

Markedness Hierarchies vs. Positional Faithfulness and the Role of Multiple Grammars in the Acquisition of Greek

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1. Introduction

Child language research investigates how language development proceeds. In pursuing this question, many researchers argued that markedness constraints are initially more prominent in the emerging grammar since they are active in early word segmentation tasks. Consequently, they must outrank faithfulness constraints at initial stages of language acquisition (Smith 1973; Demuth 1995; Levelt 1995; Goad 1997; Gnanadesikan to appear, among others). Inventories of entirely unmarked structures are expected to be more easily processed in production and/or comprehension but do not allow for the range of distinctions required for the expressiveness of adult language. The child's job is not to learn to imitate adult productions of a given stock of words but to learn the target grammar and, more specifically, to determine which compromises have been adopted in its target language. In order to account for the stage-like developmental progression found in the acquisition production data, Tesar and Smolensky (2000) assume acquisition to proceed by means of constraint demotion. That is, the child starts from a hierarchy where all *markedness* constraints dominate all *faithfulness* constraints and gradually, by demoting markedness constraints only as needed, it admits into its inventory those marked structures that are evidenced in the target adult language. More importantly, it is often the case that the learner, in going from the initial state of the grammar, G_{initial} , to the final state, G_{final} , passes through several intermediate grammars known as *learning paths* (cf. Levelt and Van de Vijver to appear).

This paper investigates intermediate stages of phonological development during which markedness is not as prominent as in earlier stages. Unlike other approaches that account for segmental selection in children's truncated outputs either in terms of structural restrictions such as the sonority hierarchy and the markedness scales (Barlow 1997; Barlow and Gierut 1999; Pater and Barlow 2003), or contiguity considerations (cf. Van der Pas this volume), the focus here is on positional faithfulness constraints. In particular, children's outputs that preserve perceptually salient positions, i.e. stressed and/or edgemoat syllables, are shown to be quantitatively more prevalent in non-initial states of acquisition than segmentally unmarked outputs. In fact, the stressed syllable faithfulness grammar is argued to

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constitute the core grammar in this stage. In short, a central claim in this paper is that positional faithfulness emerges before general faithfulness and, more importantly, takes over markedness constraints in advanced states of acquisition.

In addition, this paper puts forward the claim that learning does not consist of a series of linearly ordered grammars, each one corresponding to a clearly defined developmental stage. Instead, it is proposed that acquisition proceeds through a system of multiple parallel co-grammars, which together give rise to a pool of variable output productions for a given input string. In this system, certain blocks of co-grammars are associated with certain developmental phases. More precisely, next to the stressed syllable faithfulness core grammar, it is shown that children employ several parallel co-grammars, that is, different hierarchies of markedness and faithfulness constraints where usually specific types of positional faithfulness constraints are top-ranked. We focus on a co-grammar that promotes the faithful production of word initial consonants in children's outputs (the initial consonant faithfulness co-grammar). Parallel co-grammars are not quantitatively as robust as core grammars but constitute a statistically significant part of the overall production data. The existence of multiple parallel co-grammars is considered to be vital for the enrichment of the child's production repertoire with variable output forms and hence for the maturation of its phonological system.

Moreover, the effects of markedness constraints fade away as acquisition progresses without, however, been completely annulled (cf. Pater 1998 for the issue of minimal violation of constraints). Certain markedness principles such as the sonority hierarchy are reported to exercise influence on the featural composition of the produced stressed syllable or the preserved initial consonant of the target form. The lingering effects of the sonority hierarchy and the markedness scales intimate the existence of what we call here 'hybrid co-grammars'. These are constraint hierarchies where, in contrast with the markedness grammars of initial states, a subset of markedness constraints dominates (positional) faithfulness. It is shown that only a small fragment of children's productions is liable to sonority effects. Hybrid co-grammars are of pivotal importance because, first, they provide empirical support for gradual markedness demotion and, second, they form natural linking paths between the markedness grammars of initial states and the (positional) faithfulness grammars of advanced ones.

The above assumptions are based on the study of naturalistic data drawn from the Greek child language database developed at the University of Leiden Center for Linguistics. In particular, we examine data from three boys and two girls with an age range of 1;07 to 3;06.

