub-theory of AF. This should strike with no surprise because the whole functionalism—and AF is a functionalist approach—started in fact with phonology. The phonological theory of AF is in many respects based on phonology of a French linguist André Martinet which in turn owes much to phonological theory of the Prague School, namely of Nikolai S. Trubetzkoy. AF brings in and modifies hypotetico-deductivism of the philosopher Karl Popper (see Popper [1959] 2002), introduces formal methods and the use of set-theory in theory and description. As a consequence of rigid methodology and the overall structure of the approach, phonology in AF has in some considerable details developed further from Martinetian phonology. Yet, these two phonological theories have many things in common.

However, it is not only the theoretical side that has been minutely thought through. A theory, understood here as a set of models to be applied on particular phenomena, should in the first place serve as a tool for description, and AF has always aimed to produce consistent, adequate and simple descriptions. Their commendable advantage is the languages chosen. Unfortunately, many of these descriptions have to date remained unpublished and are available only in the

form of academic theses: a description of Arabic (Heselwood 1992), including Baghdadi Arabic (Said 1983), Kamali Arabic (Hadj-Hohammed 1976), a description of Eastern Libyan (Rakas 1981) and of Yulu (a Nilo-Saharan language; Gabjanda 1976). Yet several descriptions were published, though: of Pekingese Chinese (Mulder 1968), of San Martín Quechua (a Native American language; Howkins 1973, based on Howkins 1972) and of Sudanese Arabic (Dickins 2007). In addition, there are many partial descriptions focusing mostly on the inventory of phonemes and their distribution: of English (Mulder & Hurren 1968, also in Mulder 1989, Rastall 1993; see also Heselwood 1997, 2007, 2008, 2009), including Scottish dialects of Angus and Perthshire (Mulder 1974), French, Russian (both in Rastall 1993), of German, Japanese, Dutch and Thai (all in Mulder 1989). Moreover, the present writer is currently working on a full description of the phonology of Czech parts of which have already appeared or are imminent (Bičan 2008a, 2008c, 2009).

Structure of phonology

Phonological theory and description are distributed over three compartments: phonematics, phonotactics and para-phonotactics. Phonematics accounts for *unordered* systems of phonological entities and thus, crudely speaking, covers description of systems of phonemes as unordered bundles of distinctive features. On the other hand, phonotactics accounts for *ordered* systems of phonological entities, i.e. it deals with bundles of phonemes ordered into complexes called phonotagms (roughly: syllables). We may put it otherwise and say that phonematics deals with the paradigmatic aspect of phonemes in terms of their decomposition into distinctive features whereas phonotactics with the syntagmatic aspect in terms of the decomposition of phonotagms into phonemes. However, a description of these two aspects is generally not sufficient. Every natural language has an additional system of para-phonotactics. It covers features generally understood as prosodical or suprasegmental but is not limited to them. For one thing, it is given by the scope of phonotactics which operates only with single phonotagms, not their combinations. Since phonological forms of words are in most languages built of conglomerations of several phonotagms, it is upon para-phonotactics to account for such structures. Such conglomerations are united by certain features superimposed upon them (like accent or tones).

Phoneme

As was mentioned above, phonematics deals with unordered systems of phonological entities. Like in other structuralist approaches, the key notion is here *phoneme*. The phoneme is viewed as having two aspects: paradigmatic and syntagmatic. On the one hand, a phoneme is the maximum entity in phonematics and

is defined as a self-contained (and by definition unordered) bundle of one or more distinctive features as its immediate, and at the same time ultimate, constituents (see Mulder 1989: 443). By virtue of their mutual commutability (opposability) phonemes are analyzed into unordered bundles of distinctive features which express their distinctive function. From the syntagmatic perspective, a phoneme is the minimum phonotactic entity or the minimum syntagmatic entity in phonology, which means it is the minimum phonological entity capable of being ordered. Phonemes can be combined into ordered bundles—phonotagms—and enter, within these bundles, into mutual constructional phonotactic relations.

