Proposing Morphonotactics[1]

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Abstract

In this contribution we propose the establishment of morphonotactics as a subpart of morphonology based on previous research in morphonology, Natural Morphology and Natural Phonology, notably the Beats-and-Binding model of phonotactics. Our area of investigation concerns consonant clusters. Focusing on morphonotactics in English (5.1.), German (5.2.), Italian (5.3.) and Polish (5.4.), we establish a gradient continuum between morphonotactics and phonotactics and investigate the impact of morphological and phonological typology on cross-linguistic differences in the number and nature of morphonotactic clusters.

1. Introduction

Phonotactic aspects of morphonology have not been treated as systematically as morphonological alternations (since Baudouin de Courtenay 1894, 1895) or rules (cf. Dressler 1985). In this contribution we intend to propose a distinct area of morphonology, i.e. morphonotactics, and argue for it within the semiotically based model of morphonology (Dressler 1985, 1996) and the phonotactics model of Beats-and-Binding phonology (Dziubalska-Kołaczyk 2002). Morphonotactics refers to the first of Trubetzkoy's (1931: 161ff) three parts or tasks of morphonology, i.e. "the study of the phonological structure of morphemes". Trubetzkoy understood this merely in terms of the structure of single morphemes. And here we typically find, at least in languages approaching the inflecting-fusional type (cf. below), 1) most variety in shapes of lexical roots, in terms of both phoneme inventory and

[1] This contribution goes back to a joint paper at the 2005 Poznań Linguistic Meeting, to a joint seminar at Vienna University in the winter semester of 2005/06 and to a seminar by the first author at the Scuola Normale Superiore di Pisa in February 2006. We thank all discussants at the three occasions, including PierMarco Bertinetto. Specific studies on specific problems and languages are to follow, including PhD theses by Paula Orzechowska (Poznań), Lina Pestal (Vienna) and Paulina Zydorowicz (Poznań), cf. the interim reports in

phonotactics, 2) less variety in shapes of derivational affixes, and 3) least variety, i.e. most restrictions, in shapes of inflectional affixes. A pioneer of these studies was Jakobson (1962: 108-109, cf. Kilbury 1976, Dressler 1985: 232ff) with his claim: "the different grammatical classes of formal units can be characterized by a different utilization of phonemes and even of distinctive features". This field of investigation is outsides the scope of our contribution (more in Beedham 1994, 2005). It must be noted that these claims have been made, originally and even generally later on, for inflecting-fusional languages only, which nullifies much of Bybee's (2005) criticisms.

What we will focus on here is rather shapes of morpheme combinations, particularly when they differ from the phonotactics of lexical roots and thus signal morpheme boundaries, as in E. *seem+ed* /si:m+d/. This is a prototypical case of morphonotactics. This will lead us to the definition of morphonotactics as the area of interaction between morphotactics and phonotactics and to an emphasis on the transitions between morphonotactics and ordinary phonotactics. Among phonemic sequences of morphonotactic relevance, we will limit our study here to consonant clusters.

2. Morphonology

Morphonology has been defined in Dressler (1985, 1996) as the area of interaction between morphology and phonology with gradual synchronic and diachronic transitions from phonological rules or processes (PRs) via morphonological rules (MPRs) to allomorphic rules (AMRs). Morphonology is based within an integration of the theories of Natural Morphology and Natural Phonology (cf. Kilani-Schoch & Dressler 2005, Dressler 1996, Dziubalska-Kołaczyk & Weckwerth 2002). Both theories consist of three subtheories:

1. a subtheory of universal preferences (or universal markedness), which deals with universal parameters, such as iconicity and transparency, on the one hand, and with universal natural phonological processes on the other. The main function of morphonology is to co-signal morphological patterns.

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2. a subtheory of typological adequacy, where in morphology (following Skalička 1979) languages are characterized for the degrees to which they approach ideal constructs of language types. In this contribution we will limit ourselves to the ideal inflecting-fusional, agglutinating and isolating type and will show that morphonotactics, like overall morphonology, is important only in the inflecting-fusional type. In phonological typology, polar notions such as vocalic vs. consonantal languages and stress-timed vs. syllable-timed languages are relevant.
3. a subtheory of language-specific system adequacy which studies what is normal and productive in a given language.

One main question is now whether morphonotactics can be accounted for in all three subtheories as a subpart of entire morphonology.

