The Role of Underlying Filters in the Study of Phonological Interference

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Interference of Croatian in the pronunciation of English is looked at in the light of Filter Theory, proposed by Calabrese (1988). It is argued that the notions of Filter Theory are useful in accounting for several phenomena observed in English spoken with a Croatian accent. The difficulties that Croatian speakers have in realizing such English phonemes as /ŋ/, /v/, /æ/, /θ/, /ð/ and the so-called centring diphthongs are accounted for by means of the Filter Theory notions of fission and delinking. It is also argued that in addition to the existing notions of Filter Theory, the study of foreign accent also requires the introduction of some syntagmatic restrictions on feature cooccurrence, as well as the repair strategy of fusion.

1. Introduction

This paper is an attempt to apply the notion of underlying filters to the study of phonological interference, in particular, interference of Croatian in the pronunciation of English. The notion of filter is employed in the sense in which it is introduced in the theory proposed by Calabrese (1988), i.e. it refers to restrictions on feature cooccurrence obtaining within the phonemic inventories of individual languages. The main concern of Calabrese's theory are the so called UG filters, i.e., a set of hierarchically ordered negative conditions on feature cooccurrence, provided by Universal Grammar. Each of these filters is either operating or violated in a given language. If a filter is operating, it blocks segments with the respective feature specifications from appearing in the phonemic system of the language concerned. In case it is violated, such segments will appear as part of the phonemic inventory of the language. So, for example, one of the UG filters postulated in Calabrese's theory is *[+ low, -bk]. Hence a language in which the filter is operating will not have a phoneme specified as [+ low, -bk]. By contrast, a language in which the filter is violated will have a [+ low, -bk] phoneme. Since the filter at hand, like all the others, has its place in the UG hierarchy, evidence of its violation (i.e. positive evidence in terms of the presence

of the corresponding segment) will have important implications concerning the presence and absence of other segments. So, for instance, a language like English which has the phoneme /æ/, which violates the UG filter *[+ low, -bk], must also have segments that violate all those UG filters which occupy a lower place in the UG hierarchy. Indeed, English has /e/, /ə/, /ʒ:/, /ɑ/ and /ɔ:/, which all violate the filter *[-hi, -low], a filter that occupies a lower place in the hierarchy than *[+ hi, -bk].

At first glance, Filter Theory looks like Jakobson's well-known theory in a new guise. Filter Theory does, indeed, make generalizations concerning the order of acquisition of phonemes and their loss and retrieval in aphasia and, more notably, it makes the same kind of predictions about the structure of phonemic systems as Jakobson does. However, it also provides some insights into the nature of dialectological variation and interference of mother-tongue in the pronunciation of a foreign language which no previous theory could offer. This is made possible by reliance on one of the most recent generative models of phonological representation, i.e., Feature Geometry as well as by the use of the basic notions of the Theory of Underspecification.

In phonological representation the approach under consideration operates with *metafeatures*, hierarchically organized groups of features that behave as natural classes. More detailed accounts of the status of these metafeatures in recent non-linear approaches are provided in Sagey (1986), Halle (1987) and McCarthy (1988). For the purpose of the present paper I will only point out that in all these approaches metafeatures are seen as autonomous objects, independent of feature matrices, represented on separate tiers and manipulated separately by phonological rules. This results in multitiered three-dimensional representations consisting of several geometrically organized sequences.

