On the Behaviour of sC Clusters: French Acquisition and Aphasia Data

Typhanie Prince
Laboratoire de Linguistique de Nantes
typhanie.prince@univ-nantes.fr

Introduction

This presentation explores phonological patterns of sC sequences in both French acquisition and aphasia data. The representation of sC always constituted a problem in phonology; researchers have proposed many solutions (Selkirk: 1982, Kaye: 1992 ; Carr: 1993, Barlow: 2001, Scheer: 2004, 2009, 2014, Goad: 2011, 2012, 2013, Rizollo & Barillot : 2012) since sC violates one of the syllabification rules - the *Sonority Sequencing Principle* (Clements: 1990*),* which characterizes branching onset (from now TR[1]). If sC does not seem to behave like branching onset, as many people argue, the question of its representation and its phonological status remains to be determined. The analyses of sC are far from being uniform and vary depending on the languages observed: coda+onset, extra_X, appendix (and so on). Languages such as Acoma, Mazateco or Blackfoot allow sC in initial position but no branching onset (Goad : 2012) while Spanish and Brazilian Portuguese admit TR but forbid initial #sC. sC can contrast even within the same language. In French, particularly, sC behaves somewhat inconsistently: sometimes it behaves like a cluster _TR, at other times like a heterosyllabic sequence _RT. A type of French colloquial speech, verlan, is a case in point.

(Rizollo & Barillot, 2012):

glose	API		verlan	glose	API		verlan
"baston"	[bas.tɔ̃]	→	[stɔ̃.ba]	"stone"	[stonə]	→	[nə.sto]
"basket"	[bas.kɛt]	→	[skɛt.ba]	"pastille"	[pas.tij]	→	[stij.pa]
"costard"	[kɔs.taχ]	→	[staχ.ko]	"moustique"	[mus.tik]	→	[stik.mu]
"poster"	[pos.te]	→	[stə.po]	"moustache"	[mus.taʃ]	→	[staʃ.mu]
"speed"	[spid]	→	[dø.spi] or [døs.pi]	"suspect"	[syspɛ]	→	[pesys]

So, why is sC strange?

- sC behaves inconsistently: sometimes TR sometimes RT[2]
- sC violates the *Sonority Sequencing Principle*
- sC may have different phonological representations in the world's languages

[1] Where T represents all obstruents and R sonorants.

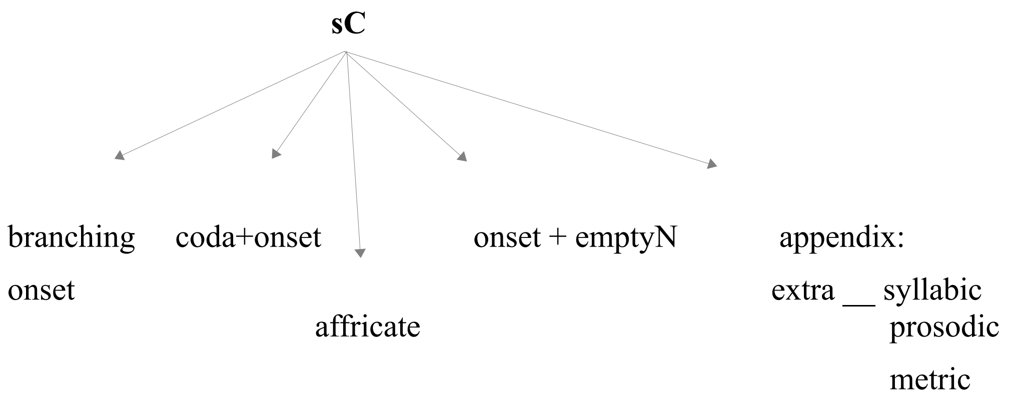
Yet, the status of sC is still controversial. The question I am addressing in this presentation is: What is the representation of sC in French? Does sC really behave differently to other clusters? To answer this, I will compare the production of sC and ʁC sequences (which is always a coda+onset) in French-speaking aphasics (Romani & Calabrese: 1998) and normally-developed children.