Every phoneme has a distinctive function given by the set of oppositions in which it may partake. The distinctive function and thus the identity of a phoneme are arrived at on the basis of a commutation test during which phonemes are analyzed into distinctive features. Phonemes enter into mutual oppositional relations which can be conveniently visualized in phoneme tables like the one for consonants in Czech (Fig. 1; note that there are two consonants standing outside the system of proportions: /j/ and /ʃ/; the affricates [ts] and [tʃ] are interpreted as single phonemes, see below). Phoneme tables are useful analytical devices showing the structure of a given phonological system and the way phonemes are decomposed into distinctive features (see Mulder 1980, Hervey 1984).

| | <i>occlusive</i> | | <i>constrictive</i> | | <i>nasal</i> |
|-----------------|------------------|---------------|---------------------|---------------|--------------|
| | <i>voiceless</i> | <i>voiced</i> | <i>voiceless</i> | <i>voiced</i> | |
| <i>labial</i> | p | b | f | v | m |
| <i>palatal</i> | tʃ | dʃ | š | ž | ň |
| <i>alveolar</i> | t | d | s | z | n |
| <i>velar</i> | k | g | x | h | |

Figure 1: Consonants of Czech

Distinctive features are not chosen from a pre-established set of universal distinctive features (such as a Jakobsonian one) and neither are they binary. They are first of all functional entities and their function is distinctive. If something is distinctive, it must distinguish something and so a feature can be regarded distinctive if, and only if, it distinguishes the phoneme it is part of from another one. For example, the phoneme /p/ is voiceless in Czech because it is not voiced (i.e. it is not /b/), it is labial because it is not palatal, alveolar or velar (i.e. not /tʃ/, /t/ or /k/) and it is occlusive because it is not constrictive or nasal (i.e. not /f/ or /m/). Thus /p/ is ‘voiceless labial occlusive’—in Czech. This stipulation is essential because the features are not universal but unique for every language as every language embodies a different set of oppositions between phonemes. On the other hand, the phoneme /m/ is neither voiceless nor voiced in Czech because the features ‘voiceless’ and ‘voiced’ do not distinguish anything in the case of nasal phonemes and cannot be distinctive for them. The phoneme /m/ is therefore ‘labial nasal’.

Hyperphoneme

The reader might have noticed that the phoneme /n/ stretches over two cells in Fig. 1. This is due to its having the status of *hyperphoneme*. A hyperphoneme is a phoneme consisting of, or containing, one or more hyper-features. A hyper-feature is defined as a “distinctive feature in a particular phonematic context, equivalent to two or more distinctive features in at least one other phonematic context” (Mulder 1989: 443). Even though these notions may be viewed with suspicion by some linguists, they are logically justified (see Mulder 1980 for explanation). They were introduced to do away with some logical deficiencies of traditional phoneme tables which contained an empty slot (or “case vide” as Martinet (1991: 205) called it). Such an empty slot would arise if the phoneme /n/ were defined as ‘alveolar nasal’. As there is no velar nasal in Czech, the slot for it would be empty. If unaccounted for, the gap would create an inconsistency and violate the functional principle (“the identity of anything we set in a linguistic description depends on its ‘distinctive function’”, see Mulder 1980: 104).

But let us suppose, as is traditionally done, that the phoneme /n/ is alveolar nasal and compare it to other alveolars /t/ and /s/. They are alveolar because they are not labial (i.e. not /p/ and /f/), not palatal (i.e. not /tʃ/ and /ʃ/) and not velar (i.e. not /k/ and /x/). In other words, occlusives and constrictives may be labial, palatal, alveolar or velar in Czech. However, as there is no velar nasal, nasals in Czech may be only labial, palatal or alveolar, so the phoneme /n/ would be alveolar because it is not labial (i.e. not /m/) or palatal (i.e. not /ɲ/). It should be obvious to the attentive reader that the value of the feature ‘alveolar’ (i.e. ‘non-labial non-palatal non-velar’) is different for the phonemes /t/ and /s/ than it is for the phoneme /n/ (i.e. ‘non-labial non-palatal’). If something is different, it cannot be the same and hence ‘alveolar’ cannot refer to the same distinctive feature in /t/ or /s/ as it does in /n/. We see that the characterization of /n/ in Czech as ‘alveolar nasal’ is logically defective as long as ‘alveolar’ is meant to be the same as ‘alveolar’ in /t/ ‘voiceless alveolar occlusive’. The introduction of the notions *hyperphoneme* and *hyper-feature* is one of the ways to mend this inconsistency. The phoneme /n/ is given the status of hyperphoneme and is defined as ‘alveolar/velar nasal’ where ‘alveolar/velar’ is a hyper-feature corresponding in the phonematic context ‘nasal’ to the distinctive features ‘alveolar’ and ‘velar’ in phonematic contexts ‘occlusive’ and ‘constrictive’. Though other phonemes could be assigned with the status of hyperphoneme, this is an adequate choice because /n/ is realized as an alveolar nasal [n] before alveolar /t/, /d/ but as a velar nasal [ŋ] before velar /k/, /g/, /x/ (/h/ is an exception). The result is the phoneme table in Fig. 1; it does not violate the functional principle.