Within this framework a phoneme is analysed as a timing unit (x) together with all the distinctive features linked to it. "These features are represented on distinct tiers or planes which are associated with a single root node. This root node with all the feature planes it dominates characterizes the phonological segment." (Calabrese 1988:13)
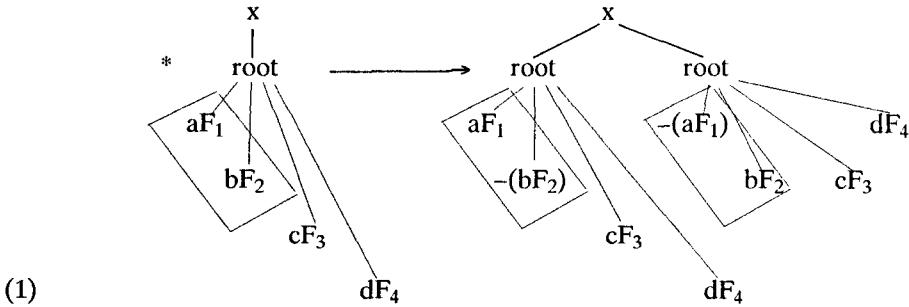
In the representation of phonological rules, Filter Theory makes use of the established procedures of non-linear phonology: association, spreading and delinking. Crucial use is also made of the notions of Underspecification Theory. It is argued that "the UG filters needed to describe the structure of a given phonological alphabet determine what features are underlyingly specified or unspecified in the feature bundles of that phonological alphabet" (Calabrese op. cit. : 11).

2. Clean up rules and their application

Disallowed configurations of features found in foreign sounds are repaired by means of the so-called clean up rules. Calabrese proposes that there are essentially three kinds of clean up rules.
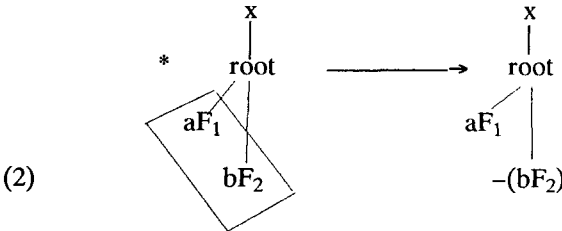
One of these is *fission*, by which "the feature bundle containing two features incompatible because of a filter is broken into two feature bundles, each of which

contains only one of the incompatible features" (op. cit: 35) The process is represented as follows:

$$
\begin{array}{l}
\text{x} \\
\mid \\
* \quad \text{root} \quad\longrightarrow\quad \text{root} \qquad \text{root} \\
\text{aF}_1 \qquad\qquad \text{aF}_1 \qquad -(\text{aF}_1) \qquad\qquad \text{dF}_4 \\
\quad \text{bF}_2 \qquad\qquad -(\text{bF}_2) \qquad\qquad \text{bF}_2 \quad \text{cF}_3 \\
\qquad\qquad \text{cF}_3 \qquad\qquad \text{cF}_3 \\
\end{array}
$$

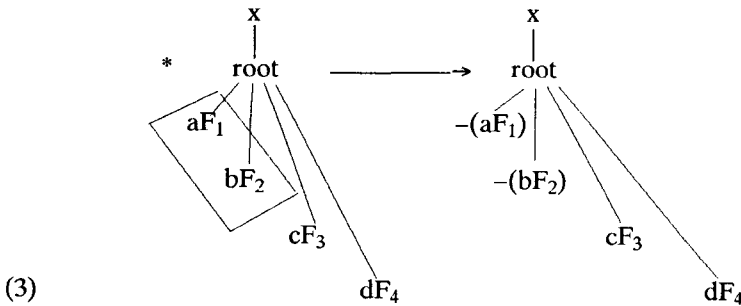(1) $\qquad\qquad\qquad\qquad$ dF$_4$ $\qquad\qquad\qquad$ dF$_4$

For the purpose of clarity, in the present paper I set off the configurations of features discussed in particular cases by enclosing them within rectangles, which were not used in Calabrese's original representation. Thus in (1) the feature bundle enclosed within the asterisked rectangle on the left to the arrow contains the features disallowed by the filter *[aF$_1$, aF$_2$], where a, b, c, d = +/–.

