The Case of Substitutions in Adult Aphasia and in Typical Acquisition of French: revisiting Element Theory

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Typhanie Prince
Université Paul-Valéry Montpellier 3, PRAXILING UMR 5267
typhanie.prince@univ-montp3.fr

The starting point of this paper is Jakobson's proposal (1968) that a parallel can be drawn between the phonological system in acquisition and aphasia. In this paper, we discuss the evidence that the observation of this parallel between acquisition and speech pathology can help achieve a new definition of complexity for the architecture of the French phonological system. We will explore the substitution errors for place of articulations deployed by French children and adult participants with aphasia. To explain these phenomena, we argue that Element Theory (Kaye, Lowenstamm and Vergnaud (1985), Harris (1994), Harris and Lindsey (1995), Scheer (1999), Backley and Nasukawa (2008), Cyran (2010) and Backley (2011)) can provide a direct measure of complexity and markedness. For these reasons, we will investigate how data can furnish new points of view on Element Theory. Then we will explore and evaluate this theoretical framework. We conclude that substitutions result from adjustments and parameter-setting in the underlying structure of language.

1 Introduction

Jakobson ([1941]1968) claimed that the complexity of segments that can be laid bare in the acquisition and impairment of language – such as aphasia – corresponds to universal laws which govern the sound systems of the world. Most research that draws on this postulate has been devoted either to the study of complexity in segmental processes (Stemberger and Stoel-Gammon, 1991; Rice, 1996, Fikkert, 2000; Morrisette and al. 2003, Pater and Werle, 2003; Pater and Barlow, 2003; Rose and Wauquier, 2007; Rose and Inkelas, 2011) and the syllabic dimension (Levelt, Schiller and Levelt, 2000; Barlow, 2001; Pater and Barlow, 2003; Pan and Snyder, 2004; Demuth and McCullough, 2009 and Goad, 2010, 2011, 2012). One of the most famous proposals resulting from Jakobson's *kindersprache* ([1941]1968)[2] argues that the loss of the phonological system in aphasia is the mirror image of the acquisition of segmental and syllabic structure in childhood. Children first acquire less complex structures prior to the more complex ones. Conversely the impairment of the phonological system leads to the loss of the most complex structures first. Many studies focus on only the (a)typical acquisition of phonology or only the phonology of French participants with aphasia (henceforth PwA) (Nespoulous and al., 1987; Béland and Favreau, 1991; Wauquier, 2007; Kirk, 2008). Most studies on phonological disorders in aphasia make direct reference to acquisition data (Caramazza, 1994; Den Ouden, 2011, 2002; Den Ouden and Baastianse, 2003; Romani, Galuzzi, Guarigli and Goslin, 2017), as suggested by Jakobson (1968), but there have not been any studies that have explored the consequences of this phonological link, or which have provided

[1] I am very grateful to: J. Harris, A. Tifrit, J-P. Angoujard, M. van Oostendorp, P. Backley, K. Nasukawa, C., the anonymous reviewer, Connor Youngberg and Faith Chiu for their insightful comments and advice. I especially thank all of them for their constructive remarks. All errors are my own responsibility.
[2] And also Alajouanine, Ombredane and Durand (1939).

any information about the structure of the consonantal inventory and the phonological complexity on the basis of empirical data. Up until now, to our knowledge, only two works have been devoted to a comparative study of language acquisition and aphasia (Béland and Paradis, 2002; Romani, Galuzzi, Guarigli and Goslin, 2017). Yet, the comparison between the acquisition and deficit of the phonological system has the potential to inform us greatly about the structure of the phonological inventory. In this way, adult aphasia and (a)typical language acquisition constitute a window into the functioning of language and more specifically the phonological system.

As proposed by Jakobson, and in the same line of thought as Béland and Paradis (2002) and Romani, Galuzzi, Guarigli and Goslin (2017), this paper aims to contribute to the understanding of the complexity of segmental representations through the notion of markedness by looking at typical acquisition and adult aphasia data in French. More specifically, we will study the notion of complexity in segmental representations by focusing on the behaviour of the places of articulation (henceforth PoAs) in the light of element theory (now ET), (Kaye, Lowenstamm and Vergnaud, 1987; Harris, 1994; Harris and Lindsey, 1995; Scheer, 1999, 2015 Backley and Nasukawa, 2008; Cyran, 2010 and Backley, 2011).

To this end, we will observe and analyse the substitution strategies deployed by French children and PwA. This first study concluded that the patterns of errors in these segments are not generated randomly and should be considered as pure effects of complexity and markedness (Jakobson, [1941]1968; Béland and Paradis, 2002; Durand and Prince, 2015). We postulate that a phonological model like Element Theory can provide us with a direct measure of complexity.

This paper therefore aims to show how data in adult aphasia and typical acquisition can inform us about the differing complexity patterns of PoAs and help shape a new understanding of element theory as applied to French. As part of this, we will compare different versions of Element Theory (or ET) and put forward new ideas about the internal representation of consonants in French. The data support the view that markedness asymmetries in PoAs are best captured as differences in representational complexity. Another line of evidence supporting our results also come from French diachrony. However, if the data also support Jakobson's claim (especially concerning the notion of markedness), we will conclude that the data from the two populations do not converge. In fact, we show that there is plenty of reason to doubt about the Jakobson's hypothesis concerning the mirror-image between acquisition and PwA.