3. Beats-and-Binding theory of phonotactics

In Beats-and-Binding theory of phonology the unmarked sequence of sounds consists of CV's (i.e. CVCV(CV)). Markedness starts with the introduction of any new consonantal phoneme into the sequence, e.g. CVC or CCV. The clusters which arise can be ordered on the scale of preference from the least marked to gradually more marked. The measure of markedness is the overall sonority, understood as a perceptual effect brought about to the ear by manner of articulation of sounds as well as place of articulation (POA) and distance in voicing. In fact, rather than the overall sonority, it's better to refer to a net auditory distance to which all the three factors contribute (sonority, POA and voicing).

The phonotactic preferences specify the universally required relationships between net auditory distances within clusters which guarantee, if respected, preservation of clusters. Clusters, in order to survive, must be sustained by some force counteracting the overwhelming tendency to reduce towards CV's. This force is a perceptual contrast as defined above. The Optimal Net Auditory Distance Principle defines the way in which segments should order themselves in a successful sequence. Optimal relations take the form of well-formedness conditions holding for double, triple and n-member clusters in all positions in a word, i.e., initial, medial and final.

The less respected the preferences are, the more marked clusters arise. In a typological perspective, consonantal languages are expected to have more dispreferred clusters than vocalic languages. The same applies to stress-timed vs. syllable-timed languages. In terms of system-adequacy, languages vary as to a language-specific tolerance to violating phonotactic preferences. What is allowed within a morpheme (a "phonological" cluster) in one language may be allowed exclusively across a morpheme boundary in another. The latter will be referred to as morphonotactic clusters.

4. Cooperative interactions between morphotactics and phonotactics

There is convergence between morphotactics and phonotactics, when morphotactic operations such as concatenation or apophony create normal phonotactic sequences which exist already in monomorphemic lexical words. For example, English preterit and past participle formation creates new sequences of /d/ preceded by homorganic sonorants /n, l, r/, as in *screen+ed* vs. *find, yell+ed* vs. *child*, *steer+ed* vs. *weird*. Such phoneme sequences are hardly apt to cosignal the application of morphological rules (MRs) and thus do not stimulate morphological decomposition and therefore, expanding on arguments used by Hay & Baayen (2002, 2005), may be liable to loose their internal morpheme boundaries in diachronic development. This type of interaction is expected to prevail in languages approaching the ideal agglutinating language type.

5. Conflictual interaction between morphotactics and phonotactics: concatenation

Within the area of the first subtheory of universal preferences, conflictual interaction between morphotactic concatenation and phonotactic preferences as formulated within Beats-and-Binding phonology (Dziubalska-Kołaczyk 2002, 2005), creates or motivates marked phonotactic structures (cf. Dressler et al. 2001), in our case, among consonant clusters. These marked consonant clusters may be of two types:

a) clusters whose number of phonemes exceeds the number of consonants found in monomorphemic words. The excessive consonants are often classified as extrametrical consonants in other phonotactic theories (recently, e.g., Fery and van de Vijver 2003), which is unfortunate because, as we will

see, there are gradual transitions between morphonotactic and phonotactic sequences.

b) Clusters which are marked in complexity, i.e. in violating universal phonotactic preferences as established by the theory.

One main question is here to what extent MRs may violate phonotactic constraints within a language and thereby violate universal phonotactic preferences (area of the first subtheory of universal markedness). In regard to the second subtheory of typological adequacy we expect, in agreement with overall morphonology, that languages approaching the ideal inflecting-fusional language type more closely (e.g. strongly inflecting languages such as Polish) will have more marked clusters of both types than languages which also approach the ideal isolating language type (i.e. weakly inflecting languages such as English and less so German and Italian).

A second main distinction in the degree of deviation of morphonotactic (i.e. morphologically and phonologically motivated) consonant clusters from purely phonotactic (i.e. merely phonologically motivated) ones follows the gradual scale of (only or also) morphologically motivated clusters,

1. which are always morphologically motivated, i.e. never occur in monomorphemic words (cf. Dressler 1985: 220f),
2. which are morphologically motivated as a strong default, i.e. which are paralleled by very few exceptions of a morphologically unmotivated nature,
3. which are morphologically motivated as a weak default, i.e. which are paralleled by more exceptions of a morphologically unmotivated nature,
4. whose majority is morphologically motivated,
5. whose minority is morphologically motivated, i.e. which are quite normal phonotactic clusters, which may also have some morphological motivation.

Since we expect, in languages approaching the ideal inflecting-fusional type, to have more radically marked morphonotactic clusters in inflectional concatenations than in concatenations of word formation (derivation and compounding), we will concentrate on inflectional morphology. A further problem of interaction between morphotactics and phonotactics is, whether and to which degree PRs repair the output of morphotactic operations.