Another clean up strategy is *delinking*, by which "... one of the incompatible features is delinked and replaced with a compatible feature" (Calabrese, ib.:35)

$$
\begin{array}{l}
\text{x} \qquad\qquad\qquad \text{x} \\
\mid \qquad\qquad\qquad\quad \mid \\
* \quad \text{root} \quad\longrightarrow\quad \text{root} \\
\quad \text{aF}_1 \qquad\qquad \text{aF}_1 \\
\qquad \text{bF}_2 \qquad\qquad -(\text{bF}_2) \\
\end{array}
$$

(2)

The third clean up rule is *negation*, by which "... the values of the incompatible features are negated and thus changed into their opposites" (Calabrese, ib.:35):

$$
\begin{array}{l}
\text{x} \qquad\qquad\qquad\qquad \text{x} \\
\mid \qquad\qquad\qquad\qquad\quad \mid \\
* \quad \text{root} \quad\longrightarrow\quad \text{root} \\
\quad \text{aF}_1 \qquad\qquad\qquad -(\text{aF}_1) \\
\qquad \text{bF}_2 \qquad\qquad\qquad -(\text{bF}_2) \\
\qquad\qquad \text{cF}_3 \qquad\qquad\qquad \text{cF}_3 \\
\end{array}
$$

(3) $\qquad\qquad\qquad\qquad$ dF$_4$ $\qquad\qquad\qquad$ dF$_4$

As argued by Calabrese (op. cit.: passim), these three strategies can account for various phonological phenomena, such as vowel harmony (examples are provided from Finnish, Akan, Ogori and paleo-Siberian languages), dialectal variation (e.g. metaphony in southern Italian dialects), diachronic processes (notably those that took place in the course of the development of Romance languages) and, finally, phonological interference, which is the actual concern of the present paper.

In the following sections I will analyse some examples of Croatian interference in the pronunciation of English in the light of the clean up strategies under discussion. I will also point to some interference phenomena which do not lend themselves to an analysis in terms of the existing notions of Filter Theory. On the basis of these cases I will argue for the introduction of a new kind of filter and a new kind of repair strategy in the study interference.

3. Interference of Croatian in the Pronunciation of English

3. 1. *Fission*

The clean up strategy of fission can account for a common tendency among Croatian learners of English to interpret the English phoneme /ŋ/ as a sequence of two phonemes, /n/ and /g/, phonetically realized as [ŋg]. It may be argued that this kind of phonological analysis is determined by the spelling, but it should be noted that data from language acquisition and foreign language learning at preliterate levels provide independent evidence for the phonological motivation of the observed tendency. After all, the "ng" spelling only reflects an earlier stage in the diachronic development of English, at which the filter under consideration, *[+ nas, + hi] was still operative. (On the deactivation of filters in the diachronic and dialectal development of languages see Calabrese, ib.:143 ff).

Cases of mispronunciation of English words such as "sing", "long", "tongue" etc. with two segments in place of one thus results from the application of the clean-up strategy of fission, by which Croatian speakers repair the configuration disallowed in their native language, [+ nas, + hi]. The fact that the surface realization of such items there is a velar sound [ŋ] has, of course, nothing to do with underlying filters, which, by definition, determine only the structure of the phonemic inventory of a given language. The allophonic realization of the underlying /n/ as [ŋ] in this context is simply accounted for by the phonetic phenomenon of coarticulation.

In other words, by interpreting the English phoneme /ŋ/ as /ng/, Croatian speakers use the same "repair" strategy as Italian or English learners of German do when they interprete the German [-bk, + round] vowel ü as a /iu/ sequence (cf. Calabrese, op. cit: 313). Although the main concern of the present paper is interference of Croatian in the pronunciation of English, and not the other way round, at this point, as a side remark, I would like to observe that the same strategy is used by English learners of Croatian when due to the filters *[+ nas, -bk] and *[+ lat, -bk], they interpret our phonemes /ɲ/ and /ʎ/ as /n + j/ and respectively /l + j/. These examples are interesting primarily because they point to an important issue, discussed in section 3.4.