Neutralization and archiphoneme

Functionalist phonology recognizes opposition as the basic relation in language system (see e.g. Trubetzkoy 1939: 60). With this notion is closely con-

nected another one: commutation; in AF it is defined as “alternation (or: choice) between semiotic entities (or ‘zero’ and semiotic entities) in functional opposition as immediate constituents, in a given context” (see Mulder 1989: 441). The definition says that commutation is an oppositional relation between entities in a given context. The context is here of crucial importance. A relation taking place in one context need not necessarily obtain in another context, i.e. it may be inoperative there. The inoperability or suspension of opposition in a given well-defined context is called *neutralization*. As a concept, neutralization has been operated with in many linguistic approaches, though it has been variously defined and generally, the only thing the multiple definitions have in common is the term *neutralization*.

Axiomatic functionalists and some other functionalists hold that the concept neutralization necessarily implies another concept: *archiphoneme*. An archiphoneme is an entity resulting from neutralization and occurring in a certain phonotactic context triggering the neutralization. It is defined as the intersection of the sets of distinctive features qua sets characterizing two or more phonemes in the other contexts. Being an intersection, an archiphoneme is logically included in the phonemes from which it results and is functionally equivalent (but not identical!) to these phonemes. It means that an archiphoneme is “a phoneme in a sub-system which, when projected into the over-all system, is represented there by two or more phonemes” (Mulder 1968: 114). It is a logical consequence of neutralization, which is itself implied from the concept of opposition (commutation). If there is an oppositional relation between two or more distinctive features characterizing certain phonemes in one context (context A), but the relation cannot be postulated in another context (context B), because the characterization is redundant there, it follows that the entity occurring in the context B cannot be equated with any of the phonemes of the context A. It follows from the definition of phoneme as a bundle of distinctive features.

It is a well-known fact that obstruents lose voicing word-finally in Czech and so only phonetically voiceless obstruents occur before a pause (cf. words *let* “flight” and *led* “ice”, both pronounced [lɛt]). It is a common practice to interpret them as realizations of voiceless occlusives and/or constrictives, i.e. to equate them with those phonemes occurring word-initially (cf. [tɛn] *ten* “that” and [dɛn] *den* “day”). However, this is inadmissible in functional phonology which is concerned with *values* and *functions* of linguistic objects. That something is similar does not mean it must have the same function. If the word-final [t] were interpreted as a realization of /t/, which is characterized by distinctive features ‘voiceless alveolar occlusive’, it would be logically absurd to say that the same phoneme occurs word-finally because the distinctive feature ‘voiceless’ is not distinctive in this context. The reader should recall that distinctive features are distinctive because they distinguish something, but the feature ‘voiceless’ would not have this capacity in the alleged word-final /t/ as it can never be confronted with /d/, i.e. with ‘voiced alveolar occlusive’. In other words, obstruents are always voiceless before a pause in Czech and so it is utterly redundant to characterize them

as ‘voiceless’. Consequently, the word-final [t] cannot be a realization of /t/ but of some other phonological entity—the archiphoneme /T/ defined as ‘alveolar occlusive’ and equivalent, in that context, to the phonemes /t/ and /d/ of which it is the intersection. The system of archiphonemes resulting from neutralization of an opposition between voiceless and voiced consonants is given in Fig. 2. The archiphonemes are phonologically neither voiceless nor voiced, though they may be realized as voiceless or voiced, cf. /pjeT kñiX/ *pět knih* ‘five books’, realized [pjɛt kɲix], and /pjeT žen/ *pět žen* ‘five women’, realized [pjɛd ʒɛn]. This is a matter of realization, though.

| | <i>occlusive</i> | <i>constrictive</i> | <i>nasal</i> |
|-----------------|------------------|---------------------|--------------|
| <i>labial</i> | P | F | m |
| <i>palatal</i> | Ṭ | Š | ň |
| <i>alveolar</i> | T | S | n |
| <i>velar</i> | K | X | |