In the following we are going to look selectively at morphonotactic consonant clusters motivated by morphological concatenation in English (5.1), German (5.2), Italian (5.3) and Polish (5.4).

5.1. Morphonotactics in English

Candidates for exclusively morphotactically motivated consonant sequences are the word-final clusters /-fs, -vz/ as in laughs, loves, wife's, wives, which occur only in plurals, third singular present forms and in Saxon genitives. These are marked phonotactic sequences, since they occupy the same rank on the sonority scale/manner of articulation and differ minimally in place of articulation. Additional exclusively morphologically motivated clusters are /-bz, -gz, -ðz, -Θs, -mz, -md, -nz/, as in bobs, Bob's, eggs, deaths, wreathes, clothes, times, seems, seemed, tons.

A very strong default case of morphonotactics is represented by the word-final clusters /-ts, -dz/, as in cats, kids, whose monomorphemic opponents are extremely rare: *waltz*, *adze*. A still strong default is represented by /-p+s/, as in *caps*, *keeps*; Latinate exceptions are few, such as *apse*, *lapse*, plus *glimpse*.

A rather weak default is constituted by the clusters /-ks/, as in *docks, lacks,* note the many Latinate words, such as *tax, sex, box, flux, fix,* plus *six*.

In contrast to the exclusively morphonotactic word-final clusters in *eight+th, six+th, ten+th, nine+th, seven+th, hundred+th* (plus *bread+th, wid+th*), only unproductive derivational MRs create the exclusively morphonotactic word-final consonant clusters in *dep+th, warm+th, leng+th, streng+th* (plus monophthongisation in *five* → *fif+th*). This goes against Kaye's (1995: 310, cf. 302, 304, 308, 311) claim that words produced by irregular, non-analytic morphology deliver normal phonotactic structures to the phonological component. A further counter-example is morphonological voicing in *wreathes, clothes*. What fits Kaye's claim better are the unproductive morphological rules which motivate *kept, slept* etc. and which produce the same phonotactics as *apt*. Whereas *keep+s, sleep+s*, created by a productive morphological rule, show morphonotactic sequence of a long vowel followed by a stop + sibilant, a sequence which only marginally occurs in monomorphemic words such as *hoax* and *coax*.

Note that the psycholinguistic reality of morpheme domains in phonotactics, as in *scream+ed*, has been confirmed by psycholinguistic experiments (see Wright 1975).

5.2. Morphonotactics in German

Our main illustration for problems of German morphonotactics comes from word-final *–Cst* clusters. They are morphologically motivated, whenever there is a suffix /st/ (2nd.Sg., superlative, unproductive nominalisation) or a suffix /t/ (3rd.Sg., past partciple, nominalisation) after a root-final /s/[2].

Exclusive morphological motivation exists for the clusters /-mst/, as in *kämm-st* 'you comb', *schlimm-st* 'worst', *ge-sims-t* 'with a moulding or mantlepiece', /-xst, -fst/, as in *lach-st* 'you laugh', *tun-lich-st* 'if possible', *schläf-st* 'you sleep', *zu-tief-st* 'deepest', with the affricate /-pfst/, as in *tropf-st* 'you drip', *stampf-st* 'you stamp' and in the longer consonant clusters /-rkst/, as in *werk-st* 'you work', *ver-korks-t* 'kink', /-lkst/, as in *welk-st* 'you fade', /-nkst/, as in *stink-st* 'you stink', /-lpst, -mpst/, as in *stülp-st* 'you turn up', *selb-st* 'self', *tramp-st* 'you tramp', *plumps-(s)t* 'you plop'.

A strong default is represented by /-lst/, as in *sattel-st* 'you saddle', *ver-mittel-st* 'by means of', *Ge-schwul-st* 'tumor' vs. monomorphemic *Wulst* 'bulge', *Hulst* (and possibly *Schwulst* 'bombast' from earlier *Schwul+st*), in regional variation /-nst/ or /-nkst/, as in *häng-st* 'you hang', *gering-st* 'least', *jüng-st* 'most recently' vs. monomorphemic *Angst* 'anxiousness', *Hengst* 'stallion' /-rpst/, as in *darb-st* ' you suffer want', *zirp-st* 'you chirp' vs. *Herbst* 'autumn' (with diachronic loss of unstressed schwa before /st/ (cf. cognate E. *harvest*), /-rnst/, as in *lern-st* 'you learn', *warn-st* 'you warn' vs. *E/ernst* 'E/earnest' (with similar schwa loss).

