*Linking history to first language acquisition: the case of Greek consonant clusters**

EIRINI SANOUDAKI

Abstract

This paper discusses a phenomenon traditionally described as manner dissimilation in Greek consonant clusters. Using data from first language acquisition, I argue for an analysis of the phenomenon as lenition controlled by a binary parameter and I show how this parameter can explain the acquisition data as well as the historical evolution of Greek clusters.

1 Introduction

In this paper I discuss clusters of voiceless stops (*pt/kt*) and voiceless fricatives (*fθ/xθ*) in Greek. The common view is that they belong to a high variety and are not part of the popular language, which has a dissimilation process that turns them into a fricative-stop cluster (*ft/xt*). However, the analysis of the process is problematic and their synchronic status of the clusters is unclear.

In cases of linguistic problems such as the above, first language acquisition can offer invaluable help in many respects. Firstly, it can offer us types of data that would not be available otherwise (consider for example the evidence given by child language of the VP-internal position of the subject in English and French (Friedemann 1992; Pierce 1992)). Secondly, the introduction of learnability considerations into linguistic theory (such as the ones put forward by the hypothesis that every child grammar is a potential adult grammar (Pinker 1984)) is essential in our quest to achieve an explanatorily adequate theory (Chomsky 1981). Thirdly, first language acquisition can shed light on diachronic change, as has been shown for instance in the case of loss of V-to-I raising in English (Lightfoot 1999).

Following this reasoning, in order to examine the phonology of the clusters in question, I test the production of the consonant clusters by children acquiring Greek

*I would like to express my deepest gratitude to the children who made this study possible. I would also like to thank my supervisors, John Harris and Neil Smith for all their help. This research was supported by a Grant from the Greek State Scholarship Foundation (IKY).

as their first language. The analysis of their production serves as a trigger for the re-evaluation of the synchronic and historical data and is the guiding force for the development of an alternative analysis of these clusters. I propose that the historical process described as dissimilation was positional lenition, due to a parameter change in the grammar of Greek.

The paper proceeds as follows: Section 2 contains a short overview of the historical and synchronic situation of diglossia. Section 3 deals with the data collection and general results, and in section 4 I proceed to the analysis; in section 4.1 some problems of the dissimilation theory are presented. In sections 4.2 to 4.4 I introduce an alternative proposal for the historical data, which is based on positional lenition, along with the notion of complexity, and in 4.5 I show how that can account for the synchronic situation and the acquisition data. A short conclusion follows.

2 The historical and theoretical background

2.1 Greek Diglossia

The linguistic situation in Greece has been that of Diglossia (Ferguson 1959) for centuries. This is a situation in which two linguistic varieties coexist within a country-state: one of them is a superimposed variety, usually the vehicle of literature. It is learned through formal education and is used for formal written and spoken purposes.

Greek throughout history has had two varieties, a low one, used as everyday language, and a high one, used in literature and often supported by authority (Horrocks 1997). But the fight between the classicists and the demoticists (supporters of the demotic, the popular language) took new force after Greece became an independent state in the nineteenth century. The language that became the official language of the new nation in 1830 was Katharevusa, a "purified demotic", with some elements of the popular language and resuscitated forms and elements of ancient Greek. Katharevusa was a constructed language that nobody spoke consistently (Browning 1983). It was used in literature, education and for official purposes, and became more and more remote from the comprehension of the average Greek.

This situation continued until 1974, when Demotic became the official language. Since 1974 two possibilities have co-existed, one of Demotic origin and one of Katharevusa origin, which serves as a social marker for the speaker (Kazazis 1992). The choice of features of one over the other indicates stylistic preferences and also marks the linguistic register and the social class and background of the speaker (Trudgill 1983).

In the following section, in the light of this historical and social background, I examine the issue of fricative and stop clusters.

2.2 The dissimilation theory

The fricative and stop clusters constitute an example of this linguistic schizophrenia. Several words have two forms: one that contains a fricative-stop sequence, and one that contains the corresponding fricative-fricative or stop-stop sequence (examples from Tserdanelis (2001)).

(1) a) *ptero- ftero* 'feather'
ktena- xtena 'comb
epta- efta 'seven'
okto – oxto 'eight'
b) *xθes – xtes* 'yesterday'
fθinos – ftinos 'cheap'
anixθika – anixtika 'I was opened'

The fricative-stop forms are the ones of the popular language, and the others belong to Katharevusa. The phenomenon has been analysed as manner dissimilation, and is viewed as part of the series of changes that led from ancient to modern Greek ((Browning 1983), Horrocks (1997)). These involved:

(2) a) spirantisation of aspirated and voiced stops
b) progressive manner dissimilation of voiceless fricatives
c) regressive manner dissimilation of voiceless stops

Ancient Greek contained three series of stops: aspirated stops p^h, t^h, k^h, voiced stops *b,d,g*, and voiceless stops *p,t,k*. Process (2)a) was context free and turned the first two series of stops into fricatives:

(3) *lop*^{h}*os> lofos*
ogdoos> oγðoos

Processes (2)b) and (2)c) affected the (new) series of voiceless fricatives (*fθ>ft, xθ>xt*), and the voiceless stops (*pt>ft, kt>xt*), respectively.

(4) *xθes> xtes*
epta> efta

According to this view, these historical rules resulted in the present situation, with most Modern Greek dialects including standard Greek exhibiting manner dissimilation (Joseph & Philippaki-Warburton 1987;Newton 1972). As for Katharevusa, it is believed that it did not undergo these processes (see e.g. Tserdanelis (2001)), and retains the original clusters that were the outcome of process (2)a.

Researchers working in the spirit of the SPE tradition postulated synchronic rules that perform the dissimilation. These rules disallow sequences of two voiceless fricatives or two plosives. The rules would be of the type:

(5) Voiceless stop→ voiceless fricative/_ voiceless stop
Voiceless fricative→ voiceless plosive/voiceless fricative_

The acquisition of these clusters has not been given much attention. In the following section, I present some such data from children acquiring Greek as their first language.

3 The data

3.1 Purpose and Subjects

The purpose of the data collection was to test children's production of fricative-fricative and stop-stop clusters. Specifically, if the two groups of clusters belong to two different varieties, children should be unable to produce the target clusters, which belong to the high variety, and would be expected to produce fricative-stop clusters instead.

The data collection took place in four different nurseries in Crete (Rethymno and Iraklio). Fifty-nine monolingual Greek children were tested. The age range was from 2;03 to 5;00, mean age 3;08. The children were selected according to their phonological development; only children who, according to the teachers, showed normal development, and were able to produce at least some consonant clusters, were chosen. Nine more children were excluded from the study, since they refused to cooperate or did not complete the task.

3.2 Methodology

A non word repetition task was used. Children were asked to repeat novel, made-up words that had the desired structures. The task was chosen for its effectiveness in producing a large amount of relevant data, compared to spontaneous production.