Another important issue that arises in connection with the rule of fission concerns the order of the features in the sequence. This is accounted for by Keyser, Stevens and Kawasaki's (1984) theory of phonological enhancement, i.e. in terms of a hierarchy in saliency.
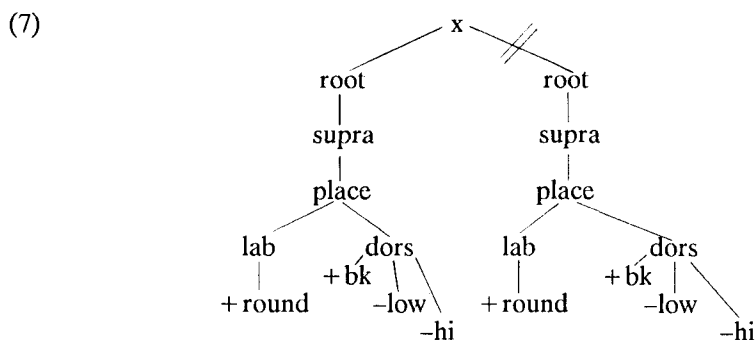
3. 2. Delinking

The clean up rule of delinking can account for one of the most common manifestations of the Croatian accent in the pronunciation of English – the mispronunciation of the phoneme /æ/. This segment violates the UG filter *[-bk, +low], which Croatian, as opposed to English, does not allow. Filter Theory equally allows the delinking of either of the features involved in the illicit configuration. There are thus two possible outcomes, of the delinking rule: the configuration [+bk, +low], which corresponds to the segment /a/ and the configuration [-bk, -low], corresponding to /e/:[1]

(6a)

(6b)
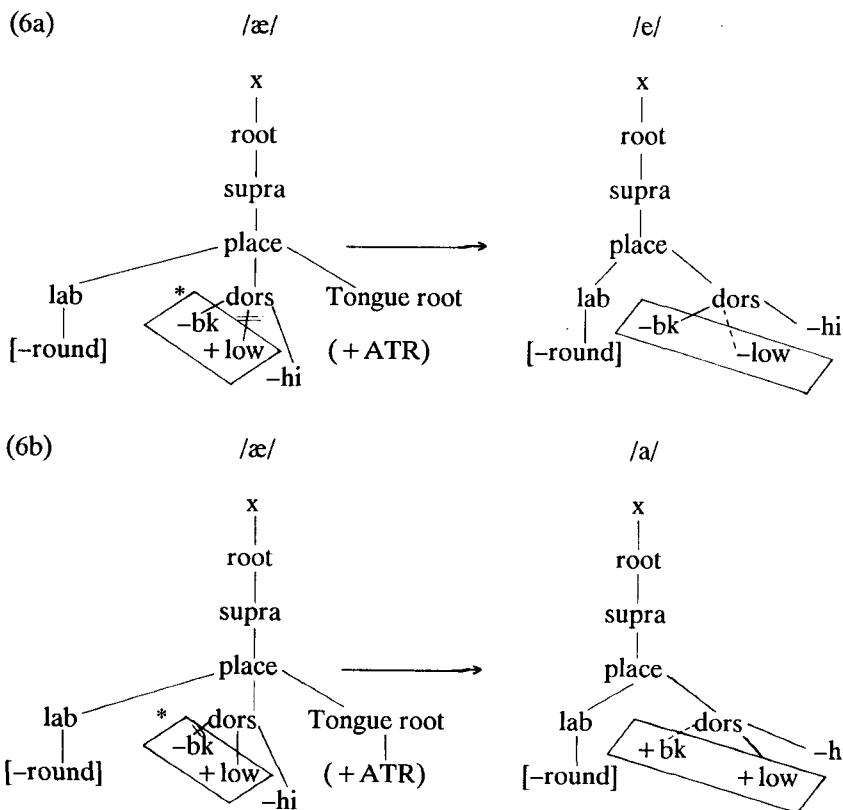
1. For convenience of representation, the irrelevant nodes and feature specifications are always omitted.

135

I interpret Croatian vowels as underspecified for the feature [ATR], so I see this feature as playing no role in clean up strategies. This is why I have included it in parentheses in the representation of the English segment and omitted it when representing Croatian vowels.

A special case of delinking is the monophthongization of English diphthongs, observed in the English spoken by Croats. A case in point would be the realization of the diphthong /ou/ as /o/, like in the word "home". Within the framework of Feature Geometry, diphthongs would be represented by two root nodes sharing the same x-slot. The English diphthong /ou/ would then be represented as follows:

(7)

The delinking rule that takes place in this case would simply delete the entire root node on the right side of the representation, together with the nodes it dominates.