The remaining of this paper is organized as follows: section 2 examines children's productions that faithfully preserve the segmental composition of the stressed syllable in target forms and comprise the statistically prevalent positional faithfulness core grammar in advanced development. Hybrid grammars that connect the core grammar with previous developmental states are also discussed in this section. Section 3 presents data that display faithfulness to the initial segment of target forms regardless of markedness considerations and hence embody the parallel co-grammar of the examined stage. Section 4 summarizes and concludes this paper.

2. The core grammar and the hybrid co-grammars in child speech

Research on the acquisition of segmental structure concentrates primarily on the realization of consonant clusters in child speech. It has been argued that children's early productions preserve the stressed and/or rightmost syllables of the adult words (Echols and Newport 1992). Pater (1998) reports that in many truncated forms the consonant of a preceding non-produced syllable is chosen as an onset provided it is less sonorous than the onset of the final/stressed syllable. Many researchers (Fikkert 1994; Barlow 1997; Barlow and Gierut 1999; Ohala 1999; Pater and Barlow 2003; Tzakosta 1999, 2001; Kappa 2003; Gnanadesikan to appear, among others) concur that children tend to produce the member of the consonant cluster that best satisfies the sonority hierarchy and the markedness scales (de Lacy 2002).¹ That is, the less sonorous a consonant is, the more likely it is to surface in the children's outputs. For instance, in a stop+liquid cluster, the less sonorous stop has more chances to surface.

It has been reported, however, that in stop+stop clusters with the same manner of articulation in English, children tend to drop the initial consonant regardless of place of articulation (Smith 1973). Following this line of investigation, Van der Pas (this volume) maintains that contiguity is a controlling factor in the shaping of child Dutch truncated forms. That is, the segment closer to the nucleus may be selected even if it is more marked compared to the deleted segment. Although this pattern is attested in English and Spanish child speech, in Greek, it is reported to be rare.

Goad and Rose (to appear) take a different position on the issue of children's truncated outputs. On the basis of reduction patterns for left-edge clusters observed in the acquisition of West Germanic languages, they distinguish between the sonority and the head pattern of reduction. In the former, the less sonorous consonant is retained in output forms, e.g. /sl/ → [S]. In the latter, the sonorant survives e.g. /sl/ → [l], because it is the head of the onset in the target form. They take both patterns of cluster reduction to be representative of distinct stages in development that differ in the degree to which inputs are elaborated. The head pattern, characteristic of an advanced stage, presupposes highly structured target-like inputs. The sonority pattern, on the other hand, arises from less articulated inputs where there is no knowledge of the structural relations that hold across strings of consonants; hence, the head of the onset is defined in terms of relative prominence.

In this paper we present evidence that children's productions in Greek child speech faithfully preserve the segmental composition of the stressed syllable. More specifically, in section 2.1 we show that the stressed syllable faithfulness pattern (σ-faithfulness) is predominant and constitutes the core grammar of intermediate states in development. In section 2.2, we examine a set of facts that establish the existence of linking paths (hybrid co-grammars), which connect the σ-faithfulness grammar with grammars of earlier states of acquisition. Alternatively, however, children produce outputs where the initial consonant of the target form is realized as the onset of the stressed nucleus. The initial consonant faithfulness pattern, although it is

¹ Coronals have been claimed to be cross-linguistically less marked than labials and dorsals (*DORS, *LAB >> *COR). Similarly, fricatives and voiced consonants are regarded as less marked than stops and voiceless consonants, respectively, hence the constraints *FRIC, *VOI.

statistically significant, is not prevalent enough to qualify as a core grammar. This will be discussed at length in section 3.

2.1 The core grammar: stressed syllable faithfulness

Let us have a close look at some examples of the $\acute{\sigma}$ -faithfulness pattern, which is typical for monosyllabic as well as disyllabic productions. Monosyllabic truncations are predominant during the so-called subminimal word stage, while disyllabic templates are more frequent during the minimal, usually trochaic, word stage. However, it is hard to accurately define the beginning and ending points of stages in Greek child language. For instance, monosyllabic truncations are not restricted to the subminimal word stage since they often expand to late language development. Our subject F's production data are quite representative in this respect (see Tzakosta in prep. for detailed discussion of this issue). Moreover, as we will argue in the following sections, acquisition is not a linear process but proceeds through a complex network of parallel grammatical systems. This entails that certain blocks of parallel co-grammars are associated with certain developmental stages. For this reason, we refrain from defining concrete stages in this study.