Even though studies have already shown that results in imitation tasks are similar to patterns found in spontaneous speech (see, for example Kehoe & Stoel-Gammon

(2001)), extra care was taken to ensure the naturalness of the task. Firstly, the words were paired with pictures of novel animals, so that the words would have a referent; I thus made sure that the task is a linguistic one (rather than a non-linguistic sound-production task). Secondly, the children did not hear the stimuli from a recording, but from a real person (a trained linguist), something that is more likely to occur in everyday life. Thirdly, the task was not presented to the children as a request to repeat words, but as a game in which they were taking active part, as in a real life situation (see procedure, section 3.4).

I have good reasons to believe that I have succeeded in making the task both natural and linguistic. Apart from the reassuring fact that children were enjoying the "game" and some were asking for more, they were making comments that indicated that they were in an everyday situation, one that could have taken place in their classroom, and not just in an artificial experimental environment; for example:

(6) "Will my sister meet these animals, too?" (Argiro 4;01)
"This animal looks strange. And it has a strange name." (Natalia 4;03)

Moreover, some children formed diminutives out of some words, in the regular way for Greek nouns. In the case of neuter nouns that is done by adding *-aki* to the stem of the noun, after removing the inflectional ending. So, for example, an animal called *kixro*[1] became *to mikro kixraki* "the little kixro (dim)". That involved recognising the word as a neuter singular noun by the ending *-o,* removing the ending and adding the diminutive suffix. This was a linguistic operation that could not be carried out unless the children were involved in a linguistic task.

3.3 Materials

The clusters tested consist of two voiceless fricatives or two voiceless stops. Specifically, the following combinations of consonants were tested:

(7) *fθ, xθ, kt, pt*

All words were designed to respect the phonotactics of Greek, and were either feminine or neuter nouns, with inflectional endings *-a* (feminine), *-i* (feminine or neuter), or *-o* (neuter). In order to keep the task consistent throughout trials, no masculine endings were used, because they involve (in the nominative) a word final consonant (*-s*), and that would increase the structural complexity of these trials. All

[1] This word is not one of the forms discussed in this paper. It is, however, part of the series of tests that I conducted with these children.

words were disyllabic, with a voiceless stop as an onset for the non target syllable; *p, t* or *k*. The clusters were tested in word initial and word medial position. The target clusters were always in the stressed syllable. The words that have the cluster in initial position are listed under 388.

(8) *fθoki, xθapi, ktito, ptika*

The second category was formed by reversing the syllable order. The stimuli were the following:

(9) *kifθo, pixθa, tokti, kapti*

3.4 Procedure

The test items were arranged in three different pseudo-random orders[2] so as to avoid sequence effects, and each of these orders was pseudo-randomly assigned to a third of the children tested. There were four warm-up items that did not contain any clusters.

Pictures of novel animals were put inside a Russian doll representing a wizard. The child was told that the wizard had eaten some strange animals and that he/she could free them by calling each animal by its name. The child was then invited to open the wizard, take out the animals one by one, and say its name. If after two attempts the child was still not replying, we would move on to the next animal/ word, and the word would be added to the end of the list as the name of some other animal. The same (that is repetition of the word at the end) was done for words that were masked by any external noise.

3.5 Results

Table 1 shows the categories used for coding the responses, with some examples. A short explanation of the code names and more examples follow.

Table 1. Categories used in coding with examples of corresponding responses.

Code	Stimulus	Response
Correct	*fθoki*	*fθoki*
Single	*fθoki*	*θoki*
FT change	*pixθa*	*pixta*
Other FT cluster	*ptika*	*xtika*

[2] In the same list as items for other tests, see footnote 1. The items were put in a random order, and then sequences consisting of three or more items that belong to the same category were broken up.

Other cluster	*fθoki*	*xroki*
Other	*fθoki*	*floki*

"Correct" indicates an adult-like cluster. For instance:
(10) *fθoki*→ *fθoki* (Emanouela 4;11)

"Single" indicates a single consonant that can be either one of the two comprising the cluster or a different one. For example:

(11) *fθoki*→ *θoki* (Epistimi 2;03)
kapti→ *kapi* (Kali 3;00)
fθoki→ *toki* (Fenia 3;01)

I coded as "FT change" clusters of which the first member is a fricative and the second a stop. These are the clusters that are the result of a dissimilation process according to the view presented in section 2.3.The cluster is the result of stopping of the second member of the cluster, in the case of fricative-fricative clusters.

(12) *pixθa*→ *pixta* (Maro 3;09)
kifθo→ *kifto* (Manolios 4;00)
fθoki→ *ftoki* (Dimitra 3;00)
xθapi→*xtapi* (Zoi 4;02)

In the case of stop-stop clusters, it is the result of frication of the first member of the cluster.

(13) *ktito*→ *xtiko* (Manos 3;04)
ptika→ *ftika* (Kostantina 3;11)
tokti→ *toxti* (Stamatis 3;08)
kapti→ *kafti* (Manthos 3;00)

"Other FT cluster" indicates any change in one of the consonants that results in a cluster of the form fricative-stop. This category was included because these clusters indicate a preference for fricative-stop clusters, even if they are not the result of the same process as the clusters of the previous category (see also section 4.5).

(14) *ptika*→ *xtika* (Elisavet 3;07)
tokti→ *tofti* (Sofia 3;01)

"Other cluster" indicates any other change of both consonants that does not result in a fricative-stop (FT) cluster.

(15) *fθoki*→ *xroki* (Aglaia 3;03)

"Other" indicates any other response. It includes a change of one of the consonants, in a way that does not result in a FT cluster, as well as instances of vowel epenthesis and metathesis, grouped together because of their low percentages.

(16) *fθoki*→ *floki* (Nikos (4;03)
kapti→ *kaputi* (Vasiliki 3;10)

Following the coding mentioned above, the results for word initial clusters are given in Figure 1.

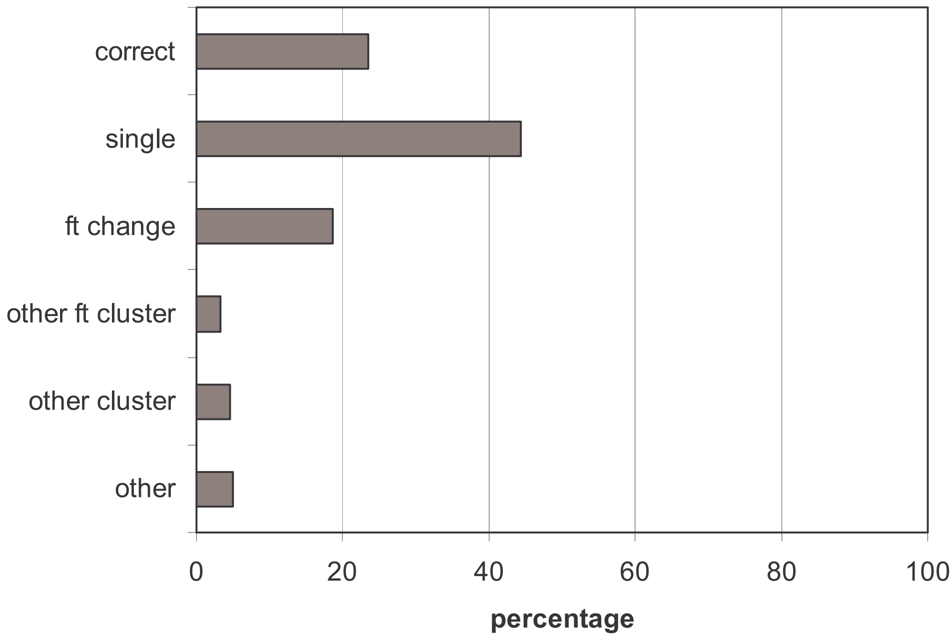


Fig. 1. Word initial clusters (n=236), percentage of responses by category.

