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THE STATUS OF *Complex IN GREEK

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Περίληψη

*Η βιβλιογραφία πάνω στην ανάπτυξη της ελληνικής ως μητρικής έχει καταστήσει σαφές ότι τα συμφωνικά συμπλέγματα σε θέση συλλαβικής έμβασης συχνότατα απλοποιούνται μέσω διάφορων διορθωτικών μηχανισμών. Σε σύγχρονες γλωσσολογικές αναλύσεις, μια τέτοια γλωσσική συμπεριφορά αποδίδεται στην ενεργοποίηση του περιορισμού *Complex ο οποίος αποτρέπει την εμφάνιση συμφωνικών συμπλεγμάτων. Στο πλαίσιο της Θεωρίας του Βέλτιστου, όλοι οι περιορισμοί θεωρούνται καθολικοί και εγγενείς, συνεπώς δεν γίνονται αντικείμενο κατάκτησης. Στο παρόν άρθρο προτείνουμε μια εναλλακτική θεώρηση σύμφωνα με την οποία ο περιορισμός είναι δυνατόν να γίνει αντικείμενο κατάκτησης βάσει (της συχνότητας) των δεδομένων στα οποία εκτίθεται ο δυνάμει φυσικός ομιλητής.*

Keywords: Modern Greek, L1 acquisition, consonant clusters, Optimality Theory, innateness

1. Introduction

The acquisition of a first-language (L1) grammar is a process in which the child faces many hurdles. Slowly but surely a native speaker emerges after going through a number of stages which are remarkably similar in languages around the world. In the past few decades, research into first language acquisition has truly taken a flight, due both to the availability of more suitable equipment and, concurrently, to the

development of better informed and more sophisticated theories in this area of linguistics. In this paper we focus on the acquisition of consonant clusters in Modern Greek. The facts of Greek, both for the adult language as well as for the way in which these clusters are treated in child Greek, are well described and, to a large extent, well understood.

This paper is organized as follows: in section 2 we present a short literature review and discuss the facts and the standard analysis of onset cluster simplification in Greek. Key in any analysis of cluster simplification is the constraint *Complex, which forbids consonant clusters (Prince and Smolensky 1993 [2004]). As an OT constraint, this constraint is assumed to be universal and innate. In section 3, we try to show that this constraint could also be acquired on the basis of general cognitive strategies which the child might use to make sense of its ambient environment, i.e. general Modern Greek. Section 4 discusses the implications of this view and concludes.

2. Onset Cluster Simplification in child Greek

In this section, we present the facts of adult and child Greek and the different analyses as they have been presented in the literature. Neither the facts nor the analyses are particularly controversial, but we wish to focus on one aspect that might receive some discussion. This is the use of the constraint *Complex - a constraint which forbids surface forms with consonant clusters – which has played a central part in OT analyses.

2.1 Adult Greek

Standard Greek is a language which shows a preference for 'simple' open syllables (cf. Kappa 1995, Tzakosta 2013, and more references cited there). Word-initially, syllable onsets tend to be occupied mostly by two-member consonant clusters. This does not mean that three- or four- member consonant clusters are not attested in Greek. However, they are quite rare; word-initial syllabic onsets are occupied maximally by three-member clusters (1a, 1b). Four-member clusters appear in syllabic onsets only word-medially (1c, 1d). Word-medial onset clusters are the product of morphological conditioning/ fusion (1a, 1c) and loanword adaptation (1d).

(1a)	/é.k+pto.si/	→ [ék.pto.si]	'sale'[1]
(1b)	[spró.xno]		'push'
(1c)	/e.k+stra.tí.a/	→ /[ek.stra.tí.a]	'campaign, expedition'[2]
(1d)	[a.fstra.li.a]		'Australia'[3]

Syllable codas are restricted to word-final /s/ and word medial /n/, /l/, /r/. The only cases of word final clusters are relics from ancient Greek (2a) or loanwords (2b, 2c).