Figure 2: Archiphonemes of Czech

Distributional unit

Let us now return to the syntagmatic aspect of the phoneme and move to phonotactics which deals with ordered systems of phonological entities. Phonemes are grouped into ordered complexes called *phonotagms*. The aim of phonotactics is to describe the distribution of phonemes within phonotagms, and for this purpose, a theoretical notion *distributional unit* is postulated as a model upon which the distribution could be completely and exhaustively described. Every phoneme in a phonotactic construction (i.e. in a certain self-contained complex of phonemes) is assumed to occupy a position. A position is a division within a phonotactic construction, such that in every such division a phoneme, as an immediate constituent of that construction, can stand and commute with other phonemes or with \emptyset (see Mulder 1989: 443). Alternatively, positions may be viewed as related in phonotactic relations, i.e. a phoneme via its position enters into phonotactic relations with other phonemes occupying other positions. Subsequently, distributional unit is a self-contained bundle of positions in phonology constructed in such a way as to account for the distribution of phonemes completely and exhaustively. It means a distributional unit contains as many positions as necessary for achieving such a complete and exhaustive description. One of the positions within the distributional unit is *nuclear*; it is such a position the other positions are dependent upon for their phonotactic function. The phonemes occurring in nuclear position are called *vowels*. The dependent non-nuclear positions are called *peripheral* or non-nuclear. Functional dependency is the most important phonotactic relation. Phonemes standing in non-nuclear position only are called *consonants*. For some languages it may be necessary to introduce a third class of

phonemes: *semiconsonants* or *semivowels* as phonemes capable of standing in both nuclear and non-nuclear position. Such a language is Czech which has two semiconsonants /r/ and /l/.

Fig. 3 provides an example of distributional unit in Czech together with phonemes occurring in particular positions (for details see Bičan 2009). The labels ‘pre2’, ‘pre1’ stand for two pre-explosive positions which are occupied by phonemes, only if one of the explosive (pre-nuclear) positions ‘e3’, ‘e2’ and ‘e1’ is filled with a phoneme. The ‘n’ stands for the nuclear position and ‘i1’, ‘i2’, ‘i3’ and ‘i4’ for implosive (post-nuclear) positions. The slots extending over more slots of another row represent archi-positions. An *archi-position* is a position equivalent to two or more positions. It is a parallel of the archiphoneme in phonematics; it results from suspension of a contrast (syntagmatic difference) between positions. Its introduction allows us to account for peculiar distributions of phonemes like /r/ and /d/ in Czech. These two phonemes cannot be, in the pre-nuclear context, followed by a phoneme other than a vowel, though they can be preceded by up to two phonemes belonging to the positions ‘pre1’ and ‘pre2’ (cf. /FSd’elanī/ *vzdělaný* ‘educated’ or /Kř’ini/ *křtiny* ‘Christening party’).

| pre2 | pre1 | e3 | e2 | e1 | n | i1 | i2 | i3 | i4 |
|---------|----------|---------|----|-------|---------|-------|-------|-----|-------|
| P T K | T S Š | kg | v | m n ň | aeio | m n ň | P T K | T S | K T Ṭ |
| F S Š | | x h | M | rl | u ā ē ī | | Š | ř | |
| X | ř | t d | ∅ | j ř | o ū ä | ∅ | ∅ | ∅ | ∅ |
| r l j M | ∅ | s z š ž | ∅ | ∅ | ě ö | r l j | F X | | ∅ |
| ∅ | ∅ | p b f | | ∅ | rl | ∅ | m n ň | | ∅ |
| | | t d’ | | | | | | | |

Figure 3: Distributional unit of Czech

Distributional unit is an underlying structure behind all phonotagms in a language. A phonotagm is an instance of distributional unit, i.e. an actual self-contained bundle of positions filled with a phoneme or with \emptyset (i.e. being empty). The term *syllable* could have been a convenient name for this notion, were it not for the danger of being confused with the phonetically defined notion ‘syllable’. Though there is generally a correspondence between a phonotagm and a phonic syllable because in many languages phonotagms are realized as single syllables, it need not be always and necessarily the case. Phonotagms may be realized by two or more syllables depending on whether the occurrence of one syllable or its components affects the occurrence of the other syllable(s) or its/their components. In other words, one of the syllables may be bound or dependent on another syllable. An example is the schwa [ə] in English: it occurs in unstressed syllables only and these are in turn distributionally dependent on the stressed ones. Phonotagms in English are thus sometimes realized by two or more syllables. A similar situa-

tion can in fact be found in Czech in the case of so-called side-syllables (Czech: *pobočné slabiky*) in words like *rty* “lips”, *lhát* “to lie”, *msta* “vengeance” or *jsem* “I am”. They are generally viewed as mono-syllabic, though it is admitted that the sonants [r], [l], [j] and [m] form secondary peaks of sonority if not genuine syllables. From the phonological perspective, however, these words correspond to single phonotagms with the phonemes /r/, /l/, /j/ and /M/ distributionally dependent on the vowels in the nuclear position (/M/ is an archiphoneme resulting from neutralization of an opposition between /m/, /n/ and /ň/). Fig. 4 gives examples of phonotagms in Czech.