The paper is organized as follows. After a brief overview of literature regarding the case of substitutions, section 2 investigates the theoretical notions about complexity and provides information on Element Theory, mainly Harris (1990, 1994), Scheer (1998), Cyran (2010) and Backley (2011). In section 3 we will describe our experiment and the data from French children and PwA. We will argue that the mechanisms at play for PoAs in cases of substitutions allow us to outline predictions about the nature of complexity. We will provide an analysis of these substitution patterns in section 4. Finally, the data is used to shed light on the Element Theory framework. We will advance a new proposal for element theory regarding the complexity of PoAs in French, specifically [coronal], [labial] and [dorsal] classes. We favour a version of the model in which [coronal] is unspecified and unmarked.

2. Theoretical Background

2.1 Phonological substitutions' case in the literature

Many works (Blumstein, 1978; Béland and Favreau 1991; Béland and Paradis, 2002, Den Ouden, 2011; Romani, Galuzzi, Guarigli and Goslin, 2017) have demonstrated that deletions, segmental substitutions and epenthesis are the most evidenced errors in aphasia, especially in English, French, Italian or Dutch. These errors are consecutive to a phonological deficit which leads to the production of paraphasias. According to Béland and Paradis (1997) paraphasias, such as substitutions, are surface manifestation of the application of compensatory strategies made by PwA to solve a conflict between their own constraints of their internal

grammar and the constraints of the language. Substitutions are also frequently found during the (a)typical acquisition of phonology (Chin and Dinnsen, 1992; Fikkert, 1994, 2000; Kirk, 2008; Demuth and McCullough, 2009; Rose, 2003, 2009; Johnson and Reimers, 2010) depending on the position and the nature of different consonants. They are applied during the setting of parameters of the grammar in language acquisition. Substitutions mainly concern consonants but can also affect vowels. They can include cases of consonantal harmonies, reduplications, segmental modifications of place or mode features and also voicing.

On the basis of Jakobson's idea, several authors propose that markedness plays a major role in the acquisition of phonology and in aphasia. In this way, Chin and Dinnsen (1992), Kappa (2002:21) and Fikkert (1994) have shown that the production of children tends to be unmarked in structure though different strategies can be adopted. Children and PwA respect a hierarchy of complexity which depends on the constraints applied for a specific language. Following this line of thought, the result is always the reduction of complexity by adopting less marked structures.

The analysis of substitutions in acquisition and adult pathology constitutes a perfect way to inform our work on this hierarchy of complexity. This section begins by presenting this strategy in the literature.

2.1.1 Treatment of substitutions in typical language acquisition

Segmental substitution and consonantal harmony (henceforth CH) are shown to be mainly concerned with PoA rather than the manner of articulation (henceforth MoA) (Ingram (1974), Stoël-Gammon and Stemberger (1994), Smith (1973), Goad (1997), Pater (1997), Rose (2000); Kappa (2002), Pater and Werle (2003), Dos Santos (2007) or Yamaguchi (2012, 2015), Dos Santos and Kern (2015)). Following Jakobson (1968) who proposed that the coronal /t/ is unmarked and the least complex, Yamaguchi, Dos Santos and Kern (2015) have proposed that CH principally affects [coronal] in French, as opposed to Pater and Werle (2003) who have shown that [dorsal] is the favorite target for CH in English. Fikkert (2000) has shown for Dutch that [coronal] is the target of assimilation, as well as in French. Coronals assimilate to all other PoAs from the other consonants. She assumes that assimilation always comes from specified features like [dorsal] and [labial] and turn into [coronal], which are placeless and unspecified. According to this, Fikkert (1998) also argues:

> Usually, this stage is preceded by one in which children only have words that are either completely labial or completely coronal […]; dorsal words are usually produced much later. At the initial stage of acquisition, there is thus only one place specification per word. […] Gradually, more differentiations are made[3].

Children will produce words with only one place of articulation within the word.

(1)	brood	*bread*	/bro:t/ → [bo:p]
	poes	*cat*	/pus/ → [puf]

Children also tend to assimilate progressively before they produce the target form. Congruent with this, Rose and Wauquier-Gravelines (2007) have shown that in French, [velar] consonants are acquired later than [coronal] and [labial]. In European Portuguese, Da Costa (2010) has shown that [labial] is also acquired earlier than [dorsal]. Another study conducted by Stemberger and Stoel-Gammon (1991), reported that substitutions, which are the result of harmony process in English, also affected [coronal]. Children used assimilation to substitute a [coronal] segment by a [labial] or a [dorsal], as shown by the following examples:

[3] Fikkert, P. (1998:177).

(2)	*duck*	/dʌk/ → [gak][4]	velar harmony
	dog	/dɔg/ → [gɔg]	velar harmony
	book	/bʊk/ → [bup]	labial harmony

In summary, they proposed that [coronal] are unspecified. For these reasons, they can be specified for PoA and can receive the properties of other consonants. However, if [labial] consonants are stable, variation provides that substitution may be made for [dorsal] and also [coronal]. Based on 211 English children, Morrissette and al. (2003:351) have tested if [dorsal] is more marked than [coronal] by reviewing the substitutions. They demonstrate that:

> In terms of the children's substitution patterns, dorsals were replaced by coronals... in a large proportion of the cases. However, a small proportion of the children replaced coronals with dorsals.