The most common mistake that children made was to produce a single consonant instead of two (44.45% of the time). The second most common mistake was the FT change (18.6% of the time), and the remaining mistakes were a lot less common (other FT cluster 4.2%, other cluster 4.6%, other 4.6%). Correct responses were given 23.5% of the time.

In a similar manner, Figure 2 contains the results for word medial clusters.

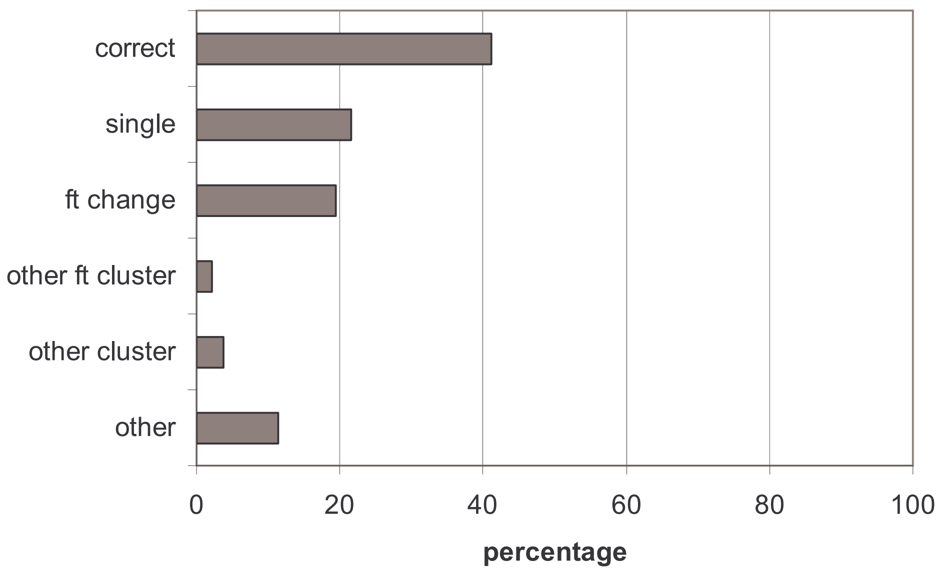


Fig. 2. Word medial clusters (n=236), percentage of responses by category.

In the case of word medial clusters, correct responses were given 41.1% of the time. Single consonants were produced 21.6% of the time, and a FT change was again the second most common mistake 19.5%, much more common than the rest of the mistakes (FT change 2.1%, other cluster 3.8%. other 11.4%).

There was a difference in performance between the two positions. As argued in Sanoudaki (2005), according to the parametric model of the acquisition of consonant clusters outlined there, word medial clusters of non rising sonority are expected to be acquired earlier than their word initial counterparts. Children gave 56 correct responses (out of 236 trials) in word initial position versus 97 in medial position (out of 236). A chi-square test (χ^2=16.257, DF=1) showed a statistically significant difference (p<0.001) between the two positions.

There was, however, no difference between the two positions with regard to the FT change. FT change was produced with comparable frequencies in word initial and word medial position. This is evident from the percentages in Figures 1 and 2 (18.6% for word initial and 19.5% for word medial clusters). Because our age range was wide, and in order to control for the fact that medial clusters are acquired earlier, correct responses were excluded. Single consonant responses were not considered either. By doing so, only the responses that have two consonants in the relevant position are taken into account, and a more reliable comparison is made. The resulting percentages are 58.6% for initial and 52.3% for medial position. A chi square test (χ^2=.669, DF=1) showed no significant difference (p=.413) between the initial and medial positions.

Finally, to move to the point that interests us the most, the percentage of correct answers was relatively high. In both word initial and word medial position, the number of correct answers was higher than the number of FT changes. In the case of word medial clusters, the percentage was a lot higher, and a chi-square test (χ^2=18.189, DF=1) showed a statistically significant difference ($p<0.001$). Such results point against the view that the popular language only allows FT clusters, with the fricative-fricative and stop-stop clusters belonging to the high variety. Even though the FT change was performed quite often, children were often able to produce clusters that were supposed to belong to Katharevusa. This is quite unexpected, since it would be very strange to assume that children aged two to five could and would use language of the high variety.

A possible explanation might be found in the children's sociolinguistic background. As mentioned in section 2.1, the application of FT change or not marks the linguistic register and also the social class of the speaker. It is therefore possible that children from higher social classes and backgrounds are more exposed to Katharevusa forms[3], and would consequently avoid the application of FT change. If this turns out to be correct, it would be in line with a frequency account for acquisition, which would expect that children's cluster production follows the frequency the clusters have in their input. We would therefore expect to find differences in the number of children that perform a FT change between social classes in our experiment.

A first step towards testing this is to check whether there is any difference in the performance of children according to their nursery, something that might indicate social variation. Our experiment was conducted in four different nurseries. The nurseries were divided in two categories. The first category included the first three nurseries, which were closer in terms of socio-economic profile, as they were State nurseries in working class areas, with the first one being a Worker's Guild nursery. Children in these nurseries, being in environments that show a preference for fricative-stop clusters, would be expected to perform a FT change more often than children in nursery four. Nursery four was a private nursery, and therefore had children coming from families with a higher socio-economic profile, that might tend to use FT clusters less often.

The results were the following: in the state nurseries, 79% of the children (37 children) performed a FT change at least 25% of the time (one out of four responses). The corresponding percentage for the private nursery was 75 (9 children). A 2x2 chi-square test was carried out to discover if there was a significant relationship between the type of nursery and FT change. The χ^2 value of 0.77 had an associated probability value of .781, DF=1, showing that such an association is likely to have arisen as a result of a sampling error. It can therefore be concluded that there is no difference between the nurseries.

[3] Unfortunately, to my knowledge, no such data from child-directed speech are available.

The results point against the hypothesis that FT change in children's performance is a direct consequence of the frequency of the clusters in the children's linguistic environment, since environments of different social background, with an assumed different cluster frequency do not result in different performance[4].

Our question is thus recalcitrant: why are children performing the FT change, what causes and conditions the phenomenon? In the following section, I attempt to give an answer.