It would be interesting to explain within the same theoretical framework why some diphthongs get monophthongized and some do not. Being a theory of phonemic inventories, rather than a theory of phonological interference, Filter Theory does not address the issue at all. I propose that the problem should be solved by the introduction of the notion of syntagmatic filter, argued for in section 3.4.

There are also two important consonantal phenomena that can be explained by delinking. One regards the mispronunciation of the English consonant /v/, which, as argued in Josipović and Šikić (1989), plays a significant role in the creation of the overall effect of the Croatian accent in the pronunciation of English. The underlying filter that is violated in the pronunciation of this segment is the consonantal filter *[+cont, lab] / [-son]. Croatian speakers repair the disallowed configuration by delinking:

(8)
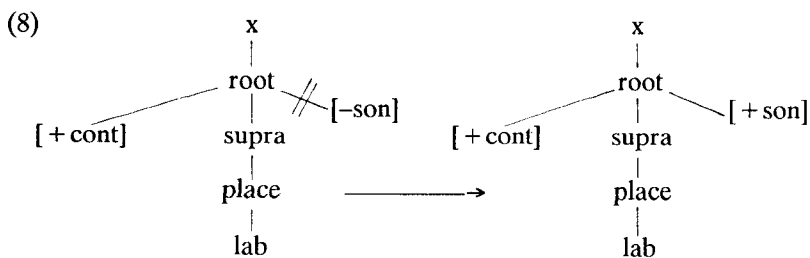
The resulting configuration reflects the fact that this segment, as pronounced by Croats, strikes native speakers of English as too "loose". Articulatorily this means that the stricture in the supralaryngeal cavity is not radical enough to produce supraglottal pressure that would prevent spontaneous voicing. In other words, the configuration of the vocal tract is such as to allow for spontaneous voicing, i.e., the resulting segment is by definition sonorant, which corresponds to the Croatian segment /v/, which in all respects also phonologically behaves as a true sonorant.

Another difficulty that Croatian learners of English have in common concerns the pronunciation of the segments /θ/ and /ð/, traditionally referred to as dental fricatives. Filter Theory can account for the different varieties of its non-native realization, though not without controversy. These two segments violate the UG filter *[+ cont, - strident], which is underlyingly present in Croatian, like in lots of other languages. The expected results of delinking are the following:
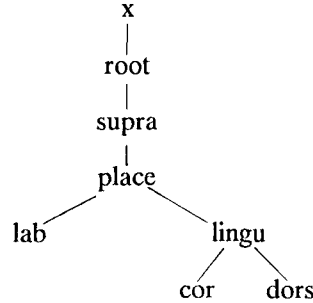
(9)   (a) [–cont, –strident]   : /t/, /d/

              (b) [+ cont, + strident]   : /s/, /z/

This is indeed what one can hear in the pronunciation of English by non-native speakers, including Croats. The output of (a) is also common in a number of native accents of English. Wells (1982:passim) observes it in Irish English, West Indian English, Indian English, New York English, Black American English, West African English and Newfoundland English and refers to it as "TH-Stopping". It is interesting to note that the feature configurations as in (b) do not seem to be common in any native accent of English, though they are quite common in the pronunciation of English as a foreign accent, notably in the English spoken by Croats (e. g. "think" [sink]; "father" [fazr] etc.). The important point to note in this connection is that instead of the expected coronals /t/ and /s/, the actual pronunciation of /θ/ by Croatian speakers involves the labial segment /f/, e.g. "three" [fri]. This is again quite common in native accents of English, most notably in Cockney, but also in Newfoundland English, Black American English and some varieties of African English. The phenomenon is referred to by Wells (1982:passim) as "TH-Fronting", and, most interestingly, it also involves the confusion of /ð/ with /v/ (e.g. in Cockney: "father" [favə], "either" [i:və]). This, however, turns out not to be the case in English spoken with a Croatian accent. There are thus two questions that arise at this point. In the first place, what repair strategy can account for the confusion of /θ/ and /ð/ by /f/ and /v/, which involves a change in the value of two phonological features that cannot be comprised in any UG filter? Secondly, why the repair strategy that is involved here, whatever we decide it is, does not apply as symetrically for both /θ/ and /ð/ in the English spoken by Croats as it does in native accents of English?