| pre2 | pre1 | e3 | e2 | e1 | n | i1 | i2 | i3 | i4 | phonological form of |
|------|------|----|----|----|---|----|----|----|----|----------------------|
| F | S | k | v | j | e | ∅ | T | ∅ | ∅ | vzkvět “prosperity” |
| ∅ | ∅ | | b | ∅ | o | r | Š | T | Š | boršč “borsch” |
| ∅ | ∅ | ∅ | ∅ | n | e | ∅ | X | | ř | necht “may it be” |
| ∅ | ∅ | ∅ | ∅ | j | i | l | | m | | jilm “elm” |
| r | ∅ | t | ∅ | ∅ | i | ∅ | ∅ | ∅ | ∅ | rty “lips” |
| l | ∅ | h | ∅ | ∅ | ā | ∅ | T | ∅ | ∅ | lhát “to lie” |
| j | ∅ | s | ∅ | ∅ | e | m | ∅ | ∅ | ∅ | jsem “I am” |
| M | S | t | ∅ | ∅ | a | ∅ | ∅ | ∅ | ∅ | msta “vengeance” |

Figure 4: Phonotagms in Czech

One or two phonemes

There is one analytical problem bothering linguists for a long time. It is a question whether a sound or a group of sounds corresponds to one or two phonemes. Numerous solutions have been offered (e.g. Trubetzkoy 1939: 50–9, Martinet 1965) but they usually suffer from inefficient reliance on purely phonological criteria and recur to phonetic ones instead. A phonological approach should base its procedures on phonological criteria only, as the phonetic ones belong to phonetics, not to phonology. A functionalist approach should moreover use functional criteria only (see Mulder 1968: 28–30, Hervey 1972: 355–9). Above all, the functional evaluation of speech events should be based on the theory adopted for description. One should not slip to naïve phoneticism and think something is a single phoneme because it is a single sound. Essential is the function of the sound in a language system.

Whether a certain sound group corresponds to one or more phonemes, let alone whether a sound corresponds to a phoneme, must be decided solely on the grounds of the definition of phoneme in a given theory. Nothing can be a phoneme unless it complies with the definition of phoneme. In the present approach an entity is given the status of phoneme if, and only if, it can be defined in terms of an unordered bundle of distinctive features and if, and only if, it is, at the same time, capable of being orderable, i.e. if it is the minimum phonotactic entity. In the case of a group of two sounds $[s_1s_2]$, we are entitled to say they correspond to

two phonemes $/p_1p_2/$ if, and only if, both of $/p_1/$ and $/p_2/$ are decomposable into unordered bundles of distinctive features and capable of entering into ordering relations. As phonemes occur in positions within distributional unit, the capacity of being orderable means that two sounds $[s_1s_2]$ correspond to two phonemes $/p_1p_2/$ if it can be shown that at least one of the tentative phonemes is capable of standing in a different position within the distributional unit and thus to enter in a relation different to the one that applies for the construction $/p_1p_2/$. Put simply, we must show that the occurrence of either phoneme in a combination $/p_1p_2/$ is not wholly dependent on the occurrence of the other one. For this reason, in English, word-initial aspirated $[t^h]$ cannot be analyzed as a combination of two phonemes $/t/$ because word-initial $/t/$ would always be followed by $/h/$.