4 The analysis

4.1 The Dissimilation rule-problems

There are several question marks surrounding the analysis of FT change. The dissimilation rule introduced in (2) was proposed as a diachronic change/rule leading from ancient to Modern Greek. But what would the synchronic status of the rule be? Especially in a variety that does not have instances of the assumed underlying forms (in the case of the popular language these are fricative-fricative or stop-stop clusters, see section 2.2), we would have to answer questions about the psychological status of the rule and its learnability: how do children acquire such a rule[5]?

Seigneur-Froli (2004; 2003) points at further weaknesses of the dissimilation analysis. For example, she claims that dissimilation cannot explain the medio-passive aorist forms such as *liftike* 'was lacking' (present active *lipo*, suffix -*θike*). The dissimilatory derivation according to Holton et al (1997) is the following:

(17) *li**p**-**θ**-ike* > *li**f**-**t**-ike*

The problem for this analysis is that the sequence *pθ* does not contain two adjacent fricatives or plosives, and the rules in (5) should not change it. The form changes despite the fact that it does not need to be repaired. If the dissimilation rule was the correct analysis, the form should remain *lipθike.*

In the list of unanswered questions we can include the absence of dissimilation in clusters of voiced fricatives (*vð, γð*). The rules in (5) can describe the lack of dissimilation in this case, but do not explain it.

Moreover, dissimilation as a historical process has been questioned. There is scepticism towards the conclusiveness of evidence for the existence of the assumed

---

[4] This does not mean that frequency plays no role in this phenomenon, as we shall see in section 4.5.

[5] This is a familiar problem with SPE type rules, and in this case it is more acute because the synchronic rule was borrowed from a diachronic one.

stage *fθ*, which was the supposed input to one of the two dissimilation rules (Horrocks 1997). Seigneur-Froli (2003) challenged the interpretation of Egyptian writings and Latin transcriptions of Greek and argued that such a stage never existed. Instead she proposed a diachronic lenition analysis following a CVCV framework. The following section contains some information on the lenition approach and the theoretical frame.

4.2 The framework

The analysis of a word medial *pt>ft* change as lenition would be welcomed by the majority of syllabic theories: the first stop being in a position traditionally called coda, which is recognised as weak, it would not be surprising that it lenites.

Seigneur-Froli (2004; 2003) couches her analysis in a CVCV framework (Lowenstamm 1996; 1999), following, specifically, the Coda Mirror theory (Ségéral & Scheer 2001), for good reasons. Greek contains the clusters in question in word initial position, as well (see examples in section 2.2). The sheer existence of these clusters is problematic for traditional syllabic theories[6], let alone the fact that they behave – in terms of strength– like their word medial counterparts, since they follow identical lenition patterns. But for CVCV theory the two events are expected and fall under a single explanation. For the details of the mechanism the reader is referred to the work mentioned above. For our purposes, it suffices to say that in this phonological approach, structure and segmental strength are effects of the combined action of government and licensing. In a cluster like *pt,* the position occupied by *t* is strong because it receives the strengthening power of licensing by the following nucleus, while the position of *p* is weak because it is not licensed[7].

Moreover, following research on monovalent elements[8] (see e.g. Harris (1990)), lenition is viewed as the loss of material, and fortition its addition. The change of *p* to *f*, for example, would be as follows:

---

[6] For attempts to accommodate these clusters in other frameworks, see e.g. Steriade (1982) and Pagoni (1993; 1998) for an analysis in Standard Government Phonology.

[7] The situation is of course a lot more complex, since government and licensing are dispensed in different ways and strength is a result of an interaction of the two. This does not affect our discussion; for details see Ségéral et al (2001).

[8] Government phonology (and CVCV as its development), as well as Dependency and Particle Phonology, do not use binary (or multi-valued) features in the representations of segments, but rely instead on monovalent objects. Complexity can thus be seen as the number of primes a segment is composed of (Harris 1990). I provide no list of primes, since there is no consensus as to which these primes are. Some contributions to the debate can be found in Harris (1990; 1994), Harris & Lindsey (1995), Kaye (2001), Rennison (1999), Scheer (1999), Szigetvári (1994).

(18) *p* → *f*

```
x   x
|   |
h   h
|   |
U   U
|
?
```

The lenition is due to the loss of the occlusion element (?). The elemental make-up of these sounds in (18) is taken from Pagoni's (1993) analysis for Greek consonants. It involves the place element U, along with the noise element h and the stop/occlusion element. However, the exact representation of these consonants is not crucial for our discussion. Despite the fact that there are numerous proposals for the internal composition of consonants in terms of elements (see footnote 8), most analyses would agree on the statement that a fricative could be the lenited version of the corresponding stop, via the loss of some kind of occlusion element.

CVCV theory provides us with the tools to determine which positions are strong or weak, and consequently where we should expect to find lenition or fortition diachronically, and where it would be impossible for them to happen. However, it does not say much about what changes in the speaker's grammar when such a process occurs and why the change takes place.

Already in the nineteenth century it was believed that language change is a result of language acquisition (Passy (1890) cited in Lightfoot (1999)). The challenge is therefore to find the link between these two. In our case, that would be to reconstruct in a plausible way the diachronic evolution of Greek with respect to consonant clusters, bearing in mind that the evolution was the result of some change in the speakers' grammar. This would involve determining how it was possible, at some point in history, for the grammar that ancient Greek children acquired to be different from the one their parents had.

The advantages of such an approach are double. On the one hand, as part of our work towards an explanation of the historical change and language acquisition it is more economic, since it provides a single explanation for the two. Moreover, it enforces a criterion for theories of language change that has long been used as a criterion for linguistic theory: explanatory adequacy (Chomsky 1981). A linguistic theory has achieved explanatory adequacy if it can show how descriptively adequate grammars can arise on the basis of exposure to primary linguistic data, in other words, if the different grammars predicted by the theory to exist are learnable. In language change a theory would have explanatory adequacy if it can not only determine what the two grammars are – the one before and the one after the change –, but also specify the trajectory of the change, that is show, in learnability terms, how the change came about. For instance, in Optimality Theoretic phonological analyses, a change is generally thought to be a re-ranking of constraints (e.g. McMahon (2000), Gess (2006)). However, the question often not answered (or even asked) is what the conditions are under which this re-ranking takes place. What kind of change in the primary linguistic data causes the grammar to change.

In the following sections, I attempt to fill in this gap by suggesting some answers to the above questions, by proposing a grammar change that occurred with respect to consonant clusters in Greek, and suggesting possible reasons why it took place.

4.3 The parameter

I argue for the existence of a parameter that was responsible for the historical change. The parameter is based on the distintion between a preconsonantal and a post consonantal position: recall that in CVCV the former position is unlicensed while the latter licensed. The parameter has the following two settings:

(19) Complexity Parameter
Setting a)
If A is a licensed position and B an adjacent unlicensed one, and α is the number of elements in A and β the number of elements in B, then β must be smaller than α.
Setting b)
If A is a licensed position and B an adjacent unlicensed one, and α is the number of elements in A and β the number of elements in B, then β must be smaller than or the same as α.