On the basis of this, the theoretical framework I will adopt here is Government Phonology (Kaye, Lowenstamm and Vergnaud, 1990). As Pan & Snyder (2004:437) point out: “GP is a 'principles and parameters' approach to phonology- [Universal Grammar is taken to consist of a set of universal principles common to all languages, together with a series of parameters each with a limited set of values]. This framework implies that a child’s task in acquiring core grammar is one of setting the parameters correctly, based on the linguistic input.”

I will focus on the case of sC, particularly in French. Firstly, I will have a brief look at what has been said about sC in the literature. Then, I will outline the methodology of my experimental protocol and present my data. Lastly, I will present my analysis of the status of sC.

1. Background

sC has been represented in many ways. As a reminder, here are the different hypotheses concerning these clusters in previous works:



The behaviour of sC can be defined across the world's languages by 5 hypotheses. As Goad summarised (2011:5) we can distinguish: branching onset, coda+onset, affrication, onset+emptyN or appendix and so on.

1- Branching onset = TR sC is a TR. Many proposals argue against sC as a branching onset. A branching onset is characterised by increasing sonority where T are less sonorous than R. This is not the case for sC, which violates the sonority sequencing principle (fricatives are

[2]Where R represents all sonorants and T obstruents.

more sonorous than stops). So, sC is naturally treated differently than TR by speakers. (See Kaye (1992), Pan & Snyder (2004) and Goad (2011: 917) for a summary of relevant arguments).

2 - Extra_X: Here, /s/ doesn't belong to the linear string. But a segment has to be linked to something to be phonetically interpreted. To solve this problem, many solutions have been proposed: extrasyllabicity (see Van der Hulst : 1984); or extraprosodicity, /s/ can be attached directly to the syllable (Halle & Vergnaud : 1980, Stériade : 1982) or to a prosodic word (see Goldsmith : 1990). But, why does /s/ behave differently, more so than any other consonant, and why isn't it part of the CV string?

3 - Affrication: according to Selkirk (1982), Carr (1993) and Yildiz (2005), sC is an affricate, i.e. two phonetic objects (melodic constituents) are associated with the same skeletal point.

If sC is sometimes tautosyllabic and at others heterosyllabic, the status of affricate can't account for heterosyllabicity. (However, on the basis of my data, as I will show, deletion of /s/ is adopted more often than deletion of the sequence, so affrication is not an option in acquisition).

4 - Onset+emptyN: sC is an onset followed by an empty nucleus in languages where codas are forbidden, like Acoma (Goad : 2012) or Zulu (Cyran, 2001:2). This proposal can't represent sC in French because French has codas.

5 - Finally, the last hypothesis is **Coda+onset:** Kaye (1992), Pan & Snyder (2004) and Goad (2012) propose that sC behaves like coda+onset in the Indo-European languages. But, in Government Phonology, a coda doesn't appear in initial position. To solve this problem, Kaye has suggested *Magic licensing,* as you can see on the diagram. Following Kaye, Pan & Snyder (2004) propose a Magic Empty Nucleus in #sC. This corresponds to the nucleus before an sC that is magically licensed, and hence inaudible. The [MEN] parameter has two settings depending on the language: [+MEN] in French, Italian, Dutch and English and [-MEN] in Spanish or Mazateco.

Based on a comparison between sC and ʁC in French acquisition and aphasia, I will explore particularly the last proposal, made by Government Phonology. The reason for adopting this approach is as follows: if sC behaves like RT, so, as coda+onset sequences, I assume that the transformations applied to RT sequences should be similar to the ones applied to sC sequences. I will start by comparing theses sequences according their positions. I will then see how these data are or aren't an argument in favour of the proposal made by Kaye (1992) and Goad (2012).

2. Data processing

2.1. Methodology

Participants

Data is based on a cross-sectional study on a sample of 20 French monolingual children and 20 aphasic patients. The child participants were standardly developed children between 2;1 and 3;8 years (M_{age} = 2;34 years), and were recorded at a kindergarden in France. 18 of the aphasic patients were recorded between Day+1 and Day+25 at the stroke (Neurovascular) unit of a hospital in Nantes, while the other 2 were recorded in a speech therapy practice. All the aphasics suffer from a phonological disorder called phonemic paraphasias, stemming from a lesion of the left hemisphere. Phonemic paraphasias are the focus of this presentation. It involves patterns such as: metathesis, epenthesis, substitutions and deletions of one or more segment(s) in a word, and can be found across multiples tasks (spontaneous speech, repetition, picture naming task, and so on). I have recorded 7 Broca's aphasics including 1 in therapy, 6 Wernicke's aphasics including 1 in therapy, 4 conduction aphasics and 3 Transcortical aphasics.