In this regard, to justify variability in the data presented here, we should not forget that Jakobson (1968:58) also postulates that if a child starts to acquire /t/, when the child acquires the [dorsal] /k/, he goes through a transitional phase during which they confuse and use /t/ and /k/ randomly. This idea seems consistent with the data we have presented here.

2.1.2 Treatment of substitutions in acquired aphasia

As we already said, substitutions are one of the main errors realized by PwA (Nespoulous and al., 1987; Béland and Favreau, 1991, Valdois & Nespoulous, 1994, Blumstein, 2016) regardless the language. Case studies of substitutions have shown that the coronal class to be the most common result of substitutions. From a study of 29 people with aphasia, Béland and Favreau (1991) have shown that [coronal] consonants display a particular behaviour where they constitute the target of substitutions. [labial] segments are substituted at 56.25% by [coronal] segments, [dorsal] segments are also substituted by [coronal] segments and even [coronal] themselves can be substituted by another [coronal]. Contrary to evidence from acquisition, there is less variability in substitutions demonstrated in aphasic cases, e.g. most things become a coronal. Regardless of the type of aphasia, fluent or non-fluent, in majority, consonant substitutions result in a segment from the [coronal] class. For that reason, we have reason to believe that [coronal] is less marked than any other place of articulation.

As such, standard approaches to substitutions in aphasia have relied on *Interphonemic Distance* (ID, Blumstein 1973), which computes the number of feature changes. ID allows one to compute the degree of complexity of substitutions by comparing feature values inside two matrices. Compare, for example, the changes k>t p>t k>p in (3):

The distance between (3a) (3b) and (3c) would be 2, 1 and 1.

(3)

a) **[k]** → **[t]**

$$\begin{Bmatrix} \textbf{- cor} \\ \textbf{- ant} \\ \text{- cont} \\ \ldots \end{Bmatrix} \rightarrow \begin{Bmatrix} \textbf{+ cor} \\ \textbf{+ ant} \\ \text{- cont} \\ \ldots \end{Bmatrix}$$

ID=2

b) **[p]** → **[t]**

$$\begin{Bmatrix} \textbf{- cor} \\ \text{+ ant} \\ \text{- cont} \\ \ldots \end{Bmatrix} \rightarrow \begin{Bmatrix} \textbf{+ cor} \\ \text{+ ant} \\ \text{- cont} \\ \ldots \end{Bmatrix}$$

ID=1

c) **[k]** → **[p]**

$$\begin{Bmatrix} \text{- cor} \\ \textbf{- ant} \\ \text{- cont} \\ \ldots \end{Bmatrix} \rightarrow \begin{Bmatrix} \text{- cor} \\ \textbf{+ ant} \\ \text{- con} \\ \ldots \end{Bmatrix}$$

ID=1

In Blumstein's ID, the greater the distance, the more complex the substitution. Blumstein proposes that most of the changes imply an ID of 1: in other words, most of the time only one

[4] Stemberger and Stöel-Gammon (1991:189).

feature value is changed. Adopting the same perspective, Nespoulous and al. (1987) show that the substitutions are different between Broca and conduction aphasic speakers. The substitutions in Broca aphasic speakers show an ID of 1, while those in conduction aphasic speakers show an ID generally of 2 and sometimes 3. However, due to the fact that the three segments contain the same number of features, ID allows us to characterize the relative complexity of substitutions but not to predict which substitutions may appear in phonological paraphasias. Even more, ID cannot explain why [coronal] segments are involved most of the time. There is no way to understand why substitutions sometimes only affect one feature, but sometimes a conjunction of features and why there is variation among the features manipulated. Moreover, it is important to note that the distance measure is crucially affected by the specific feature used in a specific analytical framework. ID might be 1 in one feature framework but 3 in another. In this regard, we suggest that ET may better explain the different patterns of substitutions in aphasia and the asymmetrical behaviour of segmental classes.

Because the goal of this paper is to propose an analysis for the internal representation of segments in French in terms of complexity and markedness (Troubetzkoy, 1939) using data from both adult pathology and typical language acquisition, we adopt the ET framework in Government Phonology in order to explain these substitutions.

2.2 Element Theory

To provide a definition of the internal constitution of segments in phonology, we can use theories based on a unary feature system such as Element Theory (*cf.* Kaye, Lowenstamm and Vergnaud (1985, 1987), Harris (1990, 1994), Harris and Lindsey (1995), Angoujard (1997), Scheer (1998, 1999), Cyran (2010) and Backley (2011)). In fact, ET follows the traditional feature-based approach and aims to solve the problems caused by unary features.[5] In this section, we present different unary prime systems and decide which is the best to account for the clinical data of aphasia and data in typical acquisition.