In all examples, children fully realize the prosodic head of the target word, i.e. the stressed syllable, irrespective of whether its onset is structurally simple, as in (1a-e) and (1g), or complex, as in (1f). Evidently, sonority considerations are inert in segmental selection. In (1a) and (1b), the voiced dorsal fricative /ɣ/ and the voiced labial sonorant /m/, respectively, are realized at the expense of the relatively unmarked voiceless coronal stop /t/ in the neighboring unstressed syllable. Similarly, in (1g), the voiceless dorsal /k/ wins out over the coronal sonorant /n/.

(1) *monosyllabic truncations*

a	/ʎa.ta/	[ʎa]	'cat'	B2: 1;10
b	/mi.ti/	[mi]	'nose'	B2: 1;11.15
c	/va.lo/	[va]	'put-1sg'	M: 1;08.31
d	/kli.ði/	[ði]	'key'	D: 2;02
e	/sci.'la.ci/	[la]	'dog-DIM'	F: 2;0.04
f	/vle.po/	[vle]	'see-1sg'	F: 2;05.09
g	/ko.ci.no/	[ko]	'red'	F: 2;09.05

The same holds for disyllabic truncations, as shown in (2). Polysyllabic words are truncated to disyllabic ones from the age of 1;10 (cf. B1) up to the age of 2;08.15 (cf. F). Regardless of the size of output words, the examples in (2) evidence once again that children are faithful to the stressed syllable and its segmental content. It is the head of the prominent foot that the child produces faithfully, even if this entails that a dorsal /k/ is chosen over the more unmarked coronal /t/, as in (2a), or that the sonorant /r/ is favored over the voiceless stop /k/, as in (2f).

(2) *disyllabic truncations*

a	/por.to.'ka.li/	[ka.li]	'orange'	B1: 1;10
b	/me.'ya.lo/	[ya.lo]	'big'	B1: 1;11.09
c	/tra.'yu.ðja/	[yu.ja]	'song-pl'	B2: 1;11.15

d	/ka.'pe.lo/	['pe.lo:]	'hat'	M: 2;0.06
e	/ce.li.'ðo.ni/	['ðo.ni]	'swallow'	F: 2;08.15
f	/ka.'ra.vi/	['ra.vi]	'ship'	D: 2;01.23

To account for the above facts we must rely on the notion of prosodic headedness. It is well-established that phonological heads show the maximum complexity allowed by the grammar. If there is an asymmetry, the head will be more complex than the dependent. For instance, heads of feet are often heavier (i.e. bimoraic) than their dependents. Similarly, certain phonemic contrasts are tolerated only in prosodic heads such as stressed syllables, and so on (cf. Dresher and Van der Hulst 1998). The saliency of prosodic heads led researchers to propose head-specific faithfulness constraints such as HEADFAITH,² stated in (3):

- (3) HEADFAITH: Preserve the segmental and the featural composition of an input prosodic head in the output.

Ranked above the sonority and the markedness scales constraints, as shown in (4), HEADFAITH guarantees that the stressed syllable will be pronounced and, moreover, its segmental content will be faithfully realized in the child's output. Consequently, all markedness constraints referring to voicing, manner and place of articulation are irrelevant to the selection of the optimal candidate. It should be pointed out that independent markedness constraints determine the monosyllabic and di-/trisyllabic template size of the outputs (see Tzakosta in prep. for details). The following tableaux spell out the details of the competition that leads to the surfacing of the outputs listed in (1) and (2):

- (4) HEADFAITH >> *VOI, *FRIC, {*DORS, *LAB >> *COR}, FAITH

T1 /ʎa.ta/	HEADFAITH	*VOI	*FRIC	*DORS	*LAB	*COR
a [ta]	*!					*
☞ b [ʎa]		*	*	*		
c [ka]	*!			*		

T2 /ce.li.'ðo.ni/	HEADFAITH	*VOI	*FRIC	*DORS	*LAB	*COR
☞ a [ðo.ni]		*	*			*
b [do.ni]	*!	*				*
c [to.ni]	*!					*

The grammar in (4) qualifies as the *core grammar* because, besides being cross-linguistically productive, it is quantitatively prevalent in the speech of all children of our study during all states of intermediate development.