When evaluating the status of a group of two sound $[s_1s_2]$, we must start with a hypothesis that it does *not* correspond to an ordered group of phonemes $/p_1p_2/$, but to a single phoneme $/p_3/$, i.e. we must hypothesize it corresponds to a single unordered bundle of distinctive features. This hypothesis is to be put to test in an attempt to refute it by relevant empirical evidence, and only if we refute it, we can conclude $[s_1s_2]$ corresponds to a combination of two phonemes $/p_1p_2/$. However, if it withstands attempted refutation, we must conclude it corresponds to a single phoneme $/p_3/$, i.e. to one unordered bundle of distinctive features. The reason we hypothesize the absence of ordering relations is because such a hypothesis is simpler than its opposite—it is simpler to assume there is not something than to assume there is something. Only if the hypothesis of the absence of ordering relations is refuted, we can say that $[s_1s_2]$ corresponds to more than one phoneme. Every singular phoneme is, by definition, an unordered bundle of distinctive features and thus it cannot correspond to an ordered bundle. In practice such a hypothesis is usually refuted by finding the reverse combination $[s_2s_1]$ and by demonstrating that the reverse sequence is separately relevant. In most cases it will prove that the order of $[s_1]$ and $[s_2]$ is functional and so they correspond to two phonemes. In Czech a group $[ps]$ in e.g. $[psa:t]$ *psát* “to write” corresponds to two phonemes $/Ps/$ because the reverse combination $[sp]$ (in e.g. $[spa:t]$ *spát* “to sleep”) refutes the hypothesis of the absence of ordering relations. A slightly more complicated is the case of $[pt]$ in e.g. *ptát se* “to ask”: we do not find the reverse combination $[tp]$ but we can still analyze $[pt]$, on the basis of commutation test, as corresponding to $/Pt/$ because $/P/$ can be mapped onto a different position within the distributional unit and hence it enters into a different phonotactic relation with $/t/$, cf. $/pāT/$ *pád* “case” or $/tiP/$, *typ* “type”.

Thinking led along these lines has repercussions of the interpretation of the phonological system of Czech, namely on the status of affricates $[tʃ]$ and $[tʃ]$ and of diphthongs $[ɛu]$, $[au]$ and $[ou]$ but I will not go in details here (for which see Bičan 2008a). The affricates are interpreted as corresponding to combinations of two phonemes $/Ts/$ and $/Tš/$. Such an analysis is simpler than the one operating with two additional phonemes $/c/$ and $/č/$. First of all, however, it is in line with the principles outlined here: the combinations $/Ts/$ and $/Tš/$ can be readily confronted with the reverse combinations $/St/$ and $/Št/$ (realized as $[st]$ and $[ʃt]$)

and fit the pattern for the combinations of occlusives with /s/ and /š/ (cf. /Ps/, /Pš/, /Ks/, /Kš/ vs. /Sp/, /Šp/, /Sk/, /Šk/, all attested in Czech). On the other hand, the diphthongs [ɛu], [au] and [ou] must be interpreted as instances of single phonemes /ě/, /ö/ and /ä/, respectively. If we analyzed them as combinations /eu/, /au/ and /ou/, we would soon find out the tentative phoneme /u/ in these combinations does comply with the definition of phoneme because it lacks the capacity of being orderable. This is to say: we do not, in Czech, find the reverse combinations /ue/, /ua/ and /uo/ proving the capacity of /u/ being orderable within the framework of one phonotagm (roughly: syllable), as these combinations are always disyllabic. Consequently, diphthongal vowels are included in the phoneme table for Czech vowels, see Fig. 6.

| | front | | central | back | |
|-------------|-------|-----|---------|------|-----|
| | high | mid | | high | mid |
| short | i | e | a | u | o |
| long | ī | ē | ā | ū | ō |
| diphthongal | ě | | ä | ö | |

Figure 6: Vowels of Czech

Para-phonotactics

In the preceding, basic aspects of phonematics and phonotactics under AF have been outlined; we will now move to the last compartment of phonology and last part of this paper: para-phonotactics. Para-phonotactics lumps together so-called prosodic or suprasegmental features but it goes a way beyond these. Its function is to account for structures and relations that cannot be adequately accounted for in phonematics and particularly in phonotactics. Since a phonotagm is the most complex and the maximum entity of phonotactics, para-phonotactics accounts for combinations of phonotagms; they, together with accompanying para-phonotactic features, assume an identity of their own on the level of para-phonotactics. Para-phonotactic features are not only features traditionally associated with changes of pitch, length or intensity but also features determining the order of phonotagms in phonological forms. Phonological words are often built of conglomerations of two or more phonotagms but one should not be misled into thinking that if speech is by necessity linearly ordered, their order is purely realizational and not functional. Para-phonotactic features determine the way phonotagms are ordered. Let us take as an example a phonological form /masa/ of a Czech word *masa* “mass”. It is built of two phonotagms. Their arrangement is, however, not a matter of realization but is functional, for if it were otherwise, the phonological form /masa/ would not be different from /sama/, a form of a word *sama* “alone”. Para-phonotactic features therefore determine the order of phonotagms when gathered into a higher-level entity, and it is moreover a function of para-phonotactic fea-

tures to gather and unite them into such an entity. There are yet other functions of para-phonotactic features.