2.2.1 The Elements

Elements are small units which characterize the properties of a segment. Each element is independently interpretable and represents a property which can be present or absent depending on each segment. Thus, a combination between the different elements provides the internal constitution of segments. For two segments α and β, if α has property X which is defined by element Y, the value will be positive. Hence, element Y will be present in α. On the other hand, if β does not have property X, the value will be absent, and element Y will be absent in β. Phonological primes are privative, not binary (Kaye, Lowenstamm and Vergnaud, 1985, 1990).

Nasukawa and Backley (2008) and Backley (2011) argue that the characteristics of features/elements are based on speech production and the acoustics of segments. But, because speakers are also listeners, it is possible for them to understand statements by matching meaning with articulatory movements. In this regard, Backley and Nasukawa (2010:23) propose that:

> The 'elements' (features) of Element Theory represent phonological categories, which themselves are based on the phonological information that speakers and listeners use to identify morphemes. This information is transferred between speaker and listener via the speech signal, which is defined in acoustic terms. Thus, elements

[5]See Breit's work (2013) on the generative power of element theory *versus* distinctive features.

> are primarily abstract units of phonological structure, but they also relate directly to some linguistically relevant properties of the acoustic signal.

Traditionally, phonological *elements* are single-valued, privative or monovalent and this gives us a direct measure of complexity through the number of elements: the more elements a segment possesses, the more complex it is. In this definition, markedness is directly related to complexity. One example, taken from Harris (1990:269), is the lenition trajectory of the coronal [t] in the dialect of Liverpool:

(4) Lenition

x	→ x	→ x	→ (x)	
R°	R°			
h°	h°	h°		
ʔ°				
[t]	→[s]	→[h]	→	Ø

Lenition can be accounted for straightforwardly under a monovalent representation. Most consonants are the result of a combination of elements: each segment is derived from the fusion of elements according to their properties. For example, following Harris (1990), coronal stops are defined as |RʔH|. This means that they have a coronal resonance (|R|), glottal closure (|ʔ|: (glottal stop)), and there is a noise component (|h|) signalling frication.

When several segments contain a similar property, they are represented by the same element. To combine phonological elements in a representation and to differentiate between most segments, ET also integrates the notion of headedness.

> When two elements combine to form a compound, for example (A-I), it is assumed that the elements may enter into an asymmetrical relation in which one of the elements may dominate the other, thus yielding a different object than if the situation was reversed. Roughly speaking, a compound structure (A-I) which is I-headed, that is (A.I), may correspond to phonetic [e], while (A.I) should give [æ]. (Cyran 2010:6)

Several authors adopt an additional mechanism to account for complexity: a head element is more complex than an element without a head. For example, the {U} element in Backley's model expresses both [dorsal] and [labial] PoA. Because {U} represents mainly the property of labiality, the main difference between these two classes is to admit that {U} is the head in the [labial] class but not in the [dorsal] class[6]. In these terms, [labial] segments are more complex than [dorsal] segments. Both the number of elements and the notion of headedness are proposals which constitute two ways to refer to markedness and to evaluate the complexity.

The combination of elements allows us to define the set of consonantal and vocalic inventories in a given language depending on what phonological properties they reflect (KLV, 1985, 1990; Harris, 1990, 1994; Harris and Lindsey, 1995; Scheer, 1998, 1999; Cyran, 2010; Backley, 2011, *inter alia*) and we will give a summary of these approaches in the next section.

[6] See Baroni this volume for more details and analyses about |I|, |A| and |U|.

2.2.2 Representation of elements

As explained above, there are several models for the definition of elements (KLV, 1985, 1990; Harris, 1990, 1994; Harris and Lindsey, 1995; Scheer, 1998; Cyran, 2010; Backley, 2011, Tifrit, 2013, *inter alia*). The following table summarizes the most important approaches in ET. We especially focus on the place of articulation.

elements	**KLV (1990) Harris (1990)**	**Harris & Lindsey (1995)**	**Angoujard (1997)**	**Angoujard (2006) Harris (1994)**	**Scheer (1998) (1999)**	**Cyran (2010)**	**Backley & Nasukawa (2010) Backley (2011)**	**Tifrit (2013)**
I	palatal ATR	palatal	coronal		palatal	palatal	<u>palatal</u> coronal	coronal
A	Low position of the tongue RTR	uvular pharyngeal	low	low	RTR aperture	coronal	pharyngal uvular	
R	coronal	coronal		coronal				
U	labial	labial	labial		velar	labial	<u>labial</u> velar	labial
B					<u>labial</u> roundness			
_					coronal	velar		
v	tongue resting position		dorsal velar		tongue resting position			
@	*velar	neutral <u>velar</u>		dorsal				
IU								velar

Table 1. Different PoAs in Element Theory[7]

This table presents these particular approaches to ET used by different authors. In the paper, we mainly focus on the approaches of Harris (1990), Scheer (1999), Cyran (2010) and Backley (2011). Each model has a particular representation and the representational differences between them will be highlighted. Our aim is to demonstrate the differences between these models and to test them in relation to our data in acquisition and pathology.

2.2.2.1 Harris' elements (1990)

In Harris' approach, the inventory of vowels and consonants are represented using 10 elements. Each element represents a phonetic property. We can distinguish all phonological systems using two types of elements: those concerning *places of articulation* (PoAs), and those

[7] For more details, see Harris (1990, 1994) and Ewen and al. (2001).

concerning the *manner of articulation* (MoAs).