Procedure

My stimuli were comprised of twenty items including sC clusters and twenty items including ʁC in initial, middle and final positions[3]. I used a picture naming task and a repetition task. Here is a sample of the data; I am going to focus on the most important transformations (deletion and substitution).

Glose		**IPA target**	**IPA**
stylo	'*pen*'	[stilo]	[tilo]
scarabée	'*beetle*'	[skaʁabe]	[kabe]
spatule	'*spatula*'	[spatyl]	[patyl]
scorpion	'scorpion'	[skɔʁpjɔ̃]	[pɛʁpjɔ̃]
arc	'arc'	[aʁk]	[at]
escargot	'*snail*'	[ɛskaʁgo]	[ɛkaʁgo] [atoto] [ɛskago]
tortue	'*tortoise*'	[toʁty]	[tosty] [toty]
casquette	'*cap*'	[kaskɛt]	[kakɛt] [tatɛt] [kaʁkɛk]
porc-épic	'*porcupine*'	[pɔʁkepik]	[pɔʁtepik]
moustique	'*mosquito*'	[mustik]	[muʃik]
masque	'*mask*'	[mask]	[mak] [mas] [mat]

[3]. Apart from ʁC in initial position which is not represented at all because this type of cluster does not exist in French.

On the basis of this experiment, several issues will be addressed:

(1) a. Do sC and ʁC have the same behaviour?

b. Does position affect the type of transformation?

c. Does the nature of C^2 play a role in transformation?

Furthermore, following Jakobson's postulate (1968) concerning the relation between acquisition and aphasia, I will compare all the productions to find out if children and aphasics use the same strategies.

2.2. Results

There was a total of 2245 clusters analysed. Of these, 1199 were correctly produced. This therefore left 1046 to be studied (859 of which were produced by aphasics and 340 by children). Aphasics correctly produced each cluster in more than 65% of cases. Children make fewer transformations of ʁC than sC. In the following table, you can see all the strategies applied by the two groups:

Proportion of transformations

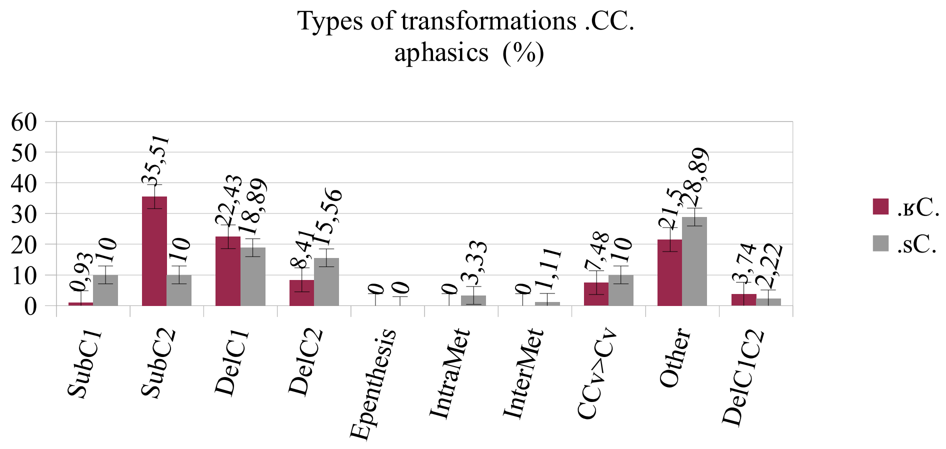
	Children		**Aphasics**	
	N	**%**	**N**	**%**
substitution C^1	11	1,68	11	2,82
substitution C^2	20	3,05	80	**20,46**
deletion C^1	378	**57,71**	84	**21,48**
deletion C^2	75	**11,45**	82	**20,97**
deletion C^1C^2	42	6,41	9	2,30
interMetathesis	2	0,31	1	0,25
IntraMetathesis	13	1,98	11	2,81
Epenthesis	4	0,61	2	0,51
Other	37	5,65	71	**18,16**
CCV>CV	73	**11,15**	40	**10,23**
TOTAL	655	100	391	100

In acquisition, deletions of C^1 are preferentially adopted, then deletions of C^2 and "coalescence" CCV > CV. There is less of a strong difference in the results for aphasics: they mostly adopted substitutions of C^2 deletions, CCV>CV and others. *Others* corresponds to the cases where I found more than three different processes of transformation on the item: "snail" ɛskaʁgo → ʦɛʁʦaʁdo. I will now look at the transformations applied for sC and ʁC depending on the position.