(2a)	[án.θro.pos]	'man, human'
(2b)	[ál.ma]	'jump'
(2c)	[ár.ma]	'car'
(2d)	[va.si.le.fs]	'king'
(2e)	[tanks]	'tanks'
(2f)	[film]	'film'

The tendency for cluster avoidance or cluster simplification in adult speech is illustrated in the work of Tzakosta and Vis (2009a, b, c). In these experimental studies, Tzakosta and Vis show that native speakers of Greek tend to simplify almost all cluster types. However, the rate of cluster simplification depends on the structural coherence within these clusters. In other words, the more coherent the cluster the less prone it is to simplification. Clusters consisting of [obstruent + liquid] are considered to be less coherent than [obstruent + obstruent] clusters, and consequently they are more susceptible to simplification. In addition, certain repair mechanism are 'preferred' by certain cluster types. More specifically, epenthesis applies mostly in [obstruent + liquid] clusters while fusion applies in [obstruent + obstruent] clusters.

All Greek syllabic types are captured by the syllabic structure in (4), according to which the only essential element of Greek syllables is the vocalic nucleus.

(4) (C)(C)(C)V(C)

1 The plus sign signals a morpheme boundary, and the dot is used to indicate syllable boundaries.

2 We suggest the syllabifications in (1c) and (1d), based on the Maximal Onset Principle (Selkirk 1982) in combination with morpheme boundary conditions.

3 According to a reviewer's comment, the syllabifications in (1c) violates sonority. However, the ones in (1a) and (1d) also violate sonority considerations. Sonority violations are attributed to the dynamics of constraint interaction. In our paper we do not assume that MAXIMIZE ONSET is undominated. For detailed discussion cf. Tzakosta (2010, 2011, 2012), Tzakosta and Karra (2011).

2.2. Child Greek

Given the tendency for cluster avoidance and/or simplification in the ambient language, monolingual children acquiring Greek L1 also simplify consonant clusters, especially during the initial and intermediate stages of their L1 acquisition (cf. Kappa 2002, Sanoudaki 2010, Tzakosta 2004, 2006, 2007). The data discussed in (3)-(7) show the various repair strategies applied in child Greek. Cluster simplification primarily takes the shape of cluster reduction (3), which is considered to be the most frequent repair strategy cross-linguistically (cf. Barlow 1997); others are epenthesis/ vowel anaptyxis (4), fusion (5), preservation of morphophonological heads (Goad and Rose 2004) and/ or positional faithfulness (Revithiadou and Tzakosta 2004a, b) (6), as well as changes in contiguity (van der Pas 2004) (7).

(3a) /tré.no/ → [té.no] 'train' (B:1;10)
(3b) /ðó.s**t**o/ → [ðó.**t**o] 'give it-2IMP.' (B.T. 1;11.07)
(3c) /s**c**í.los/ → [**c**í.lo] 'dog-SG. MASC.' (F: 2;00.27)

(4a) /kli.ðjá/ → [kə.li.ðjá] 'keys' (Me: 2;03.14)
(4b) /ɣrí.ɣo.ra/ → [ɣə.lí.ɣo.la] 'fast-ADV.' (B.M.: 2;03.04)
(4c) /xti.pá.i/ → [ɣə.ti.bá.i] 'hurt-3SG.PRES.' (Me: 2;00.26)

(5b) /klé.i/ → [té.i] 'cry-3SG.PRES.' (B.M.: 1;09.22)
(5c) /tsí.xla/ → [tí.θa] 'gum' (B.T.: 2;01.05)

(6a) /vré.çi/ → [vé.çi] 'rain-3SG.PRES.' (B.M.: 1;11.08)
(6b) /frú.ta/ → [fú.ta] 'fruits' (BT:1;10)
(6c) /fte.rá/ → [fe.lá] 'wings' (D:2;02.24)
(6d) /vɣá.lo/ → [vá.lo] 'take out-1SUBJ.' (D: 2;06.29, 2;07.06)

(7) /vɣá.lo/ → [ɣá.lo] 'take out-1SUBJ.' (D: 2;03.14)

(Data adopted from Tzakosta 2006, 2007)

Most of the above studies show that one or more but not all of the above strategies apply in different languages. For example, markedness (Gnanadesikan 2004) and headedness (Goad and Rose 2004) tend to play a major role in English cluster simplifi-

cation, markedness and contiguity do so in Dutch (van der Pas 2004). However, the Greek data show that all attested repair strategies may play a role in the same language, though in different consonant clusters. More specifically, Tzakosta and Vis (2009a, b, c) illustrate that the structural coherence of consonant clusters activate different repair strategies. To give an example, SC clusters are repaired by recourse to markedness by all children who were tested, while two out of seven children simplify them through fusion or epenthesis.

