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The beginning of the word

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The beginning of the word: child language data

Abstract

In this study, we use child language data in order to test the phonological status of the beginning of the word. Working within a strict CV framework, we predict an association between mastery of obstruent clusters word initially and accurate repetition of non-native consonant clusters in the same position. Using a non-word repetition task, we examine the production of native and non-native consonant clusters in twenty Greek-speaking children aged 4-5 years. Results support our hypothesis and the strict CV view of the beginning of the word.

Keywords

Consonant clusters, Greek, phonological acquisition, strict CV, non-word repetition, child language, phonological structure.

Introduction

Several studies have examined consonant cluster production in children (Barlow, 1997; Demuth and Kehoe, 2006; Freitas, 2003; Jongstra, 2003; Kirk and Demuth, 2005; Lleó and Prinz, 1996; Vanderweide, 2005 amongst many others); these include studies that have the explicit purpose of testing representational phonological theories (e.g. Pan, 2005; Pan and Snyder, 2004; Prince 2016). In the present study we use child production data of non-native consonant clusters to examine the phonological representation of the beginning of the word.

The beginning of the word has held a special place in phonological theory, from the early questions of whether the word initial word boundary has a special status in phonological representations (as in Chomsky & Halle, 1968), to the notorious issue of word initial clusters of non-rising (or falling) sonority (e.g. vɣ, ɣð; non-rising, ft, xt: falling sonority, see Greek examples under (1) below): such clusters are present in some languages but not others, and do not conform to regular sonority patterns in traditional sonority theory (Clements 1990,1992). Acknowledging the problematic status of these clusters, various versions of extrasyllabicity have been proposed for the first consonant of such clusters (e.g. Levin, 1985,

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Steriade, 1982 amongst many others); within parametric phonology, members of these clusters have even been called ‘magic’ (Kaye, 1992).

(1) Word initial clusters of non rising /falling sonority, examples from Greek
vɣazo ‘I remove’
ɣðino ‘I undress’
ftero ‘wing’
xteni ‘comb’

More recently, these word initial clusters were accommodated into a strict CV framework (Lowenstamm, 1999), by equating the beginning of the word with an empty CV unit controlled by a binary parameter (initial CV parameter; Sheer, 2004). Within this framework, structure consists of a sequence of consonantal and vocalic positions (onsets and nuclei, see partial representation under (2)), which may be filled (N_1 and N_3 in (2)) or empty (N_2 in (2)) .

(2) Strict CV: partial representation.

```
O1  N1  O2  N2  O3  N3
 |   |   |   |   |   |
C    V  C    Ø   C  V
```

This horizontal structure is regulated by syntagmatic relations (government and licensing) which also control segmental phenomena (Ségéral and Scheer, 2001); empty nuclei must be governed by a following full nucleus (e.g. empty N_2 is governed by full N_3 in (3)a). This requirement holds for the empty nucleus of the word initial CV unit (N_0 in (3)b).

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(3) a. Government.

gov

O_1 N_1 O_2 N_2 O_3 N_3

| | | | | |

C V C Ø C V

b. Initial CV: Government.

gov

O_0 N_0 – O_1 N_1 O_2 N_2

| | | | |

Ø C V C V

The initial CV parameter (presence versus absence of an empty CV unit word initially) regulates the presence of word initial clusters of non-rising sonority. Specifically, word initial clusters or non-rising sonority are not allowed in languages where an empty CV unit is present at the beginning of the word (initial CV parameter set to on): that is because the empty V would fail to be governed (N_0 in (4) below). In languages where there is no empty CV unit word initially (initial CV parameter set to off), word initial clusters of non-rising sonority can freely exist (Scheer 2004) (as in Greek, representation of *ftero* 'wing', example (5)).

(4) Word initial CV

*

gov

O_0 N_0 – O_1 N_1 O_2 N_2

| | | | |

Ø C Ø C V

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(5) No Word Initial CV: ftero

```
        gov

O1  N1  O2  N2  O3  N3
 |   |   |   |   |   |
f   Ø   t   e   r   o
```

According to this approach, if the word initial CV parameter is set to off, then any consonant cluster should be allowed word-initially, as the segmental properties of the two consonants are not relevant. The cluster exists due to government of the intervening empty nucleus by the following full nucleus and not due to any structural relationship between the consonants. Speakers of alanguage which allows word initial clusters of non-rising sonority (i.e. have the initial CV parameter set to off) would thus have the structure required for any word initial cluster, even one that is not present in their mother tongue. This can be experimentally tested in a child language context, where the testing ground will be provided by the developmental process of mastering consonant clusters.