3. Analysis

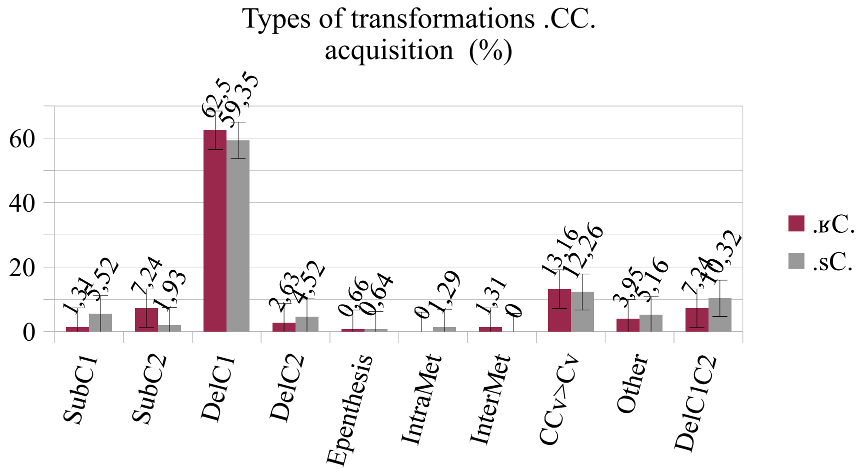
I will start by exploring results for middle and final positions.

3.1. .sC. *versus* .ʁC.



Aphasics make a difference between sC and ʁC. ʁC undergoes mainly substitution of C^2 , deletion and others while sC undergoes *others cases and* deletions of C^1 and C^2 (+CCv > Cv).

If I compare with children's transformations:



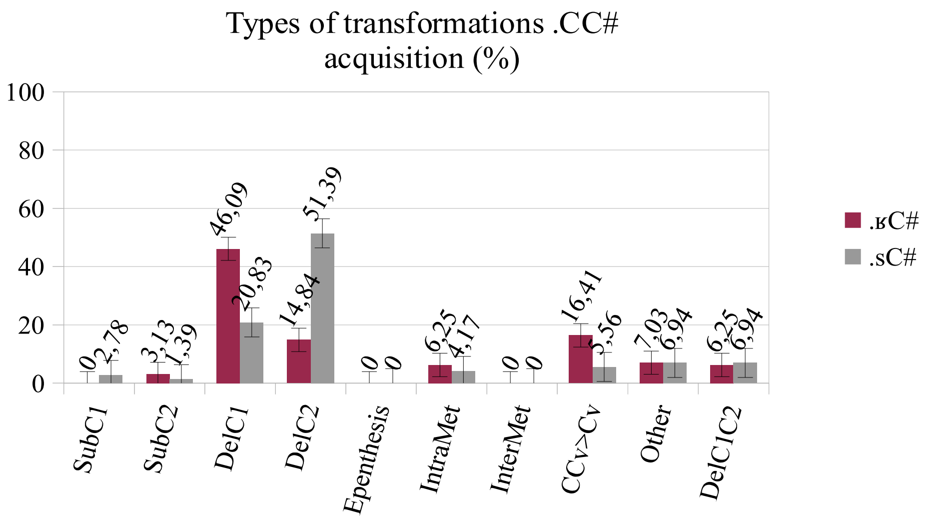
sC and ʁC are more or less treated in the same manner. Deletions of C^1 are most common, whatever the nature of the cluster. Coalescence also occurs. Position, rather than nature of the consonant, clearly seems to play a role in acquisition.

Aphasics and children do not seem to adopt the same transformations: while aphasics tend to focus on substitutions of C^2 for ʁC, children have a clear preference for deletions.