(5) Elements

|A|	pharyngeality, uvularity	|h|	noise
|I|	palatality	|N|	nasality
|U|	labiality	|ʔ|	occlusion
|R|	coronal	|H|	stiff vocal cords
|v|	velar	|L|	slack vocal cords

Below is the representation of the different place of articulation proposed by Harris (1990, 1994)

	coronal /T/	labial /P/	dorsal /K/
stops	{Rhʔ}	{Uhʔ}[8]	{vhʔ}
fricative	{Rh}	{Uh}	{vh}

Derivation of consonants (Harris, 1990)

Even if, as we have shown before, Harris' representation allows us to explain the lenition trajectories in languages, his representation does not explain if the complexity between PoAs is equivalent.

2.2.2.2 Scheer's elements

In Scheer's approach (1998, 1999, 2004, 2015), elements for PoAs are not exactly the same as in Harris's representations: two additional elements are present. Little |v| denotes a neutral position (the rest position of the tongue); and |B| denotes activity in the labial resonator (labiality/roundness). Using |B| to denote labiality contrasts with Backley's |U|, as will be explained shortly, where Backley refers instead to the dorsal or back position of the tongue body:

(6) Elements

|A|	RTR aperture	|ɨ|	ATR advanced tongue root
|I|	palatality	|N|	nasality
|U|	velarity	|ʔ|	occlusion
|B|	labiality/roundness	|h|	noise
|v|	rest position of the tongue	|T|	trill
		|H|	voiceless
		|L|	voice

Basic structure of internal constitution of segments (Scheer, 1999)

Most of the elements used by Scheer are similar to those used in the classical models like Harris (1990), Harris and Lindsey (1995), KLV (1985). Elements are carried by an old classification for vowels |A I U v ɨ N| and consonants |ʔ h L H| (Harris, 1990, Harris and Lindsey, 1995). However, in this representation, we can see two new kinds of elements: |T| which represents *trill* property and |B| which represents roundness/labiality, where labiality is the head in the matrix of the labials. Contrary to Harris's (1990) and Angoujard's (1997) approaches, Scheer (1999:205-208) postulates that |U| cannot represent roundness and labiality at the same time.

> In systems where velarity and roundness are undissociable, the velarity-primitive cannot be linked to velar consonants because [k,g,x,*ʃ*] would then be predicted to surface as rounded articulations. I therefore propose two different primitives for velarity and roundness:

[8] |U|: the underlining corresponds to the head element.

(7) a. U velarity

b. B roundness/labiality

Scheer argues that only |I U A B| and |v| can play the role of head in the representation. The representation of the places of articulation is the following:

	coronal /T/	labial /P/	dorsal /K/
stops	{v̲ʔh}	{B̲ʔh}	{vUʔh}
fricatives	{hv}	{B̲h}	{v̲Uh}

Derivation of consonants (Scheer, 1999)

2.2.2.3 Cyran's elements

Compared to Scheer, Cyran's model (2010) proposes a different type of representation for velars, where they are |_|, i.e. velarity has no place element while coronality is represented by the element |A|, labiality is represented by |U|.

(7) Elements

|I|	palatality	|h|	noise
|A|	coronality	|N|	nasality
|U|	labiality	|ʔ|	occlusion
_	velarity	|L|	fully voiced
@	neutral element	|H|	voiceless aspirated

Primary and secondary places of articulation in consonant

Yet Cyran (2010: 10) goes on to say:

> […] The best way to talk about the Element Theory is within the context of a particular system. The parsimony of the model must be striking for anyone familiar with the IPA chart. However, it is also true that no language uses all the place, or indeed manner distinctions found in the world's languages. Thus, it must be borne in mind that the actual representations of consonants in a given system must follow an in-depth analysis and should not be assumed a priori.

Then, the absence of a place element for velar in Celtic languages is necessary to explain the distinction between the labialization *g^w to [b] in *g^wou _ "cow, ox" > Old Irish *bó*, Welsh *bu*, and a similar phenomenon affecting the proto-celtic voiceless labialized velar *k^w (Cyran, 2010:10), more specifically in Brittonic. The absence of a place element for the velar allows us to differentiate the representation of velar, [g] > {_}, the labialized velar [g^w] > {U._} and the labial [b] > {U̲}. Another argument supporting this approach is given by the case of Slavic, particularly Polish (Cyran, 2011:11).

Contrary to Harris's approach, Scheer's and Cyran's models are based on observable facts in specific languages: they therefore respect the fact that the representation of elements is language-specific. We will now briefly discuss the representation described by Backley (2011).

2.2.2.4 Backley's elements

In Backley's representation (2011), there are 6 elements for the basic structure. Each element represents a property that defines a segment.

The elements for vowels and consonantal place of articulation are |I|, which represents coronality, |A| for pharyngeality and |U|, which represents labiality. Vocalic elements define resonance properties associated with the quality of vowels and may also provide information about the place of articulation of consonants. The elements for consonants manner of articulation are: |h| for noise, |N|, for nasality and stop element |ʔ| for occlusion.