If we view first language acquisition as a cue-based learning process (Dresher & Kaye 1990) whereby parameters are set gradually (Yang 2002), then child language provides us with a rich pool of speakers with grammars that differ in the setting of certain parameters only. In the case of word initial consonant clusters, children who have mastered word initial clusters of non-rising sonority (in languages that have them) have a grammar where the initial CV parameter is set to off. Children acquiring the same language but who cannot produce these clusters yet have the initial CV parameter set to on (see Sanoudaki 2010).

Following the reasoning above, we expect that children who have mastered word initial clusters of non-rising/falling sonority will be better able to produce non-native clusters of the same type than children who have not mastered these native clusters. In this study, we test the above prediction using child language data from children acquiring Greek, a language which allows clusters of non-rising (or falling) sonority word initially.

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In addition to the two target cluster types (native and non-native clusters of non-rising/falling sonority word initially), children's production of two further cluster types was examined. Firstly, the word initial non-native clusters tested here (*rt, lk* etc, see materials below) were also tested word medially, where they are permissible. Secondly, word initial clusters of rising sonority (*tr, kl* et, see materials below) were also tested. These additional conditions were included for completeness, and enable us to examine associations of non-native cluster production with mastery of clusters of different types and positions.

Method

Task

A non-word repetition task was used in this study. In this task, children are asked to repeat made-up words that contain the desired structures. The task has been used in the study of syllable structure acquisition (e.g. Kirk and Demuth 2006, Zamuner, Gerken and Hammond 2004) the study of working memory in children (Gathercole, 1995), and in the study of atypical language development (Gallon, Harris & van der Lely 2007). The task, in addition to enabling us to acquire a significant amount of useful data in a short time, also offers the advantage of avoiding familiarity effects linked to existing lexical items (in the case of native clusters).

Participants

A group of monolingual typically developing Greek-speaking children was tested. Children were tested in the production of a range of Greek consonant clusters as reported in Sanoudaki (2009, 2010). Here we analyse data coming from a subgroup of the fifty nine children tested, namely the 4-5 years olds (N=20, 13 girls, mean age 4 years 4 months). The subgroup was selected in order to avoid age effects, and also because data from younger children were not suitable for our present purposes as they included few successful repetitions of the relevant native clusters.

Children were growing up in monolingual households in two towns (Heraklion and Rethymno) in the island of Crete. They were recruited and tested in pre-schools and nurseries they attended. All children were reported by school staff as having no history of speech or language impairment, no hearing problems or developmental disabilities.

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Materials

A non word repetition task was used. In this task children are asked to repeat made up words containing the target structures. Stimuli were designed to test a range of consonant clusters that respect the phonotactics of Greek, in word initial and word medial position (see Sanoudaki 2009, 2010). Here we report on word initial clusters of non-rising/falling sonority (obstruent-obstruent, #TT) clusters) as well as word initial clusters of rising sonority (obstruent-sonorant, #TR clusters). We also analyse for the first time data from the repetition of word initial clusters of falling sonority (sonorant-obstruent, #RT clusters), which are attested word medially but not word initially in Greek. Repetition data from the same (RT) clusters word medially is also presented. The clusters tested (five per category) were the following:

(6) Clusters tested

TT clusters (word initially): ft, xt, vð, ɣð, vɣ

TR clusters (word initially): tr, kl, fl, xr, vr

RT clusters (word initially and word medially): rt, lk, rf, lt, lp

Stimuli consisted of disyllabic nonwords, which were possible feminine or neuter nouns in Greek (suffixes -i, -o, -a) in the nominative, accusative or vocative case. A voiceless stop was used as the onset of the non target syllable. A combination of vowels i, o and a were used for each word. Word medial conditions were created by reversing the syllable order. For uniformity, main stress was on the vowel following the target cluster. Resulting nonwords were either iambs or trochees. Both stress patterns are well-formed in the Greek lexical accent system, which is restricted by the trisyllabic window for main stress placement (i.e. main stress must fall in one of the last three syllables of the word).