Languages/ cluster types[4]	CL	NN	CC	sC
English	Markedness/ stopping	-	-	Markedness/ pos. Faith.
Dutch	Markedness/ contiguity	-	-	Markedness
Greek	Markedness/ epenthesis/ positional faith-fulness	Markedness	Markedness/ fusion/ pos. faith./ stopping	Markedness/ fusion

Table 1 | *Repair strategies per clusters and languages*

2.3. Analysis of the child Greek data

Given the above discussion, the question is why do the Greek children simplify clusters? One particularly interesting line of research argues that this is part of their developing grammar (see Barlow (1997), Tesar and Smolensky (2000), Tzakosta (2004), among others). While the initial state of their grammar does not permit consonant clusters (or, perhaps, any production at all), their final grammar does. In the early grammar, OT hypothesizes that all markedness constraints are ranked below all faithfulness constraints, so that outputs will be maximally unmarked. A consequence is that consonant clusters will be simplified, as in the example in tableau 1 (the constraint Faith here subsumes any and all constraints against changing the input form):

4 CL stands for obstruent + liquid clusters, NN for nasal + nasal clusters, CC for obstruent + obstruent and sC for [s] + obstruent clusters.

Input: /o.bre.la/	*Complex	Faith
a. [o.bre.la]	*!	
☞ b. [o.be.la]		*

Tableau 1 | **COMPEX >> FAITH ranking*

As the child slowly accommodates to the fact that consonant clusters are in fact permitted in adult Greek, the constraint *Complex will be demoted (Tesar and Smolensky 2000), so that in the adult language consonant clusters are permitted. In the adult language, this constraint is therefore violable, as in the adult Greek tableau 2.

Input: /o.bre.la/	Faith	*Complex
☞ a. [o.bre.la]	*!	
b. [o.be.la]		*

Tableau 2 | *FAITH >> *COMPLEX*

In the next section we will look at this crucial markedness constraint *Complex in some more detail.

*2.4. The status of the *Complex constraint*

In the analysis presented in the previous section, it is tacitly assumed that the constraint *Complex is present in the grammar from the first moment on, as part of the markedness constraints that are highly ranked at the outset of language acquisition. Since the constraint has similar effects in other languages (see e.g. Fikkert 2007, Johnson and Reimers 2010), it is usually assumed to be universal and innate. In fact, it is sometimes argued that the constraint *could not be* acquired, because adult Greek allows consonant clusters so the speech to which children are exposed contains such clusters.

Two other paths are possible here, to prevent the assumption of innateness. First, some might argue that simplification in the child data is not due to grammar, but to the fact that either physiologically or psycho-physiologically they are not yet able to produce such clusters (although they are able to hear them and will reject speech in which clusters are deliberately simplified) (cf. Buckley 2003, Hale and Reiss 1998, 2000). One thing to say about this is that it leaves open the question of the adult grammar. No-one

will deny a grammar is in place for adult speakers, so this must be formed somehow. The idea of developing grammar offers a clear perspective to study this.

The second option would be to propose that the constraint *Complex is itself also acquired by the L1-exposed child. This relieves the burden on any genetic endowment ("universal grammar") and would be more in line with current approaches to linguistics which, we think, rely more on the way language is used than on stipulation of innate principles. In the next section we explore how a constraint like *Complex might be derived (or "emerge") in the course of language acquisition.

3. Deriving the *Complex constraint

In this section we discuss a way in which the constraint *Complex might be derived, so that no assumption of innateness is required. It is very hard (or impossible) to prove that a given linguistic property is innate, and it is very hard (or impossible) to prove that some such property is *not* innate. However, if innateness is assumed, there is no reason to look for a way in which any such property might be acquired. The most restrictive approach would therefore seem to be to assume that linguistic properties are *not* innate, so that we have to look for a way in which they might emerge. If no such way can be found, we would have to conclude in favour of innateness, or re-examine the property in question.

