Perceptual asymmetries affecting cluster production in Greek L2: the case of CL and CC clusters

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1 Introduction

Cluster production is a well-studied topic in phonological language development (cf. Barlow 1997, 1999, 2001a, 2001b, 2005, Carlisle 1999, Fleischhacker 2000, Gnanadesikan 2004, Goad and Rose 2004, Jongstra 2003, Kabak 2003, Kappa 1997, 2002, Kirk and Demuth 2005, Lléo and Prinz, 1996, Menn 1978, Pas van der Pas 2004, Ohala 1998, Pater and Barlow 2003, Sanoudaki 2007, Smith 1973, for L1 acquisition, Steele 2002, for L2 learning). The discussion on consonant clusters is important for several reasons: on the one hand, clusters provide evidence regarding the order of acquisition of single and co-emerging consonants; moreover, their order of acquisition gives important information regarding the order of syllabic acquisition in the mother language.

A major cross-linguistic characteristic of child language is the simplification of complex structures to unmarked ones or, at least, as unmarked as possible. Cluster simplification is accomplished by means of several repair strategies most frequent of which are cluster reduction (Barlow 1997), fusion, preservation of morphophonological heads (Goad and Rose 2004), epenthesis and positional faithfulness (Revithiadou and Tzakosta 2004a,b). Reduction, which is widely attested, is primarily driven by the so-called "sonority pattern" (Barlow 2001a,b, Gnanadesikan 2004, Goad and Rose 2004, Jongstra 2003, Ohala 1998, Pater and Barlow 2003, see also Tzakosta 2006, 2009, Tzakosta and Vis 2009a, b, for comparable discussion) and, secondarily, by contiguity (van der Pas 2004). Epenthesis, on the other hand, takes the shape of either vowel anaptyxis in CL[1] clusters or vowel prothesis in /s/ clusters (cf. Fleischhacker 2000). Fusion is rather understudied (cf. Tzakosta 2007, for fusion in consonant harmony phenomena in child speech).

The main drawback of most studies on consonant cluster formation and production is that, first, they examine how variation applies in production without considering the perceptual factors that may govern such production patterns (cf. Kappa 1997, 2002, for Greek L1, Kirk and Demuth 2003). Second, they examine cluster preservation in relation to faithful syllabic realization (cf. Carlisle 1994, Kabak 2003, Lléo and Prinz 1996, Steele 2002, for L2, Tzakosta and Kappa 2008, for Greek L1), and, third, they do not delve into the phonological synthesis of the consonantal sequences in question; in other words, internal/ perceptual/ phonological factors which may affect surface cluster shapes in production are not considered (cf. Barlow and Gierut 1999, Menn 1978, 1979, Smith 1973) with the exception of /s/ clusters (cf. Barlow 1997, 2001a,b, 2005).

Specifically for Greek clusters, Morelli (2000) has suggested that obstruent clusters occur independently of sonority. She suggests that the sonority scale should have two dimensions, one for place of articulation (hereafter, PoA) and one for manner of articulation (hereafter MoA), along which generalizations can be made (see also Tzakosta and Karra 2010, for Greek dialectal data). According to this proposal, **F**(ricative)**S**(top) and /s/ sequences are the

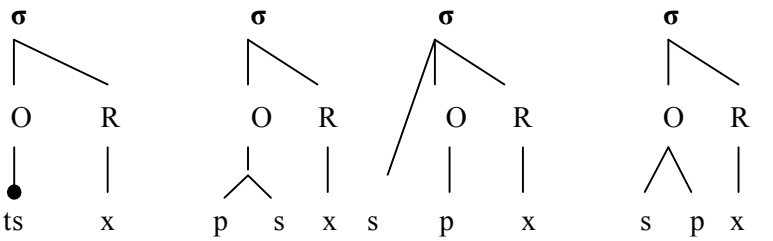
[1] In the paper we adopt the following abbreviations: C for (obstruent) segments, V for vowels, N for nasals, L for liquids, σ for syllable, O for onset, R for rhyme, S for stop segments, F for fricative segments.

only well-formed clusters in Greek. The problem with this proposal is that Greek allows all possible F/S combinations, namely SF, FS, SS, FF sequences. This means that Greek allows for more cluster types than Morelli's proposal predicts. According to Sanoudaki (2007), word-initial CC clusters are ill-formed, while word-medial CC clusters are well formed. This is the reason why word-medial CC clusters emerge first in child speech.