The relevant non-words are listed below:

#TT ftipo, xtika, vðito, ɣðoki, vɣapi
#TR trika, klito, flapi, xroki, vripo
#RT (initial) rtika, lkito, rfipo, ltapi, lpoki.

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~RT (medial) karti, tolki, porfi, pilta, kilpo

Presentation order was pseudorandomised into three different orders in order to avoid sequence effects: specifically, item order was randomised and then sequences consisting of three or more items belonging to the same condition were broken up, so that there were no more than two consecutive stimuli belonging to the same condition. The complete list of stimuli included items forming a range of additional conditions, as well as four warm-up items consisting of single consonant onsets only, so each child was presented with sixty two words overall. Each presentation order was administered to a third of the children tested.

Colour drawings depicting novel animals were used to provide a referent for the linguistic stimuli (Kirk & Demuth 2006). Each picture was presented to the children on a small (7cm x 8cm) laminated card.

Procedure

The experimenter first spent some time with the children in their classroom or in the schoolyard, and then each child was tested individually in a quiet room.

The task was presented to the children as a game: the laminated cards showing the drawings of novel animals were placed inside an object. The child was then asked to retrieve the animals one by one and to call each animal by its name in order to ‘free’ them. Container objects included: two Russian dolls, a doll’s dress, a pair of trousers, a small plastic box, and a cloth book. Each object contained 10 laminated cards so that the introduction of a new object every 10 trials would help renew the child’s interest. Instructions were given during training only, and they were not repeated during test trials; in test trials, only the test item was modelled by the experimenter, who is a trained linguist and a native Greek speaker, brought up in a monolingual environment in Crete.

In the cases where the participant was not responding or the response was unclear, the child was encouraged once more to call the animal by its name, and was provided with a second model of the test item. If the response was still unclear, the trial in question was repeated once again at the end of the session. The use of spoken novel stimuli (rather than prerecorded speech) helped create a natural play situation and encourage participants in the task (as in Kirk & Demuth, 2006).

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All sessions were DAT-recorded using a microphone set up on the table close to the participant's mouth. The task was completed in one session, which lasted about thirty minutes, with short breaks of spontaneous discussion and playing in between, as and when needed. From these recorded conversations, information on the child's production of singletons was also obtained. All children in this study could produce all target consonants accurately as singletons. Recordings were also used to monitor spoken stimuli; subsequent stimulus evaluation showed appropriate use of stress and segmental content.

Data transcription and coding

Data were transcribed on-line by the experimenter, using broad phonemic transcription. The original transcriptions were then checked and amended off-line by the experimenter. Ten percent of the data for each child were independently transcribed by a second phonetically trained transcriber, who is a Greek native speaker and is not associated with the project. The consistency rate between the two transcriptions, focussing on the cluster data, was 96%. In cases of disagreement, the author made the final decision.

Responses were coded as target or non-target, taking into account only changes to the consonant cluster. Remaining aspects of the word were generally reproduced accurately by the children. For the purposes of the present study, a child was considered to have mastered a cluster if she had at least 80% target production (4 out of 5 target).

Results

A general view of the production data shows that mean scores for native clusters ranged from 65-79 percent), while the non-native clusters were produced accurately only 13 percent of the time (table 1).

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Table 1. Mean scores (and standard deviations) for cluster accuracy expressed as a percentage

# TT	#TR	~ RT	#RT
65	79	75	13
(31.03)	(30.8)	(33)	(16.2)

Ten out of twenty children (50%) produced at least one instance of #RT clusters (of these, only two produced more than one instance). All #RT clusters apart from *rfipo* were produced accurately by at least one child. Individual data is given in the appendix.

Moving on to an analysis according to our 80% mastery criterion, we observe that 11 out of 20 children had mastered #TT. Of these, eight children produced at least one instance of initial RT (72%). Nine children had not mastered #TT. Of these, two children produced at least one instance of initial RT (22%). The above can be seen in figure 1.