² The constraint comprises both HEAD-MAX, which requires input segments of a prosodic head to be preserved in the output, and HEAD-IDENT[F], which requires correspondent segments contained in a prosodic head to be identical for F. Thus, HEADFAITH is violated when, for instance, an input prosodic head such as /ʎa/ surfaces as [ka] or [a].

2.2 Hybrid co-grammars: sonority effects on stressed syllable faithfulness

The sonority hierarchy and the markedness scales have often been found to exercise a partial influence on children's outputs. This is evidenced by production data such as the ones in (5) and (6). More specifically, the segmental composition of the targeted stressed syllable is often changed towards unmarked values. For instance, in (5a-c) fricatives are realized as stops, suggesting that the marked [+cont] value of the manner of articulation changes to the less marked [-cont]. In (5c), in particular, the coronal stop is chosen over the labial fricative. It is evident that such outputs arise from a ranking where *FRIC dominates HEADFAITH. Moreover, in (5d-e) the voicing value of the onset of the stressed syllable is altered towards the unmarked value, namely [-voice], thus suggesting that *VOI occupies a high rank in the hierarchy.

(5) monosyllabic truncations

a	/va.lo/	[ba]	'put on-1sg'	B (2): 1;10
b	/kra.'si/	[ti]	'wine'	D: 2;03.14
c	/le.'fta/	[ta]	'money'	F: 2;01.11
d	/ble/	[ple]	'blue'	B2: 1;11.14
e	/va.tra.xos/	[fax]	'frog'	F: 2;05.09

Similar shifts to the unmarked value are exhibited by disyllabic truncations, as shown in (6). The combined effects of *VOI and *FRIC can be seen in the form *pe.ða.ca* (6c) where the voiced fricative surfaces as a voiceless stop, [ta.ca].

(6) disyllabic truncations

a	/e.kli.'su.la/	[tu.la]	'church-DIM'	Me: 1;07.05
	/ka.re.kla/	[te.ca]	'chair'	F: 1;11.21
	/ka.la.'θa.ci/	[ta.ci]	'basket-DIM'	Me: 2;03.01
b	/ka.ra.'me.la/	[pe.la]	'sweet'	F: 1;11.28
	/tre.'na.ci/	[ta.ci]	'train-DIM'	B2: 1;11.28
c	/pe.'ða.ca/	[ta.ca]	'children-DIM.pl'	M: 2;02.24

The rankings in (7) formalize the described system of affairs. The selection of the optimal candidates is illustrated in tableaux 3 and 4, respectively. In all these rankings, only a subset of markedness constraints outranks HEADFAITH, thus giving rise to partially unmarked outputs.

(7) sonority effects on the σ -faithfulness core grammar

- a *FRIC >> HEADFAITH >> *VOI, {*DORS, *LAB >> *COR}: (5a-c), (6a)
 b *VOI >> HEADFAITH >> *FRIC, {*DORS, *LAB >> *COR}: (5d-e), (6b)
 c *VOI, *FRIC >> HEADFAITH >> {*DORS, *LAB >> *COR}: (6c)

T3 /va.lo/	*FRIC	HEADFAITH	*VOI	*DORS	*LAB	*COR
a [va]	*!		*		*	
b [ba]		*	*		*	

T4 /pe.'ða.ca/	*VOI	*FRIC	HEADFAITH	*DORS	*LAB	*COR
a ['da.ca]	*!		*			*
b ['θa.ca]		*!	*			*
c ['taca]			*			*

A fundamental premise of Optimality Theory (Prince and Smolensky 1993) is that different constraint rankings correspond to different grammars. Consequently, the rankings in (7) represent several parallel co-grammars³ in Greek child speech. The co-grammars are distinct strata of constraints that are enforced in parallel with each other and with the core grammar. The co-grammars in (7), in particular, reflect the minimal effects of markedness on the faithfulness-based core grammar and, in a sense, are relics of earlier stages of acquisition where markedness constraints were dominant. This point is further elucidated if we take into consideration the following examples:

(8) *markedness core grammar: cor > dors, lab*

a	ka.'se.ta	['te.ta]	'tape'	D: 2;1
b	pi.'sto.li	[te.'to.li]	'pistol'	D: 2;1
c	pe.'ða.ca	['ta.ta]	'child-DIM.pl'	D: 2;2

The examples in (8) are produced by D during initial stages of acquisition and reflect the effects of a markedness grammar. Outputs with voiceless coronals are favored over faithfulness productions of the adult forms. We infer, therefore, that at this developmental state sonority and markedness scales must outrank faithfulness to the prosodic head: *VOI, *FRIC, {*DORS, *LAB >> *COR} >> HEADFAITH.

Having said this, we can now easily conclude that the co-grammars in (7), all of which show remnants of markedness dominance, represent *linking paths* that connect the markedness grammars of early acquisition with the faithfulness grammars of advanced language development. In other words, we claim that the markedness and faithfulness grammars are not isolated from each other but rather are linked by what we call here *hybrid co-grammars*. This, in turn, entails that the learner does not follow a single path of linearly ordered grammars. On the contrary, the child enters into a network of manifold grammatical systems, which are interconnected by linking paths (see figure 1, section 4). Crucially, the existence of hybrid co-grammars provides empirical evidence in favor of constraint demotion. Children become gradually faithful to their target grammars by demoting clusters of markedness constraints. Furthermore, hybrid co-grammars represent a small fraction of children's production data, a fact that is expected under the present hypothesis. Linking paths represent transitional stages of development and cannot be more forceful numerically than core grammars. Actually, just 28% of the total number of di-/trisyllabic truncations (e.g. the examples in (6)) is the by-product of a hybrid grammar.

Finally, it should also be mentioned that the rankings in (7) constitute only some of the possible hybrid co-grammars. Constraint permutation provides all possible linking paths that progressively assist the acquisition of a final state of the adult

³ Cf. Itô and Mester (1995); Orgun (1996), among others, for co-grammars in adult speech.

grammar. The rising number of possible co-grammars is not considered problematic for the theory nor for language acquisition per se, since multiple grammars facilitate language learning and provide alternatives towards the child's primary goal, namely the acquisition of the target grammar. Interestingly, the Greek acquisition facts reveal that children actually employ several alternative grammars in order to achieve this goal. In the following section, we present evidence for the emergence of a parallel positional faithfulness grammar, which, as will be shown, leaves a lesser statistical imprint on the production data than the core grammar.

3. Parallel grammar: faithfulness to the word initial consonant

A thorough examination of children's truncations in intermediate development reveals that children rely on more than one grammar. Specifically, we found out that a substantial fraction of their outputs cannot be accounted for by means of the $\acute{\sigma}$ -faithfulness grammar or by means of hybrid co-grammars. In such cases production focuses on the faithful preservation of the word initial consonant which is realized as the onset of the stressed nucleus of the target form. The monosyllabic and di-/trisyllabic truncations in (9) and (10), respectively, are telling. Let us start with the examples in (9). Interestingly, in these examples faithfulness to the initial segment is pursued at all costs. In (9a), for instance, the dorsal fricative / χ / is retained even though it is more marked than the /k/ of the stressed syllable. Similarly, in (9b) the labial fricative /f/ supersedes the dorsal stop /g/, whereas in (9c) the labial /p/ wins over the dorsal /k/ of the stressed syllable and the coronal /t/ of the peninitial one.

(9) monosyllabic truncations

a	/ χ li.'ko/	[' χ o]	'sweet'	D: 2;01.09
b	/fe.'ga.ri/	['fa]	'moon'	D: 2;06.29
c	/por.to.'ka.li/	['pa]	'orange'	B2: 1;11.28

Similarly, in di-/trisyllabic truncations consonants, which are more marked with respect to the manner and/or place of articulation than the onset of the stressed syllable in the adult form, are also retained in children's outputs. In (10a), dorsals and labials are realized at the expense of the more unmarked coronals. Moreover, in (10b), fricatives are preferred over stops regardless of voicing values. The same holds for the trisyllabic forms in (10c-d). Here, however, the initial syllable is often preserved at the expense of the non-initial one. In (10c), for instance, the leftmost syllable with the dorsal or labial onset is pronounced instead of the second one with the unmarked (coronal) onset. Finally, in (10d), fricatives win over stops.