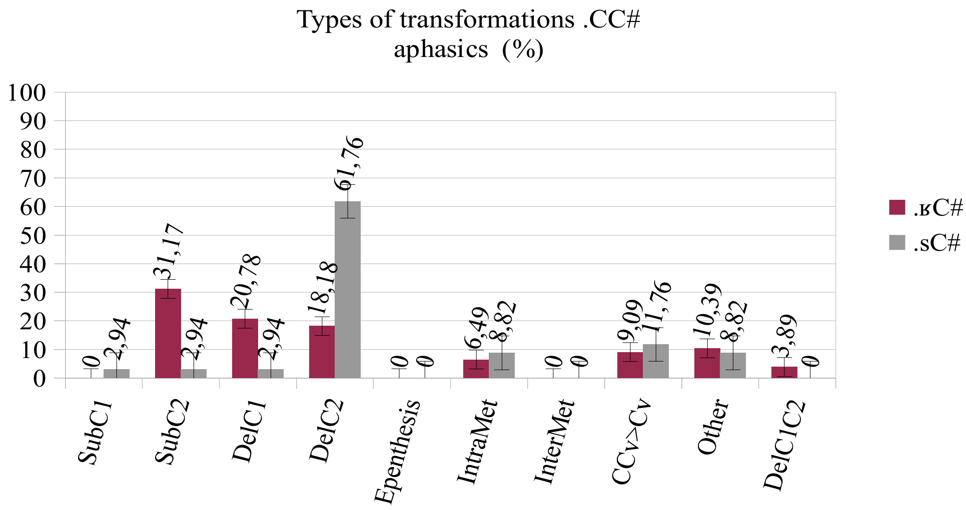
I will now compare these results with clusters in final position**.**

3.2. sC# *versus* ʁC#

For children

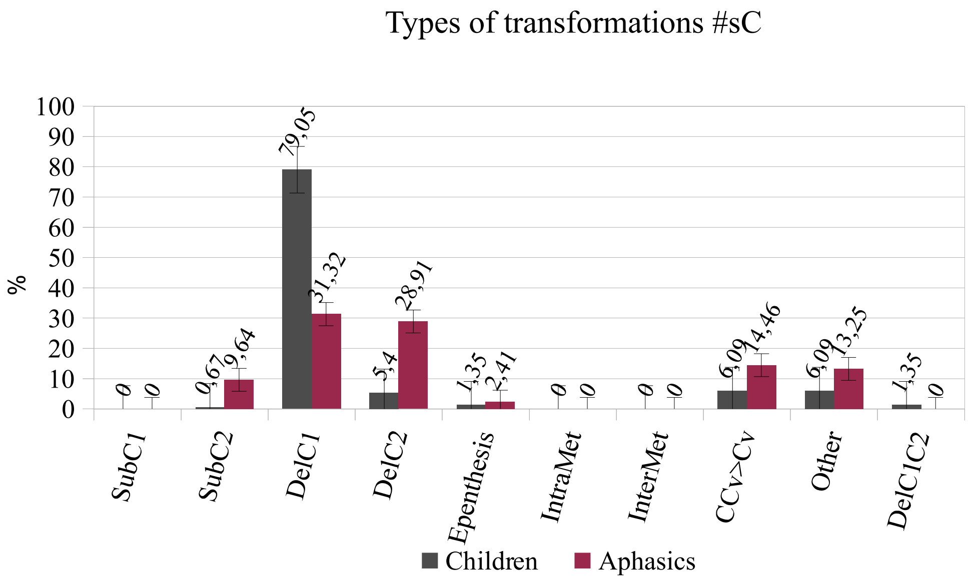


sC and ʁC have not been treated in the same manner. Curiously, children preferred to apply deletion of C^2 for sC and deletion of C^1 for ʁC. Position doesn't appear to play a fundamental role, except for sC, where transformations are applied depending on the nature of C^1. Moreover, I also found the same results in aphasics for sC. Aphasics, like children, use the same strategies for sC#, Deletion of C^2 ; like in middle position.



But, if we consider ʁC# clusters, substitution of C^2 is mostly adopted by aphasics while children delete $DelC^1$.

3.3. #sC: strange behaviour?



Finally, if we look at the following table, we see the results for the initial position for sC.