Filter Theory offers no real account of the strategy involved in repairing /θ/ and /ð/ by /f/ and /v/. On the contrary, Calabrese (1988:335) concludes his thesis by admitting to his failure to solve this problem and observes that more research is needed on this matter.

However, I would like to offer a tentative explanation that has been suggested to me by Zrinka Babić (pers. com.). Under this account, we would have to introduce an intermediate node "lingual" in the representation of place features. The lingual node

would directly depend on the place node and would, in its turn, dominate the feature "coronal". The supralaryngeal feature geometry would thus be represented as follows:

```
                    x
                    |
                   root
                    |
                  supra
                    |
                  place
                 /       \
             lab           lingu
                          /     \
                        cor      dors
```
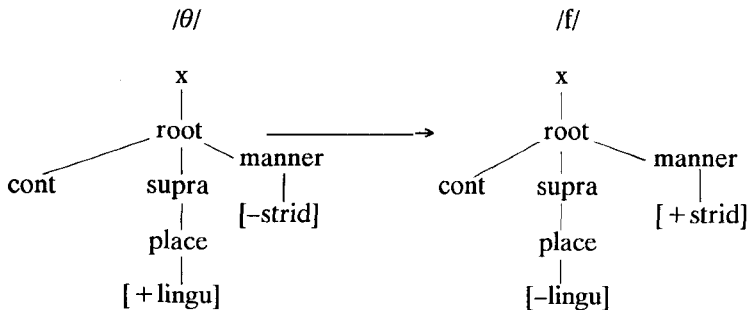
Under this account, we can explain the problem at hand by introducing an accent-specific filter that disallows the configuration [-strid, +lingual] in continuants. The configuration is then repaired by negation.

3.3. Negation

Although there are some interesting dialectal and diachronic phenomena from several languages that can by accounted for by the clean up strategy of negation, Calabrese does not assign it any role in the explanation of phenomena from English. However, if we introduce the modification in the representation of features discussed above, the replacement of /θ/ and /ð/ by /f/ and /v/ can be accounted for by means of this clean up procedure.

(11)   * [–strid, +lingu] [____contin]————→ [+strid, - lingu]

```
         /θ/                                    /f/

              x                                      x
              |                                      |
            root         ————————→              root
          /   |  \ manner                     /   |  \ manner
       cont supra  |                      cont supra  |
              |  [–strid]                        |  [+strid]
            place                              place
              |                                  |
         [+lingu]                            [–lingu]
```

2. A filter like *[+coronal, -strident] is, of course, nonsense.

138

The asymetric application of the negation rule in Croatian as against native English accents can be explained by the absence of a voiced non-sonorant continuant labial from the phonemic inventory of Croatian. It is actually for the same reason that the English obstruent /v/ is repaired by Croatian speakers by delinking, as set out in (8). In other words, Croatian speakers do not usually replace /ð/ by /v/, beacuse this would involve the change of three features, which would be too many features for any clean up strategy to repair at a time.

### 3. 4. *Syntagmatic restrictions on feature cooccurrence*

Being a theory of phonemic inventories, Filter Theory, naturally, is concerned with restrictions on the paradigmatic cooccurrence of phonological features. By using examples from English spoken with a Croatian accent, I will argue that a theory that aims at explaining interlanguage phenomena also needs to postulate some syntagmatic restrictions and clean up strategies, which are basically similar to those of Calabrese's theory. Therefore I am going to analize them by analogy with the filters and clean up strategies employed by Filter Theory.