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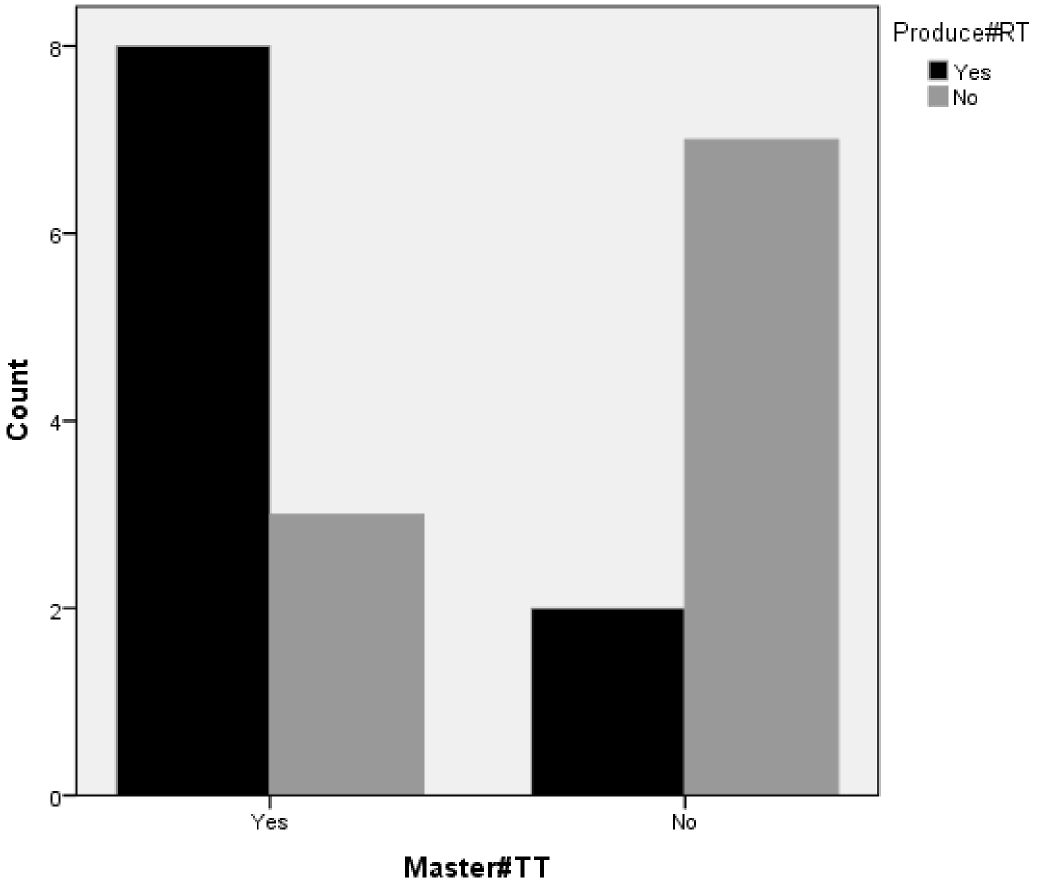
Figure 1. Clustered bar chart showing the number of children that produce #RT in relation to mastery of #TT.



A Fisher's exact test suggested that there was an association between mastery of #TT and #RT production ($x^2(1) = 5.051$, $p= .035$) Based on the odds ratio, the odds of a child producing #RT were 9.33 times higher if they had mastered #TT than if they had not.

Fifteen children had mastered #TR. Of these, eight produced an instance of initial RT. (53%). Five children had not mastered #TR. Of these, two children produced an instance of initial RT (40%). Fischer's exact test showed no association between mastery of #TR and #RT production ($x^2(1) = .267$ $p =1$).

Finally, of the 14 children who had mastered ~ RT, 10 produced #RT, while none of the six children who had not mastered ~ RT could produce #RT. A Fisher's exact test suggested

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that there was a strong association between mastery of word medial RT and #RT production ($x^2(1) = 8.571$, $p= .011$, Cramer's $v = .655$).

Overall, production of falling sonority clusters in the non-permissible word initial position (#RT) was associated with mastery of word initial native clusters of non-rising/falling sonority (#TT), as well as with mastery of clusters of falling sonority word medially (RT), but not with mastery of word initial clusters of rising sonority (#TR).

Discussion

In this study, we set out to investigate whether children who have mastered word initial clusters of non-rising/ falling sonority are better at producing word initial non-native clusters of falling sonority than children who have not mastered them, as would be expected under a strict CV account (Scheer 2004). This prediction was borne out.

Children's ability to produce non-native clusters of falling sonority word-initially was also associated to mastery of these clusters in word medial position, while mastery of clusters of rising sonority was not associated with the production of target non-native clusters.