Tzakosta (2009) and Tzakosta and Karra (2010), who developed Morelli's proposal, have promoted the idea that clusters are characterized by gradient well-formedness. More specifically, depending on the degree of satisfaction of the PoA, MoA and voicing, clusters are defined as perfect, acceptable and non-acceptable. Moreover, Tzakosta and Vis (2009a, b, c) and Tzakosta (2009), based on perception and production data, proposed representations for all consonant cluster types, which are given in figures 1–8. According to Tzakosta and Vis (2009a, b, c), the data provid evidence for consonantal sequences being represented as monopositional segments, i.e. segments with a single root and end node (fig. 1), as in the case of affricates, while CS clusters make up contour segments (fig. 2). SC clusters do not display a unified behavior since /s/ behaves as being either extrasyllabic (fig. 3) or being part of a complex segment (fig. 4).

fig. 1 **fig. 2** **fig. 3** **fig. 4**

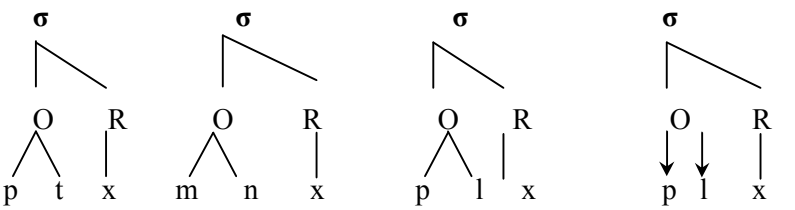
Affricates **CS clusters** **SC clusters** **SC clusters**



For CC, NN and CL clusters, Tzakosta and Vis (2009a,b,c) propose equivalent representations. CC, NN and CL sequences seem to behave like SC complex segments. This is shown in figures 5–7, respectively. However, if such a proposal is accurate, the frequency differences in repair strategies attested in the data are not accounted for convincingly. Tzakosta (2009) suggested a different representation for CL clusters illustrated in fig. 8. This representation is an attempt to mirror the psycholinguistic/ phonetic gap developed between the C and L cluster members.

fig. 5 **fig. 6** **fig. 7** **fig. 8**

CC clusters **NN clusters** **CL clusters** **CL clusters**



The aims of the present study are: (i) to evaluate the perceptibility of CL and CC clusters by native speakers and second language learners of Greek, focusing on Albanian and Bulgarian

learners of Greek, (ii) to detect the activated repair strategies, (iii) to examine the role of phonological environment in cluster realization, such as stress position, cluster position in the word, cluster adjacency, (iv) to assess the degree to which the system of the learner's L1 and language proficiency level influence L2 learning, and (v) to investigate the role of age in language learning. The rest of the paper is organized as follows: section 2 presents the principles of cluster phonotactics in Greek, Albanian and Bulgarian. Section 3 displays the working hypotheses and the research methodology, while section 4 discusses the data results. Finally, section 5 concludes the paper.

2 Cluster phonotactics

In the following subsections, we briefly present the basic rules and constraints applying to syllabic structure in Greek, Albanian and Bulgarian. It will be obvious that all three languages are quite similar with respect to their syllabic structure. Such a fact is important for the working hypotheses holding for the present study.

2.1 Clusters in Greek

Greek is a relatively simple language regarding its phonotactic constraints. It allows for open and closed syllables and codas consist of maximally one consonant. These consonants are [r], [l], [n] word internally and [r], [n], [s] word finally. It can easily be understood that there is only a limited pool of possible codas. Onsets, on the other hand, are maximally occupied by three consonants the leftmost of which is [s]. Vowel length is not distinctive in Greek and syllabic nuclei are always occupied by short vowels. According to Tzakosta and Kappa (2008), who investigated longitudinal production data, the order of syllabic acquisition heavily depends on syllabic complexity. This hierarchical order is provided in (1) below. Syllabic structures provided in parentheses occur less frequently both in adult and child speech.