The default is slightly weaker in postvocalic /-pst/, as in *lieb-st* 'you love', *tapp-st* 'you plod', *neb-s* "together with' vs. *Obst* 'fruits', *Papst* 'pope', *Propst* 'provost' (with loss of the second vowel), and /-kst/, as in *wag-st* 'you dare', *weck-st* 'you wake', *(h)eilig-st* 'holiest', *mix-(s)t* 'you mix', *klecks-(s)t* 'you blot', *wächs-(s)t* 'you/he grow(s)', *gewachs-t* 'waxed' vs. *Axt* 'axe', *Text* 'text', *verflixt* 'darned',

[2] On which also online experiments have been performed together with Gary Libben (University of Alberta) and Eva Reinisch (Max Planck Institute for Psycholinguistics, Nijmegen).

and in the affricate /ts/ plus /-(s)t/, as in *reiz-(s)t* 'you/he , *salz-(s)t* 'you/he salt(s)', *schmerz-(s)t* 'pain(s)', *pflanz-(s)t* 'plant(s)', *schluchz-(s)t* vs. *jetzt* 'now', *Arzt* 'physician' and (with earlier morpheme boundary) suppletive superlative *zu-letzt* 'last'.

The default is definitely weaker in /-rst/, as in *kehr-st* 'you sweep', *äußer-st* 'extremely' vs. *Kars* 'karst', *Werst* 'Russian measure', *Horst* nest', *Durst* 'thirst', *Wurst* 'sausage' and (with earlier morpheme boundary or schwa loss) *erst* 'only', *Oberst* 'colonel', *Forst* 'forest', *Fürst* 'prince' and /-nst/, as in *dien-st* 'you serve', *ergeben-st* 'respectfully', *Ge-spin-st* 'yarn', *frans-(s)t* 'you/he frazzle(s)' vs. *Wanst* 'paunch', *sonst* 'otherwise', *Dunst* exhalation' and (with earlier morpheme boundary or schwa loss) *Gunst* 'favour', *Kunst* 'art.', *Brunst* 'rut', *Dienst* 'service', *Gespenst* 'spectre', *einst* 'formerly'.

There is phonological repair via automatic degemination in the morphonotactic clusters /s+st/ (cf. above) and similar subphonemic degemination between the sibilant last phase of the affricate /ts/ and /st/ in *reiz+st* (see above). Or this latter simplification is simply a contact dissimilatory loss as in loss or assimilation of /s/ after the sibilant /ʃ /, as in *plausch+(s)t* 'you chat', *wäsch+(s)t* 'you/he wash(es)', *zisch+(s)t* 'hiss(es)' and after the affricate /ʧ /, as in *quietsch+(s)t* 'you squeak', *watsch+(s)t* 'you slap', *plantsch+(s)t* 'you splash'.

Morphological repair prevents opacifying fusion of root-final /t, d/ and the immediately following suffix /st/ into an affricate via morphonological insertion of /e/ in the second singular, as in, *leid-e-st* 'you suffer', *rat-e-st* 'guess', *find-e-st* 'find' and in the superlatives *rund-e-st-e* 'roundest', *bunt-e-st-e* 'most multicoloured', but not in the more recent superlatives derived from present participles, as in *weit-geh-end-st* = *weit-est-gehend* 'most far-reaching'.

Also word-internally morphological concatenation creates new consonant clusters. For example, the separable prefix/particle *ab-* motivates the exclusively morphonotactic clusters /p+d, p+t, p+g, p+k, p+h, p+m, p+ʃ , p+ts, p+v/, as in *ab+drehen , ab+treten , ab+geben , ab+kommen , ab+hängen , ab+melden , ab+schaffen* (plus longer clusters, as in in *ab+streiten*, *ab+ziehen , ab+wickeln*) . Also some of the few non-separable prefixes create new clusters, as with *ent-*, fossile *ant-, ver-, zer-*. In addition, prefixes (and compounding) create geminate consonants which are disallowed morpheme-internally, and, phonotactically even

worse, pseudogeminates are created by syllable- and morpheme-final obstruent devoicing, as in *ab-bauen* with /p+$b/.

5.3. Morphonotactics in Italian

For Italian morphonotactics we concentrate on the, mainly verbal, prefix *s-*, derived from the Latin prefix *ex-* before word-initial consonant (cf. Jacobini 2004: 112ff, 137). It becomes voiced before word-initial voiced consonants.

The only exclusively morphonotactic clusters are /zr-/, as in *s+radicare* 'eradicate', *s+ragionare* 'talk nonsense', *s+regolatezza* 'immoderateness', and the longer groups /zgr-, zgw-, sfr-/, as in *s+gridare* 'scold', *s+guardo* 'look', *s+frenare* 'unbridle'.