These findings are accommodated in a strict CV framework if language acquisition is viewed as a process of setting parameters for all parametric forces (government, licensing, initial CV). In strict CV, word medial clusters of falling sonority require the empty nucleus between the two consonants to be governed by a following full nucleus (see 3a above). If lack of word medial clusters of falling sonority in child production is due to the government parameter being set to off (Sanoudaki 2010) then we would expect that the child would not be able to produce clusters of falling sonority in word initial position as government is also required for the relevant structure (example 5 above). This was indeed the case in our data. In contrast, clusters of rising sonority are linked to a different parameter (licensing), not to government; this can explain the lack of association between mastery of these clusters and production of word initial clusters of falling sonority.

Some of the present findings could be explained without making reference to structural relationships between consonant cluster types or even phonological representations. It has been long known that infants are sensitive to phonotactic patterns of their native language; for example young infants disprefer (in listening tasks) consonant clusters in positions not allowed

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by their language (Friederici & Wessels 1993). However, findings such as the ones presented here can be explained when these sensitivities are seen as serving the building of linguistic representations. For example, under a non-structural approach we might expect an association between production of clusters in a non permissible position and their mastery in a different position (i.e. clusters of falling sonority word initially and word medially), as was indeed found in this study (but note that, in adult speakers, lexical frequency of clusters in other positions does not correlate with production accuracy of illegal clusters: Davidson 2006). On the other hand, in the absence of structural relationships, it might be harder to account for the presence of association between production of these clusters and mastery of clusters of non-rising sonority as well as the absence of such association with mastery of clusters of rising sonority, which was found here. If anything, one might expect that production of target non-native clusters would be associated with mastery of the latter cluster type (clusters of rising sonority) as both cluster types tested in the present experiment involve obstruents and liquids (albeit in different order). This was however not the case here, thus offering support to the requirement for phonological structure, as well as supporting evidence for one structural model. Despite the established link between acoustic signal and phonological structure in phonological theory (Harris, 1994), language acquisition research has only occasionally been concerned with evaluating phonological theories and exploring structural relationships.

Results of the present study strengthen the ‘anything goes’ approach to the word initial site for languages that allow word initial clusters of non-rising sonority, i.e. that any combination of consonants would be possible in that position (Scheer 2004). As the present study is an initial investigation into this matter, it opens up a number of questions and avenues. A possible direction would be cross-language comparisons, such as a comparison between children acquiring Greek-like languages (i.e. languages that allow word initial clusters of non-rising/falling sonority) and children exposed to English-like languages (i.e. languages that don’t). Based on the premise presented in this study, a between group difference would be expected, such that children exposed to Greek-like languages would be better at producing non-native clusters of non-rising sonority than children acquiring English-like languages. Moreover, as the amount of target data produced in the present study was relatively small, learning studies (involving greater or repeated exposure to target clusters) could produce larger datasets.

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To conclude, the present study, as far as we know, is the first to investigate the structure of the beginning of the word using child data from the production of non-native clusters. By revealing an association between children's production of word initial non-native clusters and mastery of native clusters of non-rising sonority word initially in a language that allows them, results offer support to the strict CV 'anything goes' view of word initial consonant clusters in these languages, and evidence for the existence of an initial CV parameter.

Appendix.

Number of target responses (out of 5) by cluster type for each child, plus #RT clusters produced accurately.

Age (years;months;days)	Female/ Male	#TT	#TR	~RT	#RT	#RT clusters
5;00;16	F	3	4	4	0	
4;11;21	M	5	4	5	1	ltapi
4;08;15	F	4	5	5	1	rtika
4;06;05	F	0	0	2	0	
4;06;04	F	5	5	5	1	rtika
4;06;01	F	5	5	5	1	lcito
4;05	F	2	5	5	2	lpoci, ltapi
4;04;01	F	2	3	1	0	
4;03;24	F	3	5	3	0	
4;03;17	F	4	4	2	0	

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4;03;16	M	0	0	0	0	
4;03;06	F	1	5	1	0	
4;02;17	M	3	5	4	0	
4;01;17	M	4	3	5	1	rtika
4;00;14	F	4	4	5	1	rtika
4;00;12	M	3	5	4	1	lpoci
4;00;03	M	4	4	4	0	
3;11;26	F	4	3	5	1	rtika
3;11;25	F	4	5	5	0	
3;11;24	M	5	5	5	3	lcito,ltapi, rtika

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