(1) CV > V > CVC > CCV > VC > CCVC > CCCV (CVCC > CCCVC > VCC > CCVCC / CCCVCC)

2.2 Clusters in Albanian

Like Greek, Albanian allows for open and closed syllables (Παπαφίλης 2003, Friedman 2004). Syllabic codas's complexity depends on the grammatical category of the word form they belong to. Therefore, in verbal forms, codas consist of one of the single consonants [l, m, r]. Syllabic codas in nominals may consist of one of the following consonants [t, s, m, n, z, r, k, g]. Other forms may have codas of maximally three-member clusters. Syllabic onsets, on the other hand, consist of maximally four-member consonant clusters, as shown in (2). Vowel length is distinctive in Albanian and syllabic nuclei are occupied by short or long vowels and nasal consonants (Παπαφίλης 2003, Friedman 2004).

(2) CV, CCV, CCCV, CVC, CVCC, CCVC, CCVCC, **CCVCCC,** CCCVC, **CCCVCC, CCCVCCC**, **CCCCVC**, V, VC, VCC

2.3 Clusters in Bulgarian

Bulgarian allows for open and closed syllables (Boyadžiev and Tilkov (1999). When syllabic codas consist of a single consonant, these are [l, r]. When codas are more complex, they consist of maximally three-member clusters. Syllabic onsets consist of maximally three-member consonant clusters, but such clusters appear rarely. Geminates and homorganic clusters, i.e. clusters sharing the same place of articulation, are not allowed in any word position. Syllabic nuclei are occupied by short vowels or nasal consonants, but no

diphthongs. Polysyllabic words allow for open syllables only, while monosyllabic words allow for closed syllables (Boyadžiev and Tilkov (1999). This is illustrated in (3).

(3) CV, CCV, CCCV (initial syllables), CVC, CVCC, CCVC, CCCVC, CCVCCC (monosyllabic words)

3 Working hypotheses and research methodology

Given the aims of our study (see section 1) and the quality of syllabic structure in Greek, Albanian and Bulgarian, the working hypotheses of our study are formulated as follows:

- Language learners' perception and production are tuned on the basis of the phonological system of their mother language (Dupoux and Peperkamp 2002, Pallier 1997, 2000). In other words, L2 learning is highly influenced by L1 acquisition.
- Cluster perception is closely related to internal coherence (Tzakosta 2009, Tzakosta and Vis 2009a, b, c). Put differently, the more complex a syllable is, the more difficult it is for the syllable to be accurately perceived.
- Age is crucial in L2 learning; the younger the learner, the easier to learn a second language.

For our experimental task, we recruited 26 subjects. Group A is the control group, which consists of eight monolingual native speakers of Greek, whose age range is 30–44 years, they all hold a University degree and they speak at least one second language. Group B consists of six pupils of a Greek primary school, who are native speakers of Albanian and live in Greece for six to nine years. Group C consists of six adults, native speakers of Albanian, who range in age between 30 and 38 and have been living in Greece for at least ten years. Finally, Group D consists of six adults, native speakers of Bulgarian, whose age range is 30–43 years and have been living in Greece for at least 10 years.

We designed an off-line task during which subjects were asked to syllabify real Greek words, i.e. words of the native Greek vocabulary. Our assumption is that word syllabification reveals whether consonant sequences are perceived as tautosyllabic or not. We tested CL and CC clusters placed in word-initial and word-medial position—indicated with '#' and '-', respectively—in stressed and unstressed syllables. Word final positions were excluded, since Greek does not allow for word-final clusters. Given that we took stress position, word position and cluster adjacency into consideration, the syllabic types and syllabic positions whose production we investigated are displayed in (4).

(4) a. #CCV′.CCV
b. #CCV′.(C)V
c. #CCV.CCV(′)
d. #CCV.(C)V(′)
e. -CCV′.CCV
f. -CCV′.(C)V
g. -CCV.CCV(′)
h. -CCV.(C)V(′)

We ended up with a set of 242 words that subjects were asked to syllabify. In this set of words, 42 different cluster combinations appeared in disyllabic and longer words. The data were collected at the subjects' homes. Subjects were recorded using a digital recorder and the selected data were transcribed in IPA by at least two trained linguists.