Default cases are the clusters /zb-, zd-, zg-, sf-/, as in *s+balzare* 'hurl' vs. *sbaglio* 'erorr', *sbadigliare* 'yawn' (from obsolete *badigliare*), *s+dentare* 'break the teeth' vs. *sdraiare* 'to stretch out' (< Lat. *ex-*), *s+gommare* 'ungum' vs. *sgamollo*, *s+favore* 'disfavour' vs. *sfinge* 'sphinx', *sfarzo* 'pomp'. A weak default is represented by /zv-, zl-/, as in *s+valigiare* 'ransack', *s-valutare* 'devalue', *s+vantaggio* 'disadvantage' vs. *svegliare* 'wake up'(< *ex-v-*), *svelto* 'quick', *svergolare* 'twist', etc.

A morpheme boundary exists in the majority of instances of /zl-, zm-, zn-, skw-/, as in *s+leale* 'disloyal', *s+legare* 'untie' vs. *slalom, slitta* 'sledge', *slogan, slang, slam,* etc., *s+membrare* 'dismember' vs. *smalto* 'enamel', *smog, smoking*, etc., *s+naturare* 'denaturate' vs. *snello* 'slender', *snob, snack-bar, snort*, etc., *s+qualificare* 'disqualify' vs. *squadra* 'team', *squallido* 'dismal', *squalo* 'shark', etc.

Quite normal initial clusters are /sk-, skr-, skj-, skl-, sp-, spr-, spl-, spj-, st-, str-/. New word-internal consonant clusters may be created by prefixation (cf. Iacobini 2004). Word-final consonant clusters are disallowed.

5.4. Morphonotactics in Polish

Polish is the most strongly inflecting language of the four languages studied in the present contribution: it has the richest morphology. Therefore we expect a greater number of morphonotactic consonant clusters in Polish than in the other three languages.

The same expectation stems from its typological status of a consonantal language. Polish has a moderately large (26 to 33 consonants according to Maddieson (in WALS)) system of consonants (31) and rich consonantal phonotactics. Complex clusters are tolerated in all positions, up to 4 consonants word-initially ([vzgl-] *wzgledny* 'relative', [ʑ ʨ bw-] *źdźbło* 'blade of grass') and 5 consonants word-finally ([-mpstf] *przestępstw* 'crime Gen.Pl.). In phonological words even 5 consonants initially may arise ([vʑ ʨ bl-] *w źdźble* 'in a blade of grass'). Geminates are also possible word-initially ([ss-] *ssak* 'mammal', [ʨ ʨ -] *dżdżu* 'drizzle Gen.'). Rhythmically Polish exhibits both the properties of syllable-timing and stress-timing (compare also a scalar approach, e.g., Bertinetto 1988).

Combining the phonological and morphological perspective we may predict that the percentage of morphonotactic clusters among consonant clusters will rise with the number of consonants in a cluster. This has been confirmed by Zydorowicz (2006) who analyzed the data compiled by Bargiełówna (1950).

5.4.1. Concatenative sources of morphonotactic clusters

There are many more cases of morphonotactic clusters in Polish than in the other languages. Here we focus on just three similar initial clusters, i.e. *ws*- [fs-], *wsz*- [f♦-], and *wsi*- [f⑨-]. According to the *Optimal Net Auditory Distance Principle*, the most likely cluster in a monomorphemic nonderived context would be either [f⑨-] or [f♦-], while [fs-] would be less preferred. [f⑨-] and [f♦-] both involve a greater distance in terms of POA than [fs-], [f⑨-] showing more distance than [f♦-]. However, the latter also involves an additional feature of retroflexion of the sibilant, which contributes to the net auditory distance. Scrutinizing the Polish lexicon one finds that there is no monomorphemic *ws*- cluster. *wsz*- occurs in the fossilized but frequent prefixoids *wsze*, *wszech*, *wszem* 'all, everybody', in archaic *wszędy* 'everywhere', in frequent *wszystko* 'everything' (all of which are semantically related in an irregular way), and in archaic *wszak* 'after all'. *wsi*- appears in the Russian loan *wsio* 'everything' and in the colloquial pronunciation of the abbreviation *WSJO* [f⑨o] from the recent term *Wyższa Szkoła Jezyków Obcych* 'college of modern languages'. Thus, the prediction about the dispreferred cluster *ws*- has been supported. As far as the other two clusters are concerned, the deductive problem of predicting which cluster should be the preferred one is mirrored in the inductive

problem of what is more relevant: phonological productivity in the case of *wsi-* or greater type frequency of *wsz-*. This cannot be decided without comparing monomorphemic and bimorphemic clusters.