If we are able to explain within the framework of Filter Theory why native speakers of English interprete the Croatian palatals /ɲ/ and /ʎ/ as sequences of two segments, then it should also be possible to account for the opposite tendency with Croatian speakers of English. It would then be convenient to establish some clean up mechanism that would be just the opposite of fission and that would explain why we tend to pronounce words like "new" or "value" as [ɲu:] and [væʎu]. For this purpose I will postulate a clean up strategy that I will refer to as FUSION. That is, I assume that there are also some restrictions on the syntagmatic cooccurrence of features, which I will define as follows:

> If two adjacent segments of a foreign language contain features that combined together contain all the necessary "ingredients" for a segment of the native language that occupies a higher place in the hierarchy, then these two segments will be interpreted as a single segment, i.e., the hierarchically superior one.
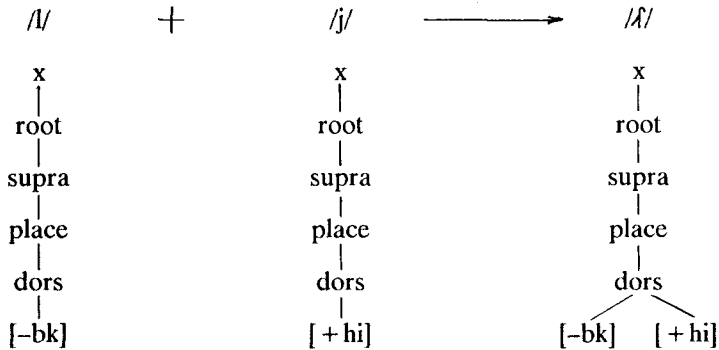
The interpretation of the /n + j/ sequence as /ɲ/ can be thus represented as follows:
(11)

139
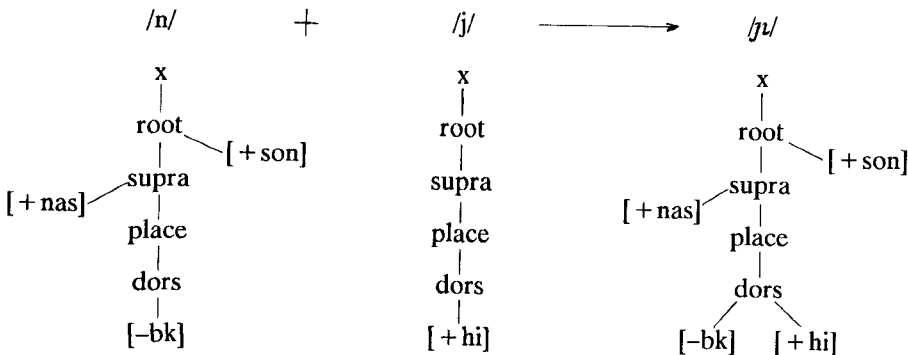
By analogy, what happens in the interpretation of /l + j/ as /ʎ/ can be represented as follows:

(12)

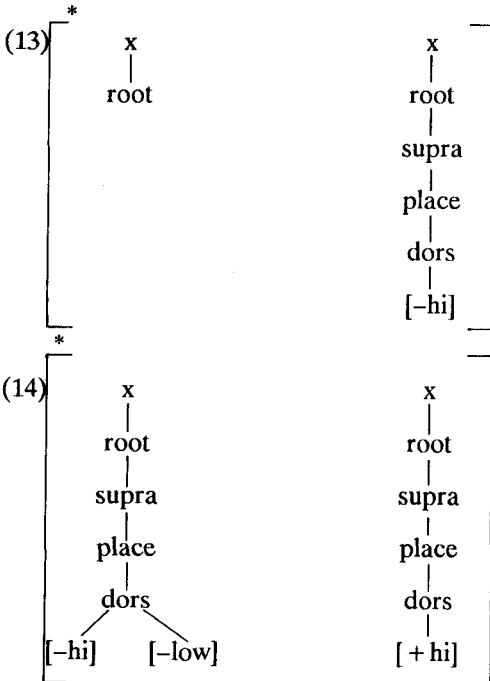| /l/	+	/j/	⟶	/ʎ/
x		x		x
root		root		root
supra		supra		supra
place		place		place
dors		dors		dors
[–bk]		[+hi]		[–bk] [+hi]