(8) Elements

|I|	coronality	|H|	noise
|A|	pharyngality	|L|	nasality
|U|	labiality	|ʔ|	occlusion

Basic structure of internal constitution of segments (Backley, 2011)

For Backley, the |U| element represents labiality when it is the head of the element complex. Fricatives share the same representation as stops except for the loss of the occlusion element |ʔ|.

	coronal /T/	labial /P/	dorsal /K/
stops	{Iʔ}	{<u>U</u>hʔ}[9]	{Uhʔ}
fricative	{Ih}	{<u>U</u>h}	{Uh}

Derivation of Consonants

In Backley's representation, which based on typological data, the [coronal] and [dorsal] classes share the same complexity because they contain the same number of elements. Labials are more complex because they contain the element |<u>U</u>|, which is a head and thus more complex.

As mentioned earlier, the most important question in this paper is the following: which kinds of representation are able to represent the behaviour of PoA errors in language acquisition and in acquired speech impairment, aphasia of French?

Adopting the ET frameworks discussed above, our hypothesis is that the asymmetries between phonological classes are proposed to involve the gain or loss of elements. As proposed by Harris (1990:205):

> Complexity is directly calculable in terms of the number of elements of which a segment is composed.

With this hypothesis, we will revisit the version of the theory that accounts best for the French phonological system. We will first describe the protocol and our corpus data.

3 Experimental Conditions

3.1 Method

3.1.1 Participants

The purpose of this experiment is to test French typical children and F-PwA's production of consonants. This paper especially focuses on the analysis of substitution strategies for PoAs. A cross-sectional study of a sample of 20 French monolingual children and 20 F-PwA is presented here.

[9]. |<u>U</u>|: the underlining corresponds to the head element.

27 children were recorded but the data of 7 of them were discarded: 5 because the children were too shy or not interested in the task, 1 because he was bilingual, 1 because they had suffered a stroke the year before. The child participants were normally developing children, 8 girls and 12 boys, aged between 2;1 and 3;8 years (M_{age} = 2;34 years). They were recorded at a kindergarten in France. All the French children selected did not suffer from speech and hearing deficits or neurological or motor control disorders.

All the aphasic participants were selected at the Central University Hospital of Nantes in the neurovascular unit. Each participant was diagnosed and classified on the basis of the MT-86 (a standardized test battery, see Nespoulous, J-L., Lecours, A-R. and al., 1986) by a speech therapist. The participants were selected based on the following criteria: they were native French speakers, monolingual, right-handed, suffered from a right-side cerebral vascular accident (CVA), they had a lesion of the left hemisphere and all are selected in the acute and subacute phases of the stroke. All of them were suffering from a phonetico-phonological deficit in production. In a set of 42 aphasic participants tested in hospital, 22 F-PwA were not included in the sample because the nature of their deficit did not correspond to our objective (for instance those who presented a major deficit such as mutism, a deficit of comprehension, jargon aphasia or more simply because they did not produce phonological paraphasias). The remaining aphasic participants were comprised of 11 women and 9 men. 18 participants were recorded between 1 and 25 days post stroke at the neurovascular unit at the hospital in Nantes (France) while 2 of them were recorded in a speech therapy practice[10]. 7 participants presented anterior lesions with a non-fluent aphasia including 1 in therapy; 6 participants presented posterior lesions and fluent aphasia including 1 in therapy; 4 participants presented conduction aphasia and 3 transcortical aphasia. All F-PwA have a phonological deficit and produced phonological paraphasias.

Phonological paraphasias are the focus of this paper and involve patterns of errors such as epenthesis, substitutions, deletions, metathesis, or coalescence of one on more segments in a word. These errors can be found across multiple tasks in production (spontaneous speech, repetition, pictures naming, reading aloud). Phonological paraphasias can occur in major kinds of aphasia.

Furthermore, during phonological acquisition, children also produce errors like consonantal harmony, epenthesis, deletions or substitutions. Whether the phonological errors involved in acquisition and in aphasia are similar is a matter of investigation. As suggested above, we will compare these cases of phonological errors in acquisition and adult pathology. The observation of this parallel between language acquisition and acquired speech language impairment can help achieve a new definition of complexity for the architecture of the French consonants.

3.1.2 Procedure

The experimental protocol is composed of a picture naming task and a repetition task. We selected forty items including consonantal sequences such as sC and ʁC in initial, medial and final positions[11]. Words are monosyllabic, bisyllabic and trisyllabic, with examples in table 5 below. Pictures were always black-and white drawings of common objects, vegetables and animals. French children were recorded at the kindergarten while the F-PwA were tested in a quiet room at the neurovascular unit. All French PwA and children were recorded with a Tascam DR 100. Each session lasted approximately 20 minutes.

Spontaneous productions were elicited where possible. The repetition task was used in

[10] One of them was recorded 6 months after the stroke while the other aphasic speaker was recorded 6 years after the stroke. These participants were recorded because the speech therapist judged that their degree of aphasia is at the same stage as any other of the aphasic participant recorded. The first one suffered from a global aphasia and was completely mute for 5 years. At the time of the recording, she was suffering from nonfluent aphasia (Broca's type). The other participant suffered from a fluent aphasia associated with a deficit of comprehension. This deficit was resolved but the participant is still suffering from a speech production deficit, especially in phonology. These participants were judged to have the same aphasic level of all other participants when they were recorded.