4 Results and discussion

In this section we will discuss representative data collected from the experimental task.[2] The general picture we get from the data is that our subjects perceive word initial clusters homogeneously: all types of word initial clusters, i.e. CL and all combinations of CC, namely, SS, SF, FS, FF sequences, are always perceived as clusters (100%).[3] These claims are exemplified in (5) below.[4]

(5) a. /**pt**ézma/ → [**pt**éz.ma] 'delict-NEUT.NOM.SG.' (Groups C and D)
b. /**fθ**íno/ → [**fθ**í.no] 'decay-1SG.PRES.'
c. /**xt**éni/ → [**xt**é.ni] 'comb-NEUT.NOM.SG.'
d. /**ft**oxós/ → [**ft**o.xós] 'poor-ADJ.MASC.NOM.SG.'
e. /**br**ostá/ → [**br**o.stá] 'front-ADV.' (Groups A, B and C)
f. /**pr**íka/ → [**pr**í.ka] 'dowry-FEM.NOM.SG.' (Groups A, B and C)
g. /**vl**épo/ → [**vl**é.po] 'see-1SG.PRES.' (Groups A, B and C)

On the other hand, word position seems to be a fundamental factor for accurate cluster perception and production, given that word medial clusters are prone to various repair strategies. Put differently, medial clusters may be perceived as both tautosyllabic and/ or heterosyllabic by both native speakers and second language learners of Greek. This is exemplified in (6). Syllabic ambiguity may be reported even for the same participant (6a, c, d-l, n). An interesting characteristic of syllabic ambiguity is that it is not influenced by stress placement. Clusters emerging in stressed syllables do not seem to have more survival chances neither regarding perception, nor, consequently, regarding production. Internal coherence does not seem to be influential either, since all cluster types are repaired word medially (cf. Tzakosta 2006 for equivalent results in L1 developmental data). In addition, cluster adjacency, i.e. cluster co-emergence in the same word, does not seem to be influential for cluster perception. However, as we observed in the data, cluster perception is differentiated in word medial position. Moreover, morphology does not constitute a perceptual cue for syllabification. For example, morpheme boundaries do not force the perception of consonant sequences as essentially heterosyllabic (6c, e, i–m).

(6) a./ra**vð**izmós/ → [ra.**vð**i.zmós], [ra**v.ð**i.zmós] 'hitting-MASC.NOM.SG.'(GA: Th. N.)
b. /i**pt**ámenos/ → [i.**pt**á.me.nos] 'flying-ADJ.MASC.NOM.SG.' (GA: S. Th.)
c. /é**fp**oros/ → [é**f**.**p**o.ros], [é.**fp**o.ros] 'wealthy-ADJ.MASC.NOM.SG.' (GA: N.)
d. /ape**xθ**ánome/ → [a.pe.**xθ**á.no.me], [a.pe**x.θ**á.no.me] 'detest-1SG. PRES.' (GA: A.)
e. /e**kl**éktoras/ → [e.**kl**é.**kt**o.ras], [e**k.lék.t**o.ras] (GA: A., GB: A, N., E..), [e**k**.**l**é.kto.ras] 'elector-MASC.NOM.SG.' (GA: M. Ag., GB: Ai. Es. N.)
f. /i**ðr**árjiros/ → [i.**ðr**á.rji.ros], [i.**ðr**ár.ji.ros], [i**ð**.**r**á.rji.ros] 'quicksilver-MASC.NOM.SG.' (GA: G., GB: N.)
g. /a**γr**óktima/ → [a.**γr**ó.**kt**i.ma], [a**γ**.**r**ó.**kt**i.ma] 'farm-NEUT.NOM.SG.' (GA: G., A., GB: N.)
h. /a**fr**ókrema/ → [a.**fr**ó.**kr**e.ma], [a**f**.**r**ó.**kr**e.ma] 'cream-FEM.NOM.SG.' (GA: S.,G.)
i. /á**vγ**altos/ → [á**v**.**γ**al.tos], [á.**vγ**al.tos] 'unfamiliar-ADJ.MASC.NOM.SG.' (GB, N., A)