And more formally:

(20) Setting a) $\beta < \alpha$
Setting b) $\beta \leq \alpha$

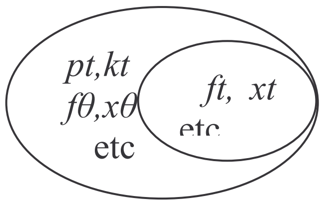
Before proceeding to a discussion on the parameter, let us briefly see how that corresponds to the clusters we are examining. In a word like *efta*, for instance, *f* is unlicensed and *t* is licensed. *f* contains a smaller number of elements than *t* (see below), fitting under setting (a) or (b). On the other hand, in the word *epta* the unlicensed and licensed positions, occupied by p and t respectively, would have the same number of elements, corresponding to setting (b) only.

Both settings of the parameter follow the spirit of the Complexity Condition (Harris 1990). From the early days of Government phonology it was argued that some positions are disadvantaged compared to others, in terms of elemental content (see also Kaye et al (1990)). The number of elements that they are allowed to contain cannot be higher than that allowed in some other, more privileged positions. In the same spirit, the licensing inheritance theory was developed (Harris 1992), according to which a position inherits licensing potential from its licensor. According to this system, licensing determines the syllabic structure, and part of its effects is that the lower down the licensing hierarchy a position is, the fewer elements it is allowed to contain. Different versions of the Complexity Condition or Licensing Inheritance have been used in Rice (1992), Pagoni (1993), Takahashi (Takahashi 1993;Takahashi 2004) Backley (1995), Nasukawa (1995), amongst others.

The parameter in (19) is a direct translation of the Complexity Condition into CVCV, with the addition of binarity: a language may allow an unlicensed position to have as many elements as the licensed one, or enforce a stricter restriction, demanding that it have fewer elements[9].

The default setting for the parameter would need to be setting (a). This follows from learnability requirements. Specifically, the possible forms for setting (a) are a proper subset of the possible forms for setting (b). This is because forms with a smaller number of elements for the unlicensed position would satisfy both settings, while forms with the same number of elements in licensed and unlicensed positions can only exist under setting (b).

(21) A subset relation



small oval: setting (a)
large oval: setting (b)

---

[9] Because structure and strength in CVCV depend on a combination of government and licensing, a complete parametric system would include both these forces. However, the parameter suggested is sufficient for our purposes, since the two positions we are examining are only differentiated by the absence versus presence of licensing. Moreover, the parameter could be more fine-grained, to include tighter restrictions on the number of elements, and should be studied in conjunction with licensing constraints (Charette & Göksel 1996;Kula 2005), which impose restrictions on the possible combination of elements within a segment. These are issues for further research.

In terms of learnability, only positive evidence can be used in acquisition (Chomsky 1981). The learner starts with a default setting for each parameter: the 'unmarked' one. Positive evidence is then required for a change of the setting to the 'marked' option. It has been argued that what constitutes a cue to the marked setting has to be empirically determined by the linguist for each parameter (Dresher 1999; 2003;Dresher & Kaye 1990)[10]. As a result, and following the subset principle, setting (a) has to be the default setting, with setting (b) being the result of positive evidence during the acquisition process. The cue for a change of the setting will be words with segments in an unlicensed position containing the same number of elements as the adjacent licensed position[11]. If setting (b) were the default one, there would be no available cue for a change of setting.[12]

Let us now see how the proposed parameter can describe the diachronic evolution of the Greek clusters. As we saw in section 2, Ancient Greek contained consonant clusters such as *pt*. These would have the same number of elements in the unlicensed and the licensed position.

```
(22)   p  t
       x  x
       |  |
       h  h
       |  |
       U  R
       |  |
       ?  ?
```

In the representation above, *p* (in the preconsonantal unlicensed position) contains three elements, right next to a licensed one, occupied by *t*, which also contains three elements. This indicates that the parameter for the grammar was set in the marked setting (20)b), allowing for an unlicensed position to have the same number of elements as the licensed one.

---

[10] Cf Borer & Wexler (1987).

[11] In this case one of the grammars produces forms that are a subset of the forms of the other, and this facilitates our decision for the initial state (see Dresher & Kaye (1990) for more complex cases).

[12] Notice that the cue cannot be read directly off the sound signal; it requires prior analysis from the learner (see Dresher & Kaye (1990)). Even if the complexity of a segment can be read off the speech signal (Harris & Lindsey 1995), this is not sufficient for the setting of the parameter. The learner needs to have worked out beforehand if the language has licensing at all and which positions are licensed and which are not (see Sanoudaki 2005).

Compare this with the forms that arose with the change, as that was described earlier.

(23) *f t*

```
x  x
|  |
h  h
|  |
U  R
   |
   ?
```

With the loss of occlusion, the new forms had fewer elements in the unlicensed position than in the licensed one. The forms with the same number of elements were no longer generated by the grammar. This corresponds to a move from the marked to the unmarked setting (20)a).

The clusters of aspirated stops followed a similar development, in a cascade effect manner. The development described in section 2.2 involves spirantisation of voiceless aspirated stops. This is true in the case of intervocalic and word initial positions.

(24) *ot^honi*→ *oθoni*
t^helo→ *θelo*

However, in the case of clusters, spirantisation would result in a cluster of fricatives, a sequence that would be illegal under the new parameter setting. A cluster like *fθ,* for example, would contain the same number of elements in the two positions, licensed and unlicensed one, contrary to the requirements of the parameter.

(25) *f θ*

```
x  x
|  |
h  h
|  |
U  R
```

Since the resulting cluster would be illegal, the end result would have to be modified in order to conform to the new parameter setting, having a greater number of elements in the licensed position. This meant that instead of *fθ* the cluster arising from $p^h t^h$ had to be *ft*.

(26) $p^h t^h > (*f\theta) > ft$

The evolution proposed here is in line with the weakness of evidence for the traditionally assumed existence of the intermediate step *fθ* (Horrocks 1997; Seigneur-Froli 2003).

Finally, the evolution of voiced stops at first glance appears to violate the new parameter setting. Voiced stops also underwent spirantisation (section 2.2). The resulting clusters of voiced fricatives would appear to disrespect the parameter setting by having the same number of elements in the two positions (just like clusters of voiceless stops or fricatives would, as we saw above). However, this is not the case. The difference between voiceless and voiced consonants in Greek is the voice element L (Pagoni 1993)[13]. In voiced clusters, this element originates in the licensed position and spreads to the unlicensed one (see representation of *vð* below).

(27) *vð*

```
x  x
|  |
h  h
|  |
U  R
|  |
<<L
```

In the above representation, the first of the two fricatives receives its voicing from the second one. This representation is supported by the fact that Greek does not allow sequences of a voiceless and a voiced fricative, thus indicating that the two fricatives somehow share their voice element. The representation is also consistent with analyses of clusters in languages that allow only geminates and/or homorganic nasal-consonant clusters (see Harris (1990). The unlicensed position in such languages is analysed as only having one element (in the case of nasal-consonant clusters) or none (in the case of geminates), the source of the rest of the elements being the licensed position.