(10) di-/trisyllabic truncations

a	/kra.'ta.o/	['ka.o]	'hold-1sg'	F: 1;11.15
	/kar.'tu.la/	['ku.la]	'card-DIM'	B2: 2;01.05
	/pi.e.'ro.tos/	['po.toθ]	'clown'	D: 2;03.28
b	/fri.' γ a.'nu.la/	['fu.la]	'cracker-DIM'	D: 2;03.07
	/ γ u.ru.'na.ci/	[' γ a.ci]	'pig-DIM'	D: 2;03.14

c	/ka.ra.'me.les/	[ka:.'me.leç]	'sweet-pl'	B1: 2;05.07
	/ka.la.'ma.ci/	[ka:.'ma.ci]	'straw-DIM'	B1: 2;09.25
	/me.li.'ti.ni/	[me.'ti.ni]	'Melitini'	D: 2;04.05
	/pe.ta.'lu.ða/	[pe.'lu.ða]	'butterfly'	F: 2;07.17
d	/yu.ru.'na.ca/	[yu.'na.ca]	'pigs-DIM.pl'	B1: 2;09.12
	/fo.to.yra.'fi.es/	[fa.'fi.eθ]	'photograph-pl'	D: 2;04.05

Generalizing this pattern, we interpret cases as *pa.pa.'ya.los* ['pa.lo] 'parrot' F: 1;11.28, *tra.'yu.ði* ['tu.i] 'song' D: 2;03.14 as the result of positional faithfulness constraints and not as side-effects of markedness restrictions on the grammar.

Word initial position has been claimed to be more salient in perception and, by extension, in language processing (cf. Smith 2002 and references cited therein). Production data from Greek child speech add to the bulk of empirical evidence that confirms this observation. Special positional faithfulness constraints have been proposed in order to deal with the increasing evidence that neutralization of featural contrasts primarily affects perceptually non-salient positions (Beckman 1998 *et seq.*). The fact that in children's speech faithful productions target prosodically salient positions and, in particular, word initial consonants compels us to include the following positional faithfulness constraint in our analytical tools:

(11) #C-FAITH:⁴ Preserve the input initial consonant and its features in the output.

The grammar responsible for the truncations in (9) and (10) takes the form of the constraint ranking in (12). Tableaux 5 and 6 illustrate the effects of the hierarchy that top-ranks #C-FAITH. It is important to emphasize that this secondary grammar co-exists together with the core grammar in (4) and the hybrid co-grammars in (7).

(12) #C-FAITH >> HEADFAITH >> *VOI, *FRIC, {*DORS, *LAB >> *COR}

T5 /fe.'ga.ri/	#C-FAITH	HEADFAITH	*VOI	*FRIC	*DORS	*LAB	*COR
a [pa]	*!	*				*	
b [ga]	*!		*		*		
☞ c [fa]		*		*		*	

T6 /kar.'tu.la/	#C-FAITH	HEADFAITH	*VOI	*FRIC	*DORS	*LAB	*COR
☞ a [ku.la]		*			*		
b [tu.la]	*!		*			*	

From the rank it occupies, #C-FAITH does not allow the markedness scales nor the sonority constraints to exercise any influence on shaping outputs. The preservation of the stressed nucleus reveals the absolute power of HEADFAITH.

The set of facts under examination confirms once again that positional faithfulness emerges before general faithfulness in intermediate stages of language development. Unfortunately, space limitations prevent us from further discussing this important finding here. Another issue that cannot be examined in the present

⁴ The constraint comprises both #C-MAX and #C-IDENT[F].

study is the hybrid co-grammars that link the #C-faithfulness grammar to other parallel as well as remote grammars. The interested reader is referred to Revithiadou and Tzakosta (to appear) for extensive discussion of both issues.

As mentioned in section 2.1, each developmental stage is associated with a core grammar, that is, a statistically predominant grammatical system and several parallel co-grammars. The following table gives a picture of the distribution of faithfulness (co-)grammars that are active during the specific stage of language development. Note that line *a* in Table 1 represents only the part of the core grammar that refers to stressed initial syllables. The core grammar numbers several thousands of words, a fact that makes it impossible to provide a global overview of the distribution of the core grammar and the parallel co-grammars.