[2] The presented data were selected from different subjects' groups given in parentheses. We also provide the names of the subjects.
[3] Both tautosyllabic and heterosyllabic clusters are bolded in the data.
[4] Data syllabifications are only provided for the subjects' output/ produced form given in square brackets and not for the phonological form given in slashes.

j. /é**fp**eptos/ → [é**f**.**p**e.ptos] & [é**f**.**p**ep.tos] ‘digestible-ADJ.MASC.NOM.SG.’ (GB: Ai, N.)
k. /á**ft**astos/ → [á**f**.**t**a.stos] ‘elusive-ADJ.MASC.NOM.SG.’
l. /neó**xt**istos/ → [ne.ó.**xt**i.stos], [ne.ó**x.t**i.stos] ‘newly built-ADJ.MASC.NOM.SG.’ (GB: E.)
m. /a**pl**évristos/ → [a.**pl**é.**vr**i.stos], [a.**plév.r**i.stos] ‘not easy to draw-ADJ.MASC.NOM.SG.’ (GB: Es, E.)
n. /a**θl**ítria/ → [a.**θl**í.**tr**i.a], [a**θ**.lí.**tr**i.a] ‘Athlete-FEM.NOM.SG.’ (GB: N., A.)

The data presented in (6) do not seem to verify our initial working hypotheses. More specifically, it is not obvious that language learners’s perception is influenced by the phonological system of their mother language. Rather, it seems that simplification mechanisms, which are activated in language learning cross-linguistically, are also activated in the data of the present study. This implies that language learners draw from the same pool of UG repair mechanisms. Moreover, accurate cluster perception does not appear to be related to internal coherence (Tzakosta 2009, Tzakosta and Vis 2009a, b, c). Put differently, complexity of syllabic structures do not drive perception and production. The major driving force for accurate perception is word position irrespective of cluster internal synthesis.

Tables 1–16 delve into our working hypotheses in statistical terms. More specifically, tables 1–16 present the statistical results of word medial productions with all possible variable combinations in all subjects’ groups. The group type is indicated in the upper leftmost table cell, the tested variables appear in the upper central and rightmost cells, next to the group name cell. The tested cluster types appear in the leftmost column. We notice that the group of native speakers of Greek give high scores of well-produced CL clusters in word medial position, though not as high as with word initial CL sequences (tables 1 and 2). Albanian children and adults (tables 3 and 4, respectively) perform equally well, interestingly, even better than native speakers of Greek.

GA	-CCV´.CCV.		-CCV.CCV(´).	
CL	Tauto	hetero	Tauto	Hetero
S+L	45/48 [94%]	3/48 [6%]	40/40 [100%]	-
F+L	76/80 [95%]	4/80 [5%]	79/88 [90%]	9/88 [10%]

Table 1

GA	-CCV´.CV.		-CCV.CV(´).	
CL	Tauto	Hetero	tauto	Hetero
S+L	53/56 [95%]	3/56 [5%]	44/48 [92%]	4/48 [8%]
F+L	82/88 [93%]	6/88 [7%]	84/88 [95%]	4/88 [5%]

Table 2

GB	-CCV′.CV.		-CCV.CV(′).	
CL	Tauto	hetero	tauto	Hetero
S+L	42/42 [100%]	-	36/36 [100%]	-
F+L	64/66 [97%]	2/66 [3%]	66/66 [100%]	-

Table 3

GB	-CCV′.CCV.		-CCV.CCV(′).	
CL	Tauto	Hetero	tauto	Hetero
S+L	32/36 [89%]	4/36 [11%]	30/30 [100%]	-
F+L	56/60 [93%]	4/60 [7%]	66/66 [100%]	-

Table 4

GC	-CCV′.CCV.		-CCV.CCV(′).	
CL	tauto	Hetero	tauto	Hetero
S+L	33/36 [92%]	3/36 [8%]	30/30 [100%]	-
F+L	57/60 [95%]	3/60 [5%]	65/66 [98%]	1/66 [2%]