Deletion of C^1 is clearly adopted by children. Once more, transformations made by aphasics are more evenly distributed. Aphasics applied, most of the time, deletions of C^1 and also deletions of C^2. I am now going to interpret these data.

4. Discussion

Can we attribute a phonological status to sC?

4.1. Concerning #sC

I propose to treat sC as a coda+onset, like ʁC, in French.

Arguments: This solution accounts for most of the data. Kaye (1992) showed how #sC is not a branching onset and suggested that sC is a coda+onset. In line with this, I argue that *magic licensing* is a parameter. I would suggest that, at this stage in acquisition, the *Magic Empty Nucleus Parameter* [MEN] proposed by Pan & Snyder (2004: 438) has not yet been set. That's why children delete /s/ before they correctly produce sC.

4.2. sC: which representation?

Arguments: The deletion of /s/ by children constitutes an argument in favour of this hypothesis. Moreover, Wauquier (2014) recalls that codas are acquired later than onsets in acquisition and Freitas (1997) argues that sC behaves as a coda+onset because children produce sC before branching onset in Portuguese. Barlow (1997: 82) arrives at the same conclusion in her study of phonological disorders in childhood. She also explains that if there are several representations of sC in the world's languages, there may be several representations of sC in acquisition. Another argument is that the deletion of /s/ does not involve transformations in $C^{2.}$. This shows that the sequence is not a real cluster; rather, it is tautosyllabic. In any case, even if children take different paths, ultimately, they all arrive at the same grammar (Barlow : 1997, 2001, Gierut :1999).

As far as acquisition is concerned, deletion reflects the fact that the coda position has not yet been apprehended by the phonological system. Substitution corresponds to the next stage: it results from the process of setting this parameter. During this second stage, children try to test the possible values in coda position depending on the parameters of their language. Thus, position doesn't seem to play an important role. Whether in initial, middle or final position, children and patients applied the same processes, except in final position where deletions of C^2 are adopted for sC and, more often, substitutions of C^2 for ʁC.

The following table recapitulates the principal transformations depending on the factors of position (on the left), cluster type (at the top of the table) and population.

	sC		**ʁC**	
	children	**aphasics**	**children**	**aphasics**
# __ v	del. C^1	del. C^1 del. C^2	*	*
v __ v	del.C^1 CCv > cv	other del. C^1 del C^2	del. C^1 Ccv > Cv	sub. C^2 del. C^1 other
v __ #	del. C^2 del. C^1	del. C^2 CCv> Cv	del. C^1 del. C^2	Sub. C^2 del. C^1 del. C^2

Regardless of the position or the nature of the cluster, deletion is the most important strategy, especially deletion of the first member. Nevertheless, we need to acknowledge that aphasics had a particular preference for substituting C^2 in ʁC but not in sC.

This indicates that the segmental structure is more problematic than the syllabic structure for most aphasics. Syllabic structure is similar in both sequences: it is consonants that cause trouble for aphasics. In contrast, syllabic structure seems to be more problematic than segmental structure for most children.

Following Pan & Snyder (2004: 444), I argue that parameter settings are not ordered. Some children may set segmental structure prior to syllable structure while others, like aphasics, may (re)set syllable structure parameters prior to segmental structure.

My hypothesis is the following: sC is more complex syllabically than ʁC (i.e. it leads to more deletions) whereas ʁC is more complex than sC segmentally.

sC involves more syllabic constraints than ʁC whereas ʁC involves more segmental constraints. Transformations may be triggered by the fact that the child is trying to deal with these two complex processes at the same time: they need to find some sort of balance between them. In acquisition the syllabic complexity leads to more problems than segmental complexity: that is why children delete sC and ʁC most of the time. As far as aphasics are concerned, clusters were produced well overall. It therefore appears that the segmental tier is more complex for them. That is why they used deletions for sC and substitutions for ʁC.

5. Conclusion

Complexity results from the interface of the segmental and syllabic tiers. Before the setting of parameters for both tiers, transformations appear. Finally, when the parameters are set, good productions occur.

The next step in this research is to carefully compare every transformation of sC by focusing on the following two factors: transformations depending on the nature of C^2, and transformations which involve segmental and syllabic tiers: coalescence. In light of the analysis proposed here, nature of the consonant appears to play an important role in acquisition, as well as in the loss of syllabic structures in aphasia.

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