<i>Faithfulness grammars/ produced words</i>	monosyllabic words	di-/trisyllabic words ⁵
a initial stressed syllable	79,3% (300)	26 % (37)
b initial unstressed syllable + stressed nucleus	15,1 % (57)	45,1 % (64)
c initial consonant + stressed nucleus	3,7 % (14)	28,9 % (41)
d initial consonant + unstressed nucleus	1,9 % (7)	0 % (0)
Total	100% (378)	100 % (142)

Table 1: Faithfulness grammars in advanced development

The last section summarizes the major findings of our discussion and concludes this paper.

4. Summary and conclusions

In this paper, we focused on intermediate stages of L1 phonological acquisition and maintained that they are associated with faithfulness grammars as opposed to initial states, which are primarily connected with markedness grammars. Interestingly, the examination of the data has revealed that grammars that promote positional faithfulness constraints emerge earlier than grammars that top-rank non-indexed faithfulness constraints. Moreover, on the basis of evidence from the Greek child speech, we proposed that language development is not linear but proceeds through a complex network of multiple parallel co-grammars. Furthermore, we claimed that at each state there is a core grammar, that is, a statistically predominant grammatical system. We have shown that in Greek the vast majority of children's productions arise from a stressed-syllable faithfulness grammar. In this grammar, templatic outputs that leave the segmental content of the stressed syllable in the target language intact are favored. Because of the numerical prevalence of such outputs, it constitutes the core grammatical system of this specific developmental stage. Alternatively, however, the Greek learners make use of several parallel co-grammars, which are not as prevalent as the core grammar. We specifically

⁵ The statistics for di-/trisyllabic truncated forms come from two children only, namely F and D, whose data cover an extended part of the age range under investigation.

examined a co-grammar that favors the faithful realization of initial consonants (or syllables in longer truncations) of the adult forms.

Although the effects of markedness constraints diminish as acquisition progresses, we have shown that traces of markedness survive in hybrid co-grammars. That is, certain markedness constraints have been shown to exercise a limited influence on the segmental make-up of children's production data that realize, for instance, the stressed syllable of the target language. Hybrid co-grammars represent linking paths between initial (i.e. markedness grammars) and intermediate stages (faithfulness grammars) of acquisition, and hence play a crucial role in the development of the children's phonological system. The existence of hybrid co-grammars is in line with the claim that children become gradually faithful to their target grammars by demoting markedness constraints. With hybrid co-grammars, the *whys* and the *hows* of phonological acquisition stop being an unsolved puzzle. The following figure depicts the proposed model of L1 acquisition.

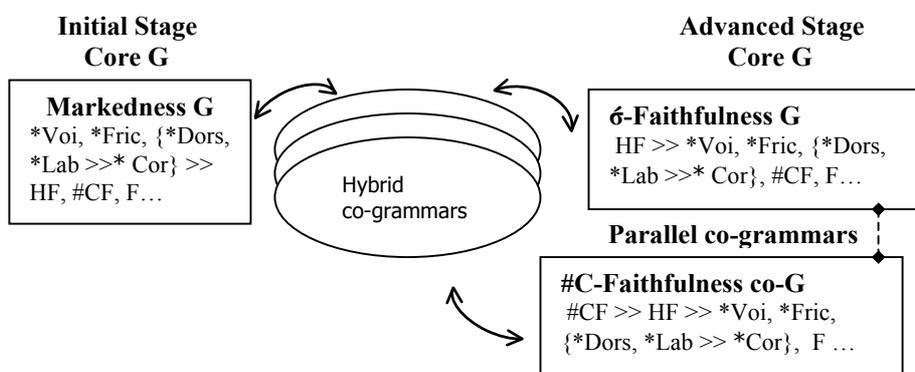


Figure 1: The network of multiple parallel grammars

To conclude, among the positional faithfulness grammars, the one that promotes featural realization of a stressed syllable is dominant suggesting that stress is the primary cue for the acquisition of Greek with leftmost edge next in line. Future research will shed more light on the role of positional faithfulness in child speech and the importance of hybrid grammars in language development.

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