Fortunately, for a constraint like *Complex it is not difficult to see how it might arise on the basis of the data to which the language-acquiring child is exposed. This is because words without clusters are in fact considerably rarer than words with clusters. Since words without clusters are rarer, it is natural for the language acquiring child to assume they are in fact the norm: they will generalize this, just like generalization takes place in other cognitive areas (see, for example, Seger and Miller (2010)), including other branches of linguistics (e.g. morphosyntax). In this scenario, the constraint emerges from the ambient speech data. In other words, a constraint is a generalization across data––particularly, frequent data. This leads to the hypothesis in (8):

(8) In Greek, the constraint *Complex can be acquired on the basis of ambient data

To examine this hypothesis, we obtained a corpus of adult Greek (freely available from http://speech.ilsp.gr/iplr, described in Protopapas et al. (2012)) which provides both

transcriptions and frequency information. We extracted the 1000 most frequent words and coded each word for having one or more clusters. By way of illustration, the 100 most frequent words are given in (9):

(9) και, του, το, να, της, η, την, που, ο, με, απο, των, τα, ειναι, οι, θα, στο, δεν, σε, τον, στην, τη, οτι, τους, τις, στη, αλλα, εχει, ενα, στις, στα, ηταν, αυτο, μας, στον, αν, οπως, ομως, ως, κατα, αυτη, κι, ειχε, δυο, εχουν, πρεπει, μου, ενω, οταν, μετα, οποια, μπορει, μονο, πολυ, προς, στους, μεσα, γιατι, χθες, οχι, καθε, τι, χρονια, ακομη, πως, ετσι, σημερα, αυτα, ειπε, ολα, χωρις, τωρα, μεχρι, υπαρχει, θεμα, οπου, μεταξυ, κυβερνηση, ενας, μια, πολιτικη, καθως, πριν, οποιο, ουτε, συμφωνα, ειχαν, οσο, αφου, θεση, τοτε, επισης, αυτες, πρωτη, γινει, τοσο, σας, κανει, δηλαδη, ενος

The 100 most frequent words in Greek contain 21 consonant clusters. This is expected, since the most frequent words in a language tend to be the shortest (Zipf 1935) and tend to be least marked. As words get less frequent, word length tends to go up and marked features tend to enter. This is also clear in the case of the Greek consonant clusters: of the 200 most frequent words 47 have consonant clusters (=24%) and of the 1000 most frequent words 40% have. The numbers of clusters in sets of words with different frequencies are presented in Table 2 and Figure 1.

Most frequent words	Words with clusters	Percentage
100	21	21%
200	47	24%
300	93	31%
400	128	32%
500	177	35%
600	214	36%
700	257	37%
800	309	39%
900	348	39%
1000	395	40%

Table 2 | The relation between word frequency and clusters in Greek

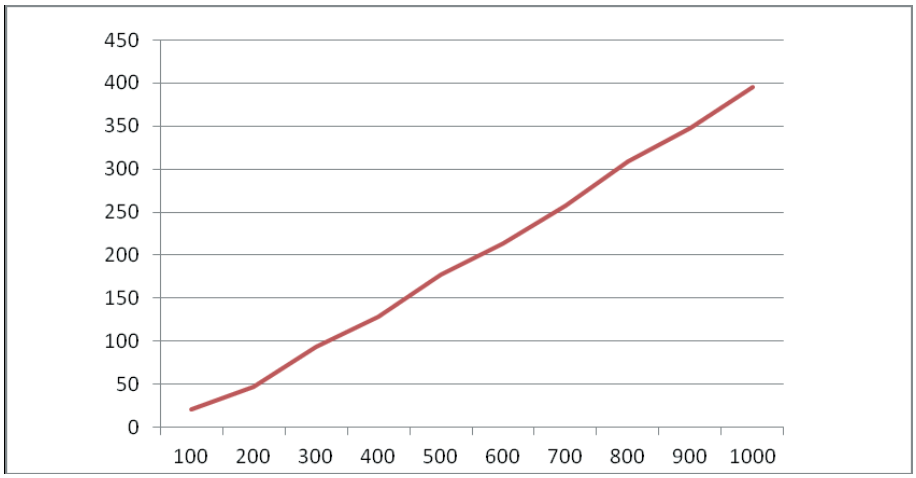

Figure 1 | *Groups of words with different frequencies, numbers of clusters*

Figure 1 illustrates the remarkable regularity of this marked feature. Here, an important assumption is made, which requires discussion. This is that L1-acquiring children are most frequently exposed to the most frequent words in their general language environment. That is, the most frequent words in the language (represented in our data file) are also the ones most frequently heard by the child. Of course, the child is partly exposed to child-directed speech, some of which may be quite distinct and quite particular to the child's situation, e.g. its name or names of family members or caretakers. Partly, of course, the child is also exposed to non-child-directed speech in its environment, which should generally follow the frequency in our data file. We conclude that the first assumption is reasonable, although it would be expedient to compare the general frequencies which we obtained with frequencies for child-directed speech (which are not available for child-directed Greek), and allow for individual differences.