All the other instances of the three initial clusters are of a morphonotactic nature. The first group consists of the words with the prefix *w-* 'in', as in the verbs *w-sypać* 'pour', *w-szyć* 'sew in' (plus 3 other items), *w-siać* 'sow in' (plus 11 other items), including the adverb *w-szerz* 'broadwise'. For examples with vowel deletion see section 5.4.2.

Comparing monomorphemic and bimorphemic clusters shows that *wsi-* is a morphonotactic cluster by default whereas *wsz-* is not.

The three double clusters discussed above are also part of triple clusters. The marked clusters [fsp-, fst-, f②t②-] (all reducible in casual speech, see 5.4.3) appear in the following monomorphemic words: *wspaniale* 'splendid' *, wspak* 'backward'*, wstążka* 'ribbon'*, wstęga* 'wide ribbon' *, wstecz* 'back' *, wstyd* 'shame' *, wściekać* 'to get furious' (with 22 derivatives[3]; all the words formerly with morpheme boundaries).

Comparable morphonotactic clusters have either one or two morpheme boundaries, e.g. two in *w-s-kazać* 'to point'(plus 13 other items), one in *w-skoczyć* 'to jump in' (plus 29 other items) and *ws-pomagać* 'to help' (plus 5 other items). Another two-morpheme-boundary cluster occurs in *w-s-chodzić* 'to rise' and *w-s-chód* 'east, sunrise', and another one-morpheme-boundary cluster in *w-szczepić* 'to implant' (plus 7 other items). Thus the morphonotactic character of those triple clusters is only a weak default.

All word-initial quadruple clusters are morphonotactic, with one morpheme boundary in *ws-tręt* 'disgust' (plus 2 derivatives, cf. *na-tręt* 'pushy person') and *w-strzelać* [f-st♦] 'shoot in' (plus 5 other items), and two morpheme boundaries in *w-s-trząsać* 'to shake' (plus 8 other items).

When passing from German and Italian doubles to triples and from Polish triples to quadruples, we observe an increase in phonotactic markedness and, as predicted, both a decrease in the number of lexical items and a bigger role of morphonotactics. However, if we move from Polish doubles to triples, then we find a

[3] All the counts of lexical items have been done according to Dubisz (2006).

reverse, i.e. an increase in the number of lexical items, and a smaller role of morphonotactics. The reason for this paradoxical phenomenon, i.e. that three-consonant clusters appear to be more system-adequate than two-consonant ones, may lie in the *Optimal Net Auditory Distance Principle*. The principle defines the preferences for sequences starting with the vowel. Preferably, the distance between the vowel and the preceding consonant should be smaller than between this and the preceding consonant. This is not the case with the word-initial sequences [fsV-, f♠V-, f②V-]. Therefore, they are dispreferred sequences because the distance between [f] and the sibilant should consequently be greater than the distance in the neighbouring sequences. In contrast, in the triple clusters [fskV-, fspV-] the distance in [-sk-] and [-sp-] is greater than in [fs-]. Thus, the preference is satisfied on the left side, whereas on the right side there is no difference to doubles. But worst of all is the cluster [fsxV-] where neither side of the preference is satisfied: this is precisely the cluster which is always morphonotactic.

5.4.2. Non-concatenative sources of morphonotactic clusters

In contrast to the other three languages, morphonotactic clusters in Polish arise also due to non-concatenative morphological operations. One such operation is a non-productive deletion of a root vowel: in the first syllable of a word it leads to the creation of new marked clusters, e.g. in adjective formation, as in *wieś* 'village' ~ *wsiowy, len* 'linen' ~ *lniany, lew* 'lion' ~ *lwi, mech* 'moss' ~ *mchowy*, *wesz* 'louse' ~ *wszawy* or comparative of adverb *lekko* 'light' ~*lżej*. The same operation also applies in inflection: masculine *len*, Gen.Sg. *ln-u*, *mech* ~ *mch-u*, feminine *wieś* ~ *ws-i, wesz* ~ *wsz-y*. Nominative *wesz* has been replaced in colloquial speech by the morphotactically transparent back-formation *wsza* with the prototypical nominative singular ending of feminine nouns and adjectives. Thus, a new citation form with initial *wsz*- (cf. 5.4.1.) came into being.