The implication of the above is that voiced fricative clusters in Greek respect the unmarked setting of the complexity parameter, which requires a smaller number of

---

[13] In the case of voiced stops, Pagoni proposes an analysis that involves an interaction between a plain (voiceless) stop and a preceding nasal segment.

elements in the unlicensed position. This explains what the dissimilation approach fails to tackle: why these clusters did not ‘dissimilate’[14] (see section 4.1).

Having claimed that the change of consonant clusters from ancient to Modern Greek involved a parameter change, the question that follows is why this change took place. In the following section I provide a feasible answer, as promised in section 4.2, by attempting a plausible reconstruction of the historical change in question.

4.4 A cue-based analysis

Diachronic change is an area not very popular amongst generative linguists. Some work has been done with the idea that change is due to rule re-ordering or change of features (see e.g. Harris (1980)), and more recently, work within the generative framework attempting to link language change with language acquisition is done by Lightfoot (1991; 1999).[15]

Lightfoot follows a cue-based approach, similar to the one we have been using. According to this view, children do not try to match the input; they scan their linguistic environment for cues that determine the setting of a parameter (Dresher & Kaye 1990). Each parameter is associated with one cue by UG.[16] Lightfoot argued that in cases when children fail to detect the cue for a parameter setting that their parents’ language has, the setting changes: children will have a grammar that will generate forms that are different from the ones their parents’ grammar generates.

The reasons for the children’s failure to find a cue vary: they may be related to language contact, or be the side effect of some other change in the parent’s grammar, that will cause the expression of the cue to fall under a certain threshold, thus making it undetectable for the children (Lightfoot 1999). A direct implication of this is that the change in the parents’ grammar might look unrelated to the parameter in question, but it can have the side effect of creating a change in the parameter setting. Lightfoot goes on to exemplify a case in which language change is a result of language contact: the loss of verb-second in English. Moreover, he

[14] Our analysis follows the spirit of Seigneur-Froli (2004; 2003). We depart from her analysis mainly in the case of aspirated and voiced stops. In her account, the loss of occlusion in the case of these series was an instance of lenition. However, notice that voiced stops lost occlusion in all positions, without exception. It would be therefore very peculiar to analyse that loss of occlusion as lenition, taking place in strong positions, too, which would be normally expected to undergo fortition.

[15] See also Kroch (2001).

[16] Lightfoot departs from Dresher & Kaye’s model, in claiming that there is not default setting for a parameter. However, this does not affect our discussion.

argues that the case of loss of V-to-I raising in English was a consequence of a change of the distribution of the relevant cue, because of preceding independent changes in the grammar.

I propose that a similar situation may have occurred in the case of Greek clusters, this time as a result of the combined action of language contact and of an independent change. Recall that ancient Greek had the marked setting for the complexity parameter, according to which the number of elements in an unlicensed position must be smaller than or the same as in the adjacent licensed position.

(28) $\beta \leq \alpha$

The difference between the unmarked and marked setting is the 'the same as' part. This means that the cue for the marked setting of the parameter would be clusters containing an unlicensed position with the same number of elements as the licensed one: [$\beta = \alpha$]. An ancient Greek child would scan the input for this cue, and find it in forms containing *pt, kt*[17], in word medial and word initial position. The linguist's problem now is to find out why the parameter changed from the marked to the unmarked setting.

Note that the change took place at some point during the first centuries AD, a period of Roman conquest. This was a period of influence and interaction for the two languages, Greek and Latin. Latin became more and more widespread as the power of Rome was increasing. Koine, the popular Greek of the time, having been the lingua franca of the East, was quite resistant, and did not disappear. Latin-speaking traders, officials and soldiers learned Koine (Horrocks 1997). The long-lasting presence of Romans in the area meant that Greek children would hear around them Greek, Greek spoken by native speakers of Latin, and some amount of Latin.

What was the structure of Latin? Latin contained *pt, kt* clusters in word medial position (examples from Sihler (1995)).

(29) scriptus (scribō 'scratch')
actus (agō 'drive')
vectus (vehō 'convey')
coctus (coquō 'cook)

However, it did not have any such clusters word initially. In fact, loans from Greek with a word initial *pt* were altered so that the end result does not contain the initial cluster (example in (30) from Goetz (1888)).

---

[17] We leave aside the issue of the analysis of clusters of aspirated and voiced stops.

(30) tisana 'pearl barley' < πτισάνη (ptisanē)

So both Latin and the Greek spoken by Latin native speakers would contain word medial examples of the cue to the marked setting, but the word initial expression of the cue would not exist in either, since there was no word initial *pt*. As a result, the proportion of cue to the marked parameter setting that Greek children would hear dropped, as they mixed with Latin speakers.

At around the same period, an independent development took place in Ancient Greek (Horrocks 1997). Greek had a number of diphthongs, including *au* and *eu*. The second element of these two diphthongs started becoming narrower around the third century BC, moving from *w* to a bilabial fricative *β* and possibly *v* by the Roman period. An example of this is a υ-β interchange (relevant segments in bold) in a Ptolemaic papyrus with ῥά**υ**δους for ῥά**β**δους repeated three times (Gignac 1976). This error indicates that υ (used until then for *u*) and β (a fricative at that period) were used for the same sound in that position, thus causing the spelling mistake. Such spellings become increasingly common during the late Roman period[18]. Further examples of υ-β interchange are listed below, with the relevant segments in bold (from Gignac (1976)).

(31) Πνε**β**τύνι corrected by a second hand to Πνε**υ**τύνις (A.D. 35/36)
ἑ**υ**δόμῃ for ἑ**β**δόμῃ (A.D. 335?)
προσαγορε**β**σει for προσαγορεῦσαι (5th/6th cent.)

With the addition of these forms in the language the proportion of consonant clusters containing the cue for the marked parameter setting would drop even more. The number of fricative-stop clusters increased, and the relative frequency of stop-stop clusters decreased as a result (Horrocks 1997). For instance, words that previously contained *aut*, now contained a consonant cluster, *aft: autos* became *aftos*. Overall, the percentage of clusters expressing the cue decreased.

This development, along with the Roman contact, may have contributed to the weakening of the cue for the marked setting of the complexity parameter. It is possible that as a result of these changes the cue was too weak to be able to cause a change in the setting of the parameter from the unmarked to he marked setting in a child's developing grammar. Therefore, in the grammar of Greek children, the parameter remained in the unmarked setting, according to which the unlicensed position has fewer elements than the licensed one. The forms with FT clusters

[18] In fact, still now in Greek spelling αυ and ευ are used to represent *av-af* and *ev-ef* respectively (voiceless before a voiceless sound). These, existing alongside φ and β, the regular symbols for *f* and *v,* still give trouble to learners of the Greek writing system.

instead of voiceless unaspirated stops and aspirated stops that were the outcome of this period reflect the unmarked setting of the parameter.