[11] The sequence ʁC is excluded in initial position as this type of consonantal sequence does not exist in French.

some cases, when the child didn't know the word, for example[12]. In this case, the researcher did not face the child directly but was positioned behind them so that they couldn't see us while they were naming the picture. For the F-PwA, we used a sheet of paper to cover our mouth.

The use of these tasks can also provide pre-structured materials where the targets are known and used to test some objects directly. Our protocol has been built in order to compare the two populations, to see whether they apply similar transformations. All these data were orthographically and phonetically transcribed by a trained French-speaking transcriber using PHON software (Rose and al., 2006). Another transcriber well trained in doing transcriptions helped us in cases of misunderstanding. From the overall data, we excluded neologisms, misunderstood productions, echolalic responses, perseverations and other paraphasias (lexical and semantic paraphasias for example).

Then, on the basis of our data, we subsumed all phonological errors into 5 categories: deletions, epenthesis, metathesis, substitutions and simplifications (which is a deletion with a substitution or a coalescence of the consonants in the consonantal group) (CCV→CV). These groups were divided depending on the population, the type of the consonantal sequence, the position (initial, medial and final) and the nature of each consonant: [labial], [coronal] or [dorsal].

(9) Typical errors in French consonantal sequences

ERRORS	GLOSS	ITEM	IPA TARGET	PRODUCTIONS
Deletion C^1[13]	*tortoise*	*tortue*	/tɔʁty/	[tɔty]
Deletion C^2	*snail*	*escargot*	/ɛskaʁgo/	[ɛsaʁo]
Epenthesis	*snake*	*serpent*	/sɛʁpɑ̃/	[sɛʁəpɑ̃]
Metathesis	*helmet*	*casque*	/kask/	[kaks]
Substitution C^1	*helmet*	*casque*	/kask/	[kaʁk]
Substitution C^2	*satchel*	*cartable*	/kaʁtablə/	[kaʁkab]
CCV→CV	*spatula*	*spatule*	/spatyl/	[ʃatyl]

We will focus on the cases of substitutions and we consider all words which contain at least one consonantal substitution in the data.

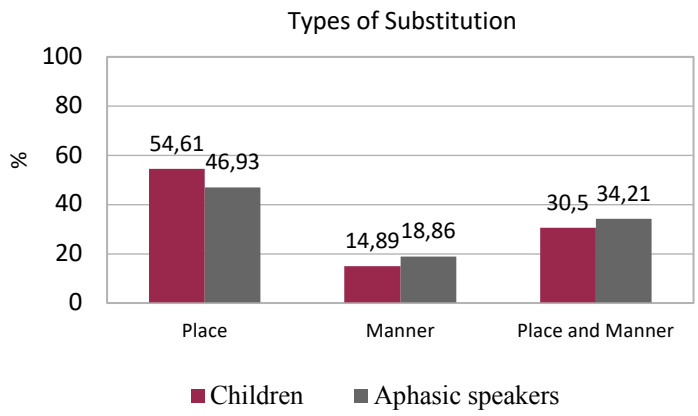
3.2 Substitution data

3.2.1 The Role of Place and Manner

Our first task consists of looking at the role of manner and place play in cases of substitutions. Graph 1 shows all the possible types of substitutions: substitutions of place, substitutions of manner and substitution of manner and place regardless of voicing. We have separated all the substitutions noted into the different types.

[12]Children produce more errors in repetition than in picture naming, but certain forms are simply not yet integrated in the lexicon and so they are not phonologically encoded. That does not mean that different strategies are selected. The type of the tasks did not exhibit different kind of substitutions.

[13] C^1 corresponds to the first consonant in a consonantal sequence while C^2 corresponds to the second member. In sC sequence, C_1 refers to /s/.



Graph 1. Types of substitution

A vast majority of substitutions concern a modification of the place of articulation (54,61% of cases for children and 46.93% for PwA) rather than manner (14.89% of the cases by children and 18.86% by PwA). Places of articulation are mainly substituted, rather than manner of articulations, for both French children and adult PwA. Substitutions can also involve two distinctive features or elements, such as place and manner, as in artichaut '*artichoke'* /aʁtiʃo/→ [aʁʃifuʁ], with /t/ realized as [ʃ].

3.2.2 Different cases of substitutions

Focusing on PoAs and MoAs, we examine substitutions. Table 2 and table 3 show some examples of these errors regardless the population.