If this assumption is accepted, it is easy to explain the emergence of the constraint *Complex. Since less than a quarter, to up to a third, of the most frequent words in Greek have consonant clusters, the child will generalize across the data and assume, as a first approximation, that simple onsets are the norm in its ambient language. In other word, the child assumes *Complex. As more and more forms are heard and processed, it will become clearer and clearer that consonant clusters are not that infrequent as perhaps initially postulated. In other words, the child demotes *Complex. In some cases, *Complex is so much demoted in the children's grammar so that tautosyllabic

and heterosyllabic sequences are used interchangeably. Some representative data from Greek SLI children are given in (10).[5]

(10a)	/pa**l.t**ó/ → [**pl**a.tó]	'coat-NEUT.NOM.SG.' (S4)
(10b)	/θe**r. m**ó.me.tro/ → [**θr**e.mó.me.to]	'thermometer-NEUT.NOM.SG.' (S1)
(10c)	/a.e.ro.**pl**á.no/ → [a.e.ro**l.p**á.no]	'airplane-NEUT.NOM.SG.' (S2)
(10d)	/a.**θl**i.tís / → [a**l.θ**i.tís]	'athlete-MASC.NOM.SG.' (S5)
(10e)	/i.ra.**kl**ís/ → [i.ra**l.k**ís]	'Hercules-Proper name, MASC.NOM.SG.'(S4)
(10f)	/a.**kr**í.δa/ → [a.**sts**íl.δa]	'grasshopper-FEM.NOM.SG.' (S2)
(10g)	/**pr**ó.va.to/ → [**sp**ó.δa.to]	'sheep-NEUT.NOM.SG. (S4)
(10h)	/**kt**í.ri.a / → [**θt**í.ri.a]	'building-NEUT.NOM.PL.' (S4)
(10i)	/**pr**á.si.no/ → [**spr**á.si.no]	'green-ADJ.NEUT.NOM.SG.' (S1)
(10j)	/**fr**á.u.la/ → [**sfr**á.u.la]	'strawberry-FEM.NOM.SG.' (S3)
(10k)	/ji.**mn**a.sti.cí/ → [zi**l.mn**a.sti.cí]	'gym-FEM.NOM.SG.' (S1)
(10l)	/ka.tsí.**k**es/ → [ka.tsí.**ks**es]	'goat-FEM.NOM.SG.' (S4)

(Data adopted from Tzakosta and Stavgiannoudaki 2013)

4. Discussion and conclusion

In this paper we have discussed the implications regarding constraint innateness for language acquisition. We have shown that in a language which shows preference for open but also allows for complex syllables, *Complex emerges on the basis of frequency effects in child-directed speech and is demoted (or even deactivated) in the course of phonological acquisition.

More specifically, the acquisition of consonant clusters in English shows similar simplification processes as that in Modern Greek. It is worth noting that consonant clusters in English are even rarer than in Greek (e.g. of the 100 most frequent words in English only one contains an onset cluster [the preposition *from*], (van de Weijer 2012, 2014)). This suggests that it would be harder for English children to acquire onset clusters than in Greek, because they are rarer in the former language than in the

5 These SLI children range in age between 4;06 and 5;0 years old.

latter, at least in the most common words (see also van de Weijer and Sloos (2013) on the relation between degrees of markedness and the order of acquisition). This is a hypothesis which needs to be checked, especially with data from languages which display high frequency of consonant clusters, like Polish and other Slavic languages (cf. van de Weijer and Tzakosta, in prep.)

If *Complex can be acquired, how about other constraints? Tesar and Smolensky (2000) state (albeit in a footnote) that Optimality Theory is neutral about the origin of constraints: they might either be innate or be acquired. Let us give an example; n a language with only CV syllables (Blevins 1995), no constraint *Complex needs to be acquired. Hypothetically, in a language in which half of the most frequent words have clusters and the other half do not, the constraint would not need to be acquired either. Therefore, if this latter line is adopted, (at least some) constraints are not universal.

The validity of our claim remains to be investigated for other aspects of phonological development, for example, the emergence of syllabic codas, in order to see if the regularity we uncovered for *Complex also applies to other constraints (cf. van de Weijer and Tzakosta, in prep.).

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