The higher-level entities are called *para-phonotactic entities*; they may be either simple or complex but the latter are ultimately analyzed into simple ones. A para-phonotactic entity consists of a *base* and *para-phonotactic features* which are features that accompany, but not determine, the identity of the respective base. In the case of simple para-phonotactic entities, the base corresponds to phonotactic entities, either to a single phonotagm or several of them. In the case of complex para-phonotactic entities, the base corresponds to two or more para-phonotactic entities. So a complex para-phonotactic entity is a group of two or more para-phonotactic entities upon which additional para-phonotactic features are superimposed. Two types of para-phonotactic features are recognized according to the function they fulfill: distinctive para-phonotactic features and contrastive para-phonotactic features, and within these we can differentiate between several kinds.

The function of contrastive para-phonotactic features is that of groupment over and above phonotactic or para-phonotactic groupment. In other words, contrastive para-phonotactic features are those features that give unity to the base they accompany. If the base is simple, the function is trivial because the base has already its unity by virtue of being simple, but if the base is constituted by several entities, the function of contrastive para-phonotactic features is to group them under one structure. Depending on the situation in a particular language we can speak about two kinds of contrastive para-phonotactic features: *accent* and *juncture* (or *diaereme*; see Bičan 2008c). The function of accent is to gather entities into higher-level groups which may be conveniently called *accent groups*. Two or more accent groups may be in turn gathered by another accent into yet higher-level groups, so we can have accent groups which may be called *word-accent groups*, *phrase-accent groups* or *sentence-accent groups*. The function of juncture (or *diaereme*) is very similar to that of accent: it also gathers phonological entities into a higher-level unit but this time by virtue of indicating boundaries of the unit, which function is not inherent in accent. This higher-level entity may be called *diaereme group*.

As a way of illustration let us assume phonotagms /na/, /ho/ and /ře/ in Czech. If we leave out the order-determining features, they may be gathered into several *diaereme groups*, say, to /#na#, /#hoře# or /#nahoře# (‘#’ standing for *diaereme*). The function of *diaereme* is in fact trivial in the case of /#na# because its base is a simple phonotagm and it has already its unity. The function of *diaereme* is, however, not trivial in the case of /#nahoře#: first of all, its base corresponds to a conglomeration of three phonotagms united together by *diaeremes*, but more importantly, /#nahoře# is something else than /#na# plus /#hoře#. If the latter is united into a group by *accent*, it produces /#na#hoře# (accent groups will be underlined here), which is a phonological form of *na hoře* “on a/the hill”, whereas /#nahoře# is a form of *nahoře* “above, up on” (note that here the *accent group* and *diaereme group* coincide but this is not a rule in Czech).

Now distinctive para-phonotactic features are those features that are in a relation of direct opposition with one or more para-phonotactic features or with \emptyset , i.e. there is a commutation between these features. I have already mentioned the feature determining the order of phonotagms; this is also a distinctive para-phonotactic feature. Another example is tones in tone languages like Mandarin Chinese where a phonotagm /ma/ can be accompanied by four different, and mutually commutable, tones, thus /ma¹/ is a phonological form of a word meaning “mother”, /ma²/ a form of “hemp”, /ma³/ of “horse” and /ma⁴/ of “to scold”. At this point a difference should be drawn between tones and (sentence) intonations. The first are phonological, para-phonotactic features whereas the second are grammatical, para-syntactic features; thus the difference between them is functional. As Hervey (1994: 37) amply put it, tones are formal entities with “the function pertaining to *figurae*, which is a function of formally distinguishing the ‘shape’ of one potential vehicle of meaning from that of other potential vehicles of meaning” whereas intonations are meaningful entities with “the function pertaining to *signa*, which consists in making a direct *semantic* contribution to messages by including one, as opposed to another, actual vehicle of meaning”. Like other meaningful entities, even intonations have phonological forms and these are also distinctive para-phonotactic features. However, they are distinctive trivially because there is generally a one-to-one correspondence between intonations and their phonological forms.