In examples (10) and (11) the syntagmatic clean up rule of fusion applies lexically and is thus insensitive to the phonostylistic register. It should be noted, however, that the same kind of rule can be observed post-lexically in what has traditionally been referred to as connected speech coalescence processes. The fusion rule in such cases is optional, sensitive to the phonostylistic register and, most notably, it is language specific. It can be observed in English expressions such as "would you like", "what you want", or "as you wish", where native speakers of English can optionally fuse a wordfinal coronal with the [+ hi] segment at the beginning of the following word, which gives a single segment specifed as both [+ cor] and [+ hi]. In Croatian there is no such style-sensitive syntagmatic filter and, consequently, native speakers of Croatian will have no corresponding post-lexical rule at their disposal when pronouncing English. This is borne out by the pronunciation of their native expressions which have environments analogous to those of the English expressions quoted above and which allow for no such fusion: "Kad je došao", "svijet je malen", "SRAZ je izašao". It may be argued that Croatian speakers of English tend not to apply this rule when speaking English merely because they rarely reach a competence level that allows for the use of the allegro style, with which the post-lexical fusion rule is as sociated. There is, admittedly, some truth in that, but it should not be forgotten that it is quite common for Croatian people to speak English very fluently, using the allegro style, and still never apply the rule. I would thus attribute this indication of the Croatian accent in English to the difference between the two languages concerning the presence of the optional filter that may disallow the syntagmatic post-lexical occurrence of the features [+ coronal] and [+ hi] and the corresponding clean up strategy of fusion.

Another phenomenon which bears on the issue of syntagmatic filters is the monophthongization of English diphthongs, referred to earlier, in connection with the clean up strategy of delinking. I assume that this has to do with some syntagmatic filters in Croatian, that determine which feature configurations can appear under adjacent root nodes, which for Croatian means adjacent vocalic segments. This is how I would

explain that the Croatian-English interlanguage is more tolerant to the English diphthongs /ai/, /oi/, /ei/ and /au/ than to the others, which are more readily monophthongized.

In order to provide a tentative explanation within the framework of Filter Theory, I will hypothesize that in Croatian there are two underlying syntagmatic filters that disallow the following configurations:

(13)

```
 *
    x              x
    |              |
   root           root
                   |
                 supra
                   |
                 place
                   |
                 dors
                   |
                 [–hi]
```

(14)

```
 *
    x              x
    |              |
   root           root
    |              |
  supra          supra
    |              |
  place          place
    |              |
  dors           dors
   / \             |
[–hi] [–low]     [+hi]
```

The filter in (13) accounts for the intolerance of Croatian speakers to the so-called centring diphthongs of English, while the configuration in (14) refers to the English closing diphthong /ou/, which is typically mispronounced as /o/ as in "home" [hom]. These configurations are then repaired by delinking the entire root node on the right.

Conclusion

The notions of Filter Theory have proved useful in accounting for several interference phenomena observed in English spoken with a Croatian accent. In particular, the clean up strategies of fission and delinking turn out to be applicable to the analysis of some characteristic cases of mispronunciation of English segments on the part of Croats. It is also argued that the mispronunciation of /θ/ as [f], for which

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ULOGA DUBINSKIH FILTERA U IZUČAVANJU FONOLOŠKE INTERFERENCIJE

Interferencija hrvatskoga jezika u engleskom izgovoru promatra se u svjetlu Teorije filtera A. Calabresea (1988). Pokazuje se kako su pojmovi te teorije korisni pri objašnjavanju nekih pojava u engleskom izgovoru s hrvatskim akcentom. Poteškoće koje hrvatski govornici imaju u realizaciji engleskih fonema kao što su /ŋ/, /v/, /æ/, /θ/, /ð/, te jedna skupina diftonga, mogu se objasniti pomoću pojmova Teorije filtera – fisije i otkapčanja. Također se pokazuje da je uz već postojeće pojmove teorije, za potrebe izučavanja stranog akcenta potrebno utvrditi i neke sintagmatske restrikcije u vezi sa supojavljivanjem razlikovnih obilježja, te strategiju "pročišćavanja" za koju se predlaže naziv "fuzija".