4.5 Linking history and acquisition

We started our quest in an attempt to explain data from children acquiring Greek. We examined the history of Greek, and we discussed a parameter that deals with the complexity of consonants in different positions. Recall that the phenomenon we were trying to explain was that children often turned *pt* and *fθ* into *ft*. In the light of our previous discussion, the developmental data now follow. As discussed earlier, children in the process of acquisition are expected to start from the unmarked setting of the parameter before moving to the marked one. This is precisely what is happening here. Children's grammar is going through the initial stage of the unmarked parameter setting, when clusters having an equal number of elements in the two positions are not allowed. The clusters *pt* and *fθ* being disallowed by that grammar, children resort to rescuing strategies[19] that give alternative outputs allowed by their current grammar. It is here that cluster frequency plays a role. Although there would be a number of possible changes that would render the form grammatical (reduction of the first member to a glottal stop, for example, would create the necessary complexity difference), the overwhelming majority of the children resort to a strategy that produces a cluster that is frequent in their linguistic environment, namely FT clusters. And this may be done with frication or stopping, the processes that have been analysed as dissimilation (FT change). The production of any other cluster that follows the structure fricative-stop would also be consistent with this grammar, and some children opt for this solution (see section 3.5, 'other FT cluster' and examples thereof).

Notice that it is implicit in this analysis that clusters like *pt*, *fθ* are generated by today's adult grammar. This means that the grammar of Greek is changing for a second time. The first change brought Ancient Greek from the marked to the unmarked setting, with the intervention of language contact. That was the change form *pt*/p^ht^h to *ft*. The second change has taken Greek back to the marked setting, from *ft* to *pt*/ *fθ*. Is there any evidence to suggest that this change is happening? And how did it take place?

According to our proposal (and Seigneur-Froli's (2003) analysis) for the change of clusters in Greek, *fθ* never existed in popular Greek. P^ht^h clusters moved directly to *ft*. However, the desire to restore the language and assumed grandeur of ancient Greece resulted in the introduction of non-existing artificial varieties. The long history of diglossia and the existence of Katharevusa in Greece (see section 2.1) is

[19] For more details on this notion see Sanoudaki (2005).

the painful result of such language policies. However, it is mainly during the twentieth century, when (Katharevusa) education became accessible to the majority of the population, and especially the last few decades of exposure to (Katharevusa speaking) mass media, that the change in question came about. Although Demotic (the low-popular variety) has been declared the official language, the language spoken in Greece, still by no means uniform, is a mixture of the popular language and Katharevusa in many respects (Mackridge 1985).

In our case, Greek children during the twentieth century were exposed to more and more *pt*/*fθ* forms that Katharevusa contained, until the exposure was high enough to change the setting of the complexity parameter. In today's language, several words contain these clusters. Although it may be true that more words of a higher register contain them (Tserdanelis 2001), there exist several words of everyday use with *pt/ fθ* . For instance: *periptero* 'kiosk', *raptomixani* 'sewing machine', *ptisi* 'flight', *fθinoporo* 'autumn' etc. Naturally, the claim that the grammar of Greek is changing to allow *pt*/*fθ* clusters will have to be tested with adult speakers of Greek.

However, we can examine our child data to test whether our parametric analysis is correct. If it is the case that the grammar of Greek allows *pt*/*fθ* clusters, which instantiate the marked setting of the complexity parameter, whilst the unmarked setting of the parameter is manifested in FT clusters in the child's production, we expect to find an age difference in the production of these clusters. Specifically, younger children will be expected to produce more FT clusters (including FT change and other FT clusters, as mentioned earlier). These will decrease with age, as their grammars move to the marked setting of the parameter. Although the two approaches are not directly comparable, note that this is not what we would expect under a dissimilation approach. If there is a dissimilation rule active in the popular language children would be expected to dissimilate more as they grow older, as they learn the rule.

In order to test this, children were divided into three age groups. The responses counted were the FT clusters versus the correct responses for each age group[20]. Under our experimental hypothesis, there should be a difference between age groups. The responses for the different age groups in word initial and word medial position are summarised in Table 2.

[20] The rest of the responses (consonant deletion, epenthesis etc, see section 3.5) were excluded, since they did not have the relevant two consonant structure, and would therefore not be a good measure for our test.

Table 2. Target versus FT clusters and FT cluster percentages by age group, in word initial and word medial contexts.

Age	Context 1: Word initial			Context 2: Word medial		
	Target	FT cluster	FT cluster %	Target	FT cluster	FT cluster %
2;03- 3;05	9	19	67	24	22	48
3;06-3;11	23	11	32	35	13	27
4;00-5;00	24	15	38	38	16	30

A chi-square test was performed for both contexts, with the two older groups collapsed as there was no significant difference between them. The results indicated a statistically significant difference between age groups in both positions[21] (for the word initial position χ^2 =8.516, DF=1 p=0.004, and for the word medial position χ^2 =5.280, DF=1, p=0.022). These results are consistent with our prediction that younger children would produce more FT clusters, and strengthen our analysis that FT clusters in the experiment are an instantiation of the initial setting of the complexity parameter. As children's grammar moves to the marked setting, the percentage of FT clusters drops.

5 Conclusion

In this paper, I examined the clusters of voiceless stops and voiceless fricatives in Greek, their historical evolution and their acquisition. Using developmental and historical data, as well as learnability considerations, I proposed a binary Complexity parameter that can capture the diachronic evolution and explain the acquisition process of these clusters.

References

Backley, P. 1995, "A tier geometry for vowel systems", *UCL Working Papers in Linguistics*, vol. 7, pp. 399-436.

Borer, H. & Wexler, K. 1987, "The maturation of syntax," in *Parameter setting*, T. Roeper & E. Williams, eds., Reidel, Dordrecht.

Browning, R. 1983, *Medieval and Modern Greek* Cambridge.

Charette, M. & Göksel, A. 1996, "Licensing constraints and vowel harmony in Turkic languages", *SOAS working papers in Linguistics and Phonetics*, vol. 6, pp. 1-25.

Chomsky, N. 1981, *Lectures on Government and Binding* Foris, Dordrecht.

Dresher, B. E. 1999, "Charting the learning path: Cues to parameter setting", *Linguistic Inquiry*, vol. 30, pp. 27-67.

[21] For the difference between the two positions, see section 3.5.

Dresher, B. E. 2003, "Meno's paradox and the acquisition of grammar," in *Living on the edge; 28 papers in honour of Jonathan Kaye*, S. Ploch, ed., Mouton de Gruyter, Berlin.

Dresher, B. E. & Kaye, J. 1990, "A computational learning model for metrical phonology", *Cognition*, vol. 34, pp. 137-195.

Ferguson, C. A. 1959, "Diglossia", *Word*, vol. 15, pp. 325-340.