Another such operation is productive zero-Genitive-Plural formation. Polish declension always adds an inflectional vowel to root-final consonants with two exceptions of zero suffixes: first, in the nominative singular of some masculine microclasses, e.g. *podarek* 'present', *wegetarianin* 'vegetarian', second in the genitive plural of many neuter and feminine microclasses and in the microclass of masc. *wegetarianin*, Gen. Pl. *wegetarian* (with truncation of the pseudosuffix *–in* in

the plural). Nominative singular feminine forms, such as *palma* 'palm' or neuter forms, such as *ranczo* 'ranch', are the citation forms that are stored in the mental lexicon. Their root-final consonant clusters appear word-finally only in zero genitive plurals: *palm* and *rancz*. In this way clusters may arise which do not appear elsewhere in word-final position in the language, e.g. in neuter nominative *przestępstwo* 'crime' ~ genitive plural *przestępstw* [-mpstf], or in feminine nominative *tratwa* 'raft' ~ genitive plural *tratw* [-tf] (with the obligatory phonological word-final devoicing of obstruents). An example from language for special purposes (e.g. mathematics) is *lambda* ~ *lambd* (without final devoicing because of the higher level of language awareness).

5.4.3. Avoidance and repair

Actual or potential marked clusters which are due either to concatenative or non-concatenative morphological operations may be avoided in various ways. Rarely there are simply empty slots in the paradigm or simply non-use of certain forms. The most radical instance is the paradigm of 'drizzle': the genitive singular *dżdżu* is in use, the instrumental *dżdżem* is potential but avoided, in contrast to the derivations adj. *dżdżysty,* verb *dżdżyć*, cf. *dżdżownica* 'caterpillar' (all with word-initial geminate affricates). However, there is no nominative singular **dżdż* , because vowel-less words are not allowed in Polish, except in extragrammatical interjections such as *pst*.

Certain marked clusters are phonostylistically repaired, i.e. reduced in fast or sloppy speech. This happens with many masculine singular preterits in *–ł* [w] follows a root-final obstruent, as in *szed-ł* 'he walked', *rós-ł* 'he grew' with the word-final morphonotactic clusters [dw, sw]. Similar reductions occur in root-final clusters in zero-genitive plural forms, e.g. as in the already mentioned *przestępstw* [-mpstf → -mstf, - ms] or in *mężczyzna* 'man' ~ gen. pl. *mężczyzn* [-zn → s]. Examples of word-initial reduction are *wszystko* 'everything' [f◗ → ◗], *wschód* 'east" [fsx → sx], etc.

An obligatory phonological repair breaks up those morphologically potential word-final stop clusters which are phonotactically banned from the final position. The repair consists in the insertion of a vowel [e], as in feminine nominative singular *kotka* 'cat' ~ genitive plural *kotek*, *babka* 'granny, cake' ~ *babek*.

There is a related morphonological e-insertion as in nom.sg. *barka* 'boat' ~ gen.pl. *barek*, *bitwa* 'battle' ~ *bitew*, *torba* 'bag' ~ *toreb'*, but here erroneous forms are produced: *bark*, *bitw*, *torb*, whereas **kotk* or **babk* are never produced. This is explained by the fact that word-final [-rk, -rp] exist in the citation forms *park*, *Serb*, and word-final [-tf] occurs in zero-genitive plurals (cf. *tratw* above).

Word-initially, there is a corresponding but rather obsolete morphonological e-insertion in *w-spinać się* 'climb' (imperfective) ~ perfective 3.Sg. *wespnie się* and in *w-ścielać* (impfv.)'to do the bed' ~ pfv. *wesłać*. The second pair is rather obsolete, whereas *wespnie się* is avoided by using the periphrasis *będzie się wspinać* 'will be climbing' or by even using *wspnie się* without insertion. There is, however, also an example in current use, i.e. impfv. *w-spierać* [fsp^{j}-] 'support' ~ pfv. *wesprzeć* [vesp$\int$ -].

Morphological repair of morphologically derived marked phonotactic clusters occurs via partial inflectional class change, as in *mizdrzyć się* 'to wheedle' with the expected imperative *mizdrz się* [-st◆②] replaced by *mizdrz+yj się* and in *spotkać* 'meet', expected 3.Sg. masc. preterit *spotkł* [-tkw], replaced by *spotkał*.

In word-final position, geminate consonants are disallowed. Thus the expected zero genitive plural of *willa* 'villa', namely *will* is phonotactically disallowed and replaced by the morphologically unpredicted form *will-i* (in analogy to other inflectional microclasses). An alternative is phonological degemination in [vil]. The same morphological replacement occurs in the genitive plural of *sybilla*, when speaking of the Sybills of the Cappella Sistina in Rome. The genitive plural of *mokka* 'mocca' is simply avoided. The zero plurals of *canzonetta, arietta, vendetta, grappa, mirra* are avoided or may have a degeminated final consonant. Or one tries to pronounce consciously a final geminate, as in the zero genitive plurals of *fontanna, sutanna, manna, henna, madonna*.