Though inherently a contrastive para-phonotactic feature, accent may sometimes function distinctively if accompanied by features determining the placement of accentual prominence or if we put it otherwise, by features determining the nucleus of an accent group. This occurs in languages with a so-called free accent. In the case of accent groups with bases corresponding to conglomerations of phonotagms, the features in question are those determining which of the phonotagms will be accented and which unaccented. Russian can serve as an example. Here two phonotagms /mu/ and /ka/ are, first, united by accent and/or diaereme and then further accompanied by distinctive para-phonotactic features determining the placement of accentual prominence, thus giving either /#múka#, a phonological form of a word meaning “torture”, or /#muká#, a form of a word meaning “flour”. These two accentual patterns are mutually opposed. English, German or Spanish are other examples of languages where these features play their part. On the other hand, Czech has always been treated as a language with a fixed accent, i.e. with a non-free accent, but it contains, though to a limited degree, these features as well. To put it crudely, it is given by the fact that a monosyllabic word forming an accent group with the following word may or may not acquire accentual prominence. To be more precise, it means that if we have an accent group of the structure /#P₁#P₂...P_n#/ where ‘P’ with an index is a phonotagm and ‘#’ diaereme, we cannot determine from this phonological structure whether the first phonotagm P₁ will bear accentual prominence or whether it be P₂. This is contrary to the traditional view of Czech being a language with a fixed accent, for if it were such a language, we would be able to determine the placement of

accentual prominence from the phonological structure alone. Examples for this phenomenon are numerous (see Bičan 2008b): /#béS#petra#/ bez Petra “without Peter” as opposed to /#beS#pétra#/ bez Petra “Peter’s lilac” or /#dó#pole#/ do pole “to the field” as opposed to /#to#póle#/ to pole “that field”. This also holds for *na hoře* mentioned above: its phonological form is /#ná#hoře#/ but *nahoře* is /#nahoře#/ because here the fact that the first phonotagm /na/ will be accented is purely realizational, i.e. determined by extra-phonological features. The rule for this is actually quite simple: if an accent group contains only one diaereme group whose base in turn contains two or more phonotagms, the first of these phonotagms is accented. On the other hand, if an accent group contains two or more diaereme groups the base of the very first of which is a single phonotagm, the placement of accentual prominence must be decided by other functional features.

To conclude this section, let us look at a para-phonotactic analysis of a phonological form of a Czech sentence *Lehl si do postele a usnul*. “He lay down on the bed and fell asleep.”; it is outlined in Fig. 7. The form consists of two phrase-accent groups, marked by ‘||’. Because para-phonotactic features corresponding to phonological form of intonation are superimposed over these groups, we may conveniently call them *tone groups*. They in fact correspond to what others have called *tone units* (in Czech *promluvěvé úseky*). Accent groups that are asterisked are those where the placement of accentual prominence is determined by additional features. The figure shows the hierarchy of analysis and complexity: lower-level entities form bases of higher-level ones, so phonotagms are bases for diaereme groups, diaereme groups for accent groups and accent groups for tone groups.

| | | | | | | | | | | |
|-----------------|---|------------------------|------------------------|---------------------------------|----------------------|--------------------------------|-----------------------|------------------------------|---------------------|-------------------------|
| | / #lehl#si#dó#poStele# #a#úsnul# / | | | | | | | | | |
| tone groups | T ₁ #lehl#si#dó#poStele# | | | | | T ₂ #a#úsnul# | | | | |
| accent groups | A ₁ #lehl#si# | | | *A ₂ #dó#poStele# | | | | *A ₃ #a#úsnul# | | |
| diaereme groups | D ₁ #lehl# | D ₂ #si# | D ₃ #dó# | D ₄ #poStele# | | | D ₅ #a# | D ₆ #úsnul# | | |
| phonotagms | P ₁ le | P ₂ hl | P ₃ si | P ₄ dó | P ₅ po | P ₆ Ste | P ₇ le | P ₈ a | P ₉ u | P ₁₀ snul |

Figure 7: Para-phonotactic analysis of Czech

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FONOLOGIE V AXIOMATICKÉM FUNKCIONALISMU

Článek představuje fonologickou teorii lingvistické školy zvané axiomatický funkcionalismus a některé jeho analytické postupy při popisu zvukové stavby jazyků. Takovýto popis se skládá ze tří částí: 1) fonematiky zabývající se systémem fonémů a opozičními vztahy mezi nimi, 2) fonotaktiky, popisující distribuci fonémů uvnitř fonotaktických jednotek, a 3) para-fonotaktiky, která popisuje vztahy a rysy přesahující rámec fonotaktických jednotek (např. akcent, tóny nebo hraniční signály). Text je doplněn příklady fonologické analýzy češtiny.

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