Friedemann, M.-A. 1992, "The underlying position of external arguments in French: A study in adult and child grammar", *Geneva Generative Papers*, vol. 1-2, pp. 145-162.

Gess, R. 2006, "On re-ranking and explanatory adequacy in a constraint-based theory of phonological change," in *Optimality Theory and Language Change*, D. E. Holt, ed., Kluwer, Dordrecht, pp. 67-90.

Gignac, F. T. 1976, *A grammar of the Greek papyri in the Roman and Byzantine period. Vol.I Phonology* Milan.

Goetz, G. & Loewe, G. 1888, *Corpus Glossariorum Latinorum* Teubner, Leipzig, repr. Amsterdam: Hakkert,1965.

Harris, A. 1980, "On the loss of a rule in syntax," in *Papers from the fourth international conference on historical linguistics*, E. Traugott, R. Lebrun, & S. Shepherd, eds., Benjamins, Amsterdam.

Harris, J. 1990, "Segmental complexity and phonological government", *Phonology*, vol. 7, pp. 255-300.

Harris, J. 1992, "Licensing Inheritance", *UCL Working Papers in Linguistics*, vol. 4, pp. 359-406.

Harris, J. 1994, *English Sound structure* Blackwell, Oxford.

Harris, J. & Lindsey, G. 1995, "The elements of phonological representation," in *Frontiers of phonology: atoms, structures, derivations*, J. Durand & F. Katamba, eds., Longman, London.

Holton, D., Mackridge, P., & Philippaki-Warburton, I. 1997, *Greek grammar:a comprehensive grammar of the modern language* Routledge, London.

Horrocks, G. C. 1997, *Greek; a history of the language and its people* Longman Linguistics Library, London and New York.

Joseph, B. D. & Philippaki-Warburton, I. 1987, *Modern Greek* Croom Helm.

Kaye, J. 2001, "Working with licensing constraints," in *Constraints and preferences*, K. Dziubalska-Kolaczyk, ed., Mouton de Gruyter, Berlin & New York.

Kaye, J., Lowenstamm, J., & Vergnaud, J.-R. 1990, "Constituent structure and government in phonology", *Phonology Yearbook*, vol. 7.2, pp. 193-231.

Kazazis, K. 1992, "Sunday Greek revisited", *Journal of Modern Greek Studies*, vol. 10, pp. 57-69.

Kehoe, M. M. & Stoel-Gammon, C. 2001, "Development of syllable structure in English-speaking children with particular reference to rhymes", *J.Child Lang.*, vol. 28, pp. 393-432.

Kroch, A. 2001, "Syntactic change," in *The handbook of contemporary syntactic theory*, M. Baltin & C. Collins, eds., Blackwell, Oxford, pp. 699-729.

Kula, N. C. 2005, "On licensing constraints for consonants," in *Papers in Government Phonology. Special Issue of Leiden Papers in Linguistics 2.4*, N. C. Kula & Jeroen van de Weijer, eds., pp. 51-75.

Lightfoot, D. W. 1991, *How to set parameters: evidence from language change* MIT Press, Cambridge, Massachusetts.

Lightfoot, D. W. 1999, *The development of language: acquisition, change and evolution* Blackwell, Malden, MA.

Lowenstamm, J. 1996, "CV as the only syllable type," in *Current Trends in Phonology. Models and Methods*, J. Durand & B. Laks, eds., ESRI, Salford, Manchester, pp. 419-441.

Lowenstamm, J. 1999, "The beginning of the word," in *Phonologica 1996*, J. Rennison & K. Kühnhammer, eds., Holland Academic Graphics, La Hague, pp. 153-166.

Mackridge, P. 1985, *The modern Greek language* Oxford.

McMahon, A. 2000, *Change, Chance and Optimality* OUP, Oxford.

Nasukawa, K. 1995, "Nasality and harmony in Gokana", *UCL Working Papers in Linguistics*, vol. 7, pp. 511-533.

Newton, B. 1972, *The generative interpretation of dialect: a study of modern Greek phonology* Cambridge University Press, London.
Pagoni, S. 1993, *Modern Greek phonological variation: a goverment phonology approach. PhD Dissertation* University College London.
Pagoni-Tetlow, S. 1998, "Breaking up is (not) hard to do: the case of the Modern Greek *pt/kt* sequences," in *Themes in Greek Linguistics II*, B. D. Joseph, G. C. Horrocks, & I. Philippaki-Warburton, eds., John Benjamins, Amsterdam.
Passy, P. 1890, *Étude sur les changements phonétiques et leurs caractères généraux* Firmin-Didot, Paris.
Pierce, A. 1992, *Language acquisition and syntactic theory* Kluwer, Dordrecht.
Pinker, S. 1984, *Language Learnability and Language Development* Harvard University Press, Cambridge, MA.
Rennison, J. 1999, "Can there be empty phonological elements? On empty heads and empty operators," in *Phonologica 1996*, J. Rennison & K. Kühnhammer, eds., Holland Academic graphics, The Hague, pp. 183-193.
Rice, K. D. 1992, "On deriving sonority: a structural account of sonority relationships", *Phonology*, vol. 9, pp. 61-99.
Sanoudaki, E. 2005, *Cluster simplification in child language and CVCV theory. Ms* UCL.
Scheer, T. 1999, "A theory of consonantal interaction", *Folia Linguistica*, vol. 32, pp. 201-237.
Ségéral, P. & Scheer, T. 2001, "La Coda-Miroir", *Bulletin de la Société de Linguistique de Paris*, vol. 96, pp. 107-152. English version available at http://www.unice.fr/dsl/tobias.htm.
Seigneur-Froli, D. 2004, "Greek *ptero:* neither extrasyllabicity nor magic," in *Phonologica 2002*, J. Rennison, ed., Vienna.
Seigneur-Froli, D. 2003, "Diachronic consonantal lenition & exotic word-initial clusters in Greek: a unified account," in *Proceedings of the 23rd annual meeting on Greek linguistics*, M. Stavrou-Sifaki & A. Fliatouras, eds., Faculty of Philosophy, Aristotle University of Thessaloniki, Thessaloniki, pp. 345-357.
Sihler, A. 1995, *New Comparative Grammar of Latin and Greek* Oxford University Press, Oxford.
Steriade, D. 1982, *Greek prosodies and the nature of syllabification. Phd dissertation* Garland Press, New York.
Szigetvári, P. 1994, "Coronality, Velarity and why they are special", *The Even Yearbook*, vol. 1, pp. 185-224.
Takahashi, T. 1993, "A farewell to constituency", *UCL Working Papers in Linguistics*, vol. 5.
Takahashi, T. 2004, *Syllable theory without syllables. PhD dissertation* University College London.
Trudgill, P. 1983, *On dialect; social and geographical perspectives* Blackwell, Oxford.
Tserdanelis, G. 2001, "A perceptual account for manner dissimilation in Greek", *Ohio State University Working Papers in Linguistics*, vol. 56.