Table 5

GC	-CCV′.CV.		-CCV.CV(′).	
CL	Tauto	Hetero	tauto	Hetero
S+L	42/42 [100%]	-	36/36 [100%]	-
F+L	64/66 [97%]	2/66 [3%]	65/66 [98%]	1/66 [2%]

Table 6

The picture is rather obscure in the data of Bulgarian participants (tables 7 and 8). We notice that clusters are mostly perceived as heterosyllabic sequences, especially in word medial position. This can be explained by the fact that Bulgarian allows for word final complex codas (at least in monosyllabic words).

GD	-CCV′.CCV.		-CCV.CCV(′).	
CL	tauto	Hetero	Tauto	Hetero
S+L	12/36 [33%]	24/36 [67%]	6/30 [20%]	24/30 [80%]
F+L	18/60 [30%]	42/60 [70%]	9/66 [14%]	57/66 [86%]

Table 7

GD	-CCV′.CV.		-CCV.CV(′).	
CL	tauto	Hetero	tauto	Hetero
S+L	11/42 [26%]	31/42 [74%]	10/36 [28%]	26/36 [72%]
F+L	28/66 [42%]	38/66 [58%]	24/66 [36%]	42/66 [64%]

Table 8

The statistical results are vague when it comes to CC clusters emerging in word medial positions (tables 9–16). Tables 9–10 display that even native speakers of Greek (GA) find it difficult to perceive clusters as tautosyllabic sequences. Cluster members sharing the same manner of articulation, such as SS or FF sequences, have more chances to remain intact in their surface realization. However, identity of manner of articulation may argue for the perception of such sequences as geminates rather than clusters.

GA	-CCV´.CCV.		-CCV.CCV(´).	
CC	Tauto	Hetero	Tauto	Hetero
S+S	15/24 [62,5%]	9/24 [37,5%]	15/24 [62,5%]	9/24 [37,5%]
S+F	9/40 [22,5%]	31/40 [77,5%]	9/40 [22,5%]	31/40 [77,5%]
F+F	29/32 [91%]	3/32 [9%]	33/40 [82,5%]	7/40 [17,5%]
F+S	14/24 [58%]	10/24 [42%]	15/32 [47%]	17/32 [53%]

Table 9

GA	-CCV´.CV.		-CCV.CV(´).	
CC	tauto	hetero	tauto	hetero
S+S	18/24 [75%]	6/24 [25%]	18/24 [75%]	6/24 [25%]
S+F	13/48 [27%]	35/48 [73%]	19/56 [34%]	37/56 [66%]
F+F	34/48 [71%]	14/48 [29%]	36/48 [75%]	12/48 [25%]
F+S	10/32 [31%]	22/32 [69%]	19/32 [59%]	13/32 [41%]

Table 10

L2 learners of Greek, perceive CC sequences as either tautosyllabic or heterosyllabic. Our assumption is that since Albanian and Bulgarian allow for various consonantal sequences compared to Greek, the perception of consonantal sequences either as tautosyllabic or heterosyllabic, is not of crucial importance for correct production. Therefore, it becomes apparent that L1 influences perception and production in L2. Age does not seem to essentially relate to the data, because adolescents and adults perform differently for different CC categories.

GB	-CCV´.CCV.		-CCV.CCV(´).	
CC	Tauto	Hetero	tauto	Hetero
S+S	12/18 [67%]	6/18 [33%]	12/18 [67%]	6/18 [33%]
S+F	1/30 [3%]	29/30 [97%]	-	30/30 [100%]
F+F	24/24 [100%]	-	6/30 [20%]	24/30 [80%]
F+S	3/18 [17%]	15/18 [83%]	5/24 [21%]	19/24 [79%]

Table 11

GB	-CCV´.CV.		-CCV.CV(´).	
CC	Tauto	Hetero	tauto	Hetero
S+S	12/18 [67%]	6/18 [33%]	9/18 [50%]	9/18 [50%]
S+F	-	36/36 [100%]	-	42/42 [100%]
F+F	17/36 [47%]	19/36 [53%]	5/36 [14%]	31/36 [86%]
F+S	4/24 [17%]	20/24 [83%]	8/24 [33%]	16/24 [67%]