6. Conclusion

The aim of the present contribution was to propose morphonotactics as a proper subfield of (mostly conflicting) interaction between phonology and morphology. As elsewhere in Natural Phonology and Morphology, we have found that also this

subfield has fuzzy boundaries. Thus, one needs to approach it with the concept of gradualness.

The consonant clusters we have investigated in the four languages can be graded according to the role of morphology and phonotactics. As a result, we can distinguish at least (a) prototypical morphonotactic clusters, i.e. clusters which are exclusively due to morphological derivation, (b) clusters which are morphonotactic as a strong default or (c) as a weak default, i.e. with very few exceptions in (b) and more exceptions in (c), (d) clusters which exist both due to morphology and without interaction with morphology, and (e) clusters which never come into being due to morphology, e.g. initial clusters in a language which has neither monoconsonantal prefixes nor morphological deletion of the first vowel of a word.

Prototypical morphonotactic clusters (a) have the function of co-signaling the existence of a morphological rule, morphonotactic default clusters (b) and (c) fulfill this function less adequately, while phonotactic clusters of the type (d) and (e) cannot fulfill this function and therefore they may be called prototypical phonotactic clusters. Since fulfilling this co-signaling function should have some repercussion in processing, psycholinguistic experiments (which we have started to devise) may provide a tool for establishing a boundary between clusters of the type (c) and (d).

Since there is, within morphology, a universal preference for concatenation, also within morphonotactics we found a preference for the concatenative origin of consonant clusters. This is the only possible origin of morphonotactic consonant clusters in English, German and Italian, and this is the default in Polish. Looking beyond the four languages investigated, so far we have found cases of non-concatenative origin of clusters only in strongly inflecting fusional languages (such as Polish). Note, for example, zero ablaut in Ancient Greek *tí-kt-ō* 'I'm giving birth to' (with reduplication and metathesis tk → kt) from the root /tek/ as in the 1.Sg. Aorist *é-tek-on*. Another example is Latin perfect *sprē-vi*, PPP *sprē-tus* from *spern-ere* 'reject', which are the only examples of initial [spr-] in Latin.

Turning to the phonological side of the interaction between phonotactics and morphology, one can say that prototypical morphonotactic clusters are always phonotactically marked, i.e. they are dispreferred with respect to comparable prototypical phonotactic preferences. By the same token, we have found that phonotactically most marked consonant clusters are of a morphonotactic nature,

and that their morphonotactic character increases with the increase of the phonotactic markedness.

A consequence of increased phonotactic markedness is the avoidance of certain morphonotactic clusters in performance. A more systematic means is a remedial repair, either only phonostylistic, or in terms of an obligatory phonological rule of vowel insertion. As may happen diachronically with any phonological ruel, such vowel insertions may morphologize, i.e. turn into morphonological rules. Finally, there is a preventive repair by morphological rules which block the creation of morphonotactic clusters.

In terms of morphological typology, we have investigated strongly and weakly inflecting fusional languages. Here we can predict the the stronger inflecting a language is the more morphonotactic clusters it should have (cf. also above for non-concatenative morphology). In support of this prediction, Polish has most morphonotactic clusters, German less, and Italian the leats of the three languages. English should have even fewer clusters, which however is not true at least for inflectional origin of morphonotactic clusters. This paradox can be explained by phonological typology: consonantal languages can be expected to have more morphonotactic clusters than vocalic languages. Since Italian is clearly a less consonantal language than English, the mutual proportion of morphonotactic clusters in the two languages is explained.

The most fundamental theoretical question is whether morphonotactics is a proper subpart of morhonology. The latter follows deductively from the definition of mophonology as the effect of the interaction of phonology and morphology, and the definition of phonotactics as a proper part phonology and of morphotactics as a proper part of morphology. Both segmental morphonology and morhonotactics ahve the function of co-signaling morphological rules. Inductively, we have found that both segmental morhonology and morphonotactics show the gradient continuum to segmental phonology and phonotactics respectively. The typological distribution of morphonotactics and segmental morphonology so far has been found to be the same.

What our studies of the acquisition of morphonotactics have demonstrated so far (see the interim report in WLG online 73, 2006) there is a following, explainable difference between segmental morphonology and morphonotactics: segmental

morhonology is being acquired after all or nearly all of phonology is acquired, whereas at least some morphonotactic clusters are acquired before comparable phonotactic clusters. Clearly, more research is needed and has been already been started by the authors and some of their research associates.

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