Table 12

GC	-CCV´.CCV.		-CCV.CCV(´).	
CC	tauto	Hetero	tauto	Hetero
S+S	8/18 [44%]	10/18 [56%]	13/18 [72%]	5/18 [28%]
S+S	5/30 [17%]	25/30 [83%]	5/30 [17%]	25/30 [83%]
F+F	24/24 [100%]	-	10/30 [33%]	20/30 [67%]
F+S	9/18 [50%]	9/18 [50%]	12/24 [50%]	12/24 [50%]

Table 13

GC	-CCV´.CV.		-CCV.CV(´).	
CC	Tauto	Hetero	tauto	Hetero
S+S	9/18 [50%]	9/18 [50%]	11/18 [61%]	7/18 [39%]
S+F	7/36 [19%]	29/36 [81%]	8/42 [19%]	34/42 [81%]
F+F	20/36 [56%]	16/36 [44%]	17/36 [47%]	19/36 [53%]
F+S	4/24 [17%]	20/24 [83%]	11/24 [46%]	13/24 [54%]

Table 14

GD	-CCV´.CCV.		-CCV.CCV(´).	
CC	tauto	Hetero	tauto	Hetero
S+S	-	18/18 [100%]	3/18 [17%]	15/18 [83%]
S+F	-	30/30 [100%]	-	30/30 [100%]
F+F	13/24 [54%]	11/24 [46%]	4/30 [13%]	26/30 [87%]
F+S	-	18/18 [100%]	4/24 [17%]	20/24 [83%]

Table 15

GD	-CCV´.CV.		-CCV.CV(´).	
CC	tauto	Hetero	tauto	Hetero
S+S	-	18/18 [100%]	3/18 [17%]	15/18 [83%]
S+F	-	36/36 [100%]	-	42/42 [100%]
F+F	11/36 [31%]	25/36 [69%]	6/36 [17%]	30/36 [83%]
F+S	1/24 [4%]	23/24 [96%]	5/24 [21%]	19/24 [79%]

Table 16

5 Conclusions

In this paper we investigated the behaviour of different subjects groups consisting of native speakers and second language learners of Greek regarding their performance in the perception and production of consonant clusters. The data come from adult native speakers, Albanian adults and primary school pupils, and Bulgarian adults. We chose for Albanian and Bulgarian learners, because of the existing language contact between these languages and Greek. We also chose for different age groups because we assumed that age might be influential in language learning.

The data analysis we performed showed that all cluster types, irrespective of their internal composition, are across-the-board perceived as clusters, when they emerge in word-initial position. However, the picture is changing in word medial positions where complexity in the phonological representation seems to play a major role. In addition, variables such as stress position or the presence or absence of another consonant cluster in the same word do not seem to affect the perceptual capacity and production performance of native speakers and learners of Greek (cf. also Tzakosta 2007). In sum, the variables playing a role in cluster perception in descending importance order are, first, word initial position, second, medial position in combination with the complexity of the clusters' phonological representations,

and finally, clusters emerging in stressed syllables or coexisting with other clusters. Neither does morphology seem to be influential, since clusters emerging in morpheme boundaries are recognized as either tautosyllabic or heterosyllabic. In other words, morphology does not seem to provide perceptual cues for cluster tautosyllabicity or heterosyllabicity.

Except for the aforementioned variables, the phonological system of the learners' L1—more specifically, the degree of syllabic complexity, as well as the degree of similarity of the learners' L1 to the Greek phonological system—plays an important role in L2 accurate cluster perception. In sum, cluster coherence tends to be driven by combined internal, i.e. phonological, as well as external factors, such as word position, and the influence of the learners' L1 system.

What is important to keep in mind is that all groups of native speakers and second language learners employ the same repair mechanisms in their attempt to understand and produce language. Native speakers and second language learners draw from the same pool of constraints/ multiple grammars, which drive language acquisition and learning. Such findings certify the dynamic role of Universal Grammar in language acquisition and language learning and demote the role of age in language learning.

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