	Productions		
Target	**Labial /P/**	**Coronal /T/**	**Dorsal /K/**
Labial	serpent *'snake'*: /sɛʁ**p**ɑ̃/[sɛʁ**m**ɑ̃] *barbe 'beard'*: /baʁ**b**/ [baʁ**p**]	pastèque *'watermelon'*: /**p**astɛk/ [**t**atɛk] sport *'sport'*: /s**p**ɔʁ/ [s**t**ɔʁ]	sport *'sport'*:/s**p**ɔʁ/ [s**k**ɔʁ] barbichette *'goatee'*: /**b**aʁbiʃɛt/ [**k**abiʃɛt]
Coronal	stade *'stadium'*: /sta**d**/ [ta**b**] artichaut *'artichoke'*: /aʁ**t**iʃo/ [saʁ**p**eʃo]	serpillière *'mop'*: /**s**ɛʁpijɛʁ/ [**t**ɛʁpijɛʁ] tortue *'tortoise'*: /tɔʁ**t**y/ [tɔʁ**d**y]	stylo *'pen'*: /stilo/ [skilo] cartable *'satchel'*: /kaʁ**t**ablə/ [kaʁ**k**ab]
Dorsal	parking *'parking'*: /paʁ**k**iŋ/ [paʁ**p**in] scarabée *'beetle'*: /s**k**aʁabe/ [**p**aʁape]	casquette *'cap'*: /**k**askɛt/ [**t**atɛt] scarabée *'beetle'*: /s**k**aʁabe/ [s**t**aʁabe]	escargot *'snail'*: /ɛs**k**aʁgo/ [ɡeɡaɡo]

Table 2. Cases of substitutions involving PoAs

Observing the table above, we see that labials may be substituted with other labials, but also with coronals and dorsals, with or without modification of voicing or manner of articulation associated. For each consonantal sequence, we note that the first or the second consonant can be substituted. For instance, in serpent *'snake'*: /sɛʁpɑ̃/ → [sɛʁmɑ̃] we observe that the voiceless bilabial /p/ became a voicing nasal [m].

Examples below illustrate substitutions of manner of articulation:
A stop consonant into a nasal: barbe '*beard'*: /baʁ**b**/ → [baʁ**m**]
A stop consonant into a fricative: artichaut *'artichoke'*: /aʁ**t**iʃo/ → [aʁ**ʃ**iʃo]
A fricative consonant into another fricative: tortue '*tortoise'*: /tɔ**ʁ**ty/ → [tɔ**s**ty],
A fricative into a lateral *aspirateur 'hoover'*: /a**s**piʁatœʁ/ → [a**l**piʁatœʁ].
These are cases of substitutions involving MoAs. Because most of the errors involved PoAs, in

language acquisition and also in acquired aphasia, we focus on the substitutions of place of articulations in order to understand how and why place of articulation is targeted in substitution.

4 Results

4.1 The Role of the Place of Articulation

Table 3 and 4 summarize substitutions targets and outcomes according to PoA for children (i) and for aphasic speakers (ii).

(i) French Children substitutions (in %) focusing on PoAs

	Productions			
Target	**Labial**	**Coronal**	**Dorsal**	**Sum %**
Labial	7.09%	6.38%	1.41%	14.89%
Coronal	1.41%	9.92%	17.73%	29.08%
Dorsal	2.48%	44.68%	8.86%	56.03%
Sum %	10.99%	60.99%	28.01%	100%

Table 3. Substitutions of PoAs (French children)

We observe a significant result between the substitutions of place of articulation applied by children ($X^2_{[4]}$= 32,609, p-value<0,001)

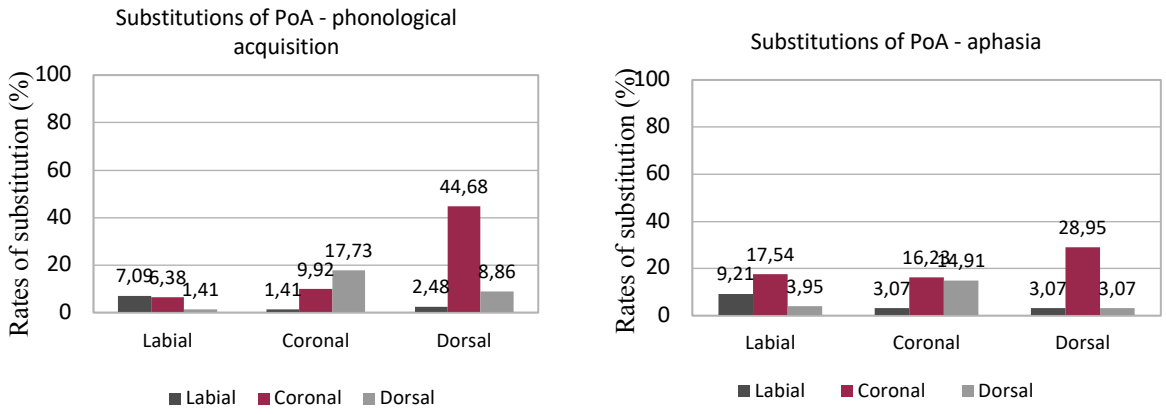
(ii) F-PwA substitutions (in %) depending on PoAs

	Productions			
Target	**Labial**	**Coronal**	**Dorsal**	**Sum %**
Labial	9.21%	17.54%	3.95%	30.70%
Coronal	3.07%	16.23%	14.91%	34.21%
Dorsal	3.07%	28.95%	3.07%	35.09%
Sum %	15.35%	62.72%	21.93%	100%

Table 4. Substitutions of PoAs (aphasic speakers)

As for French children, we observe a significative result between the substitutions and the types of place of articulation applied by F-PwA ($X^2_{[4]}$= 32,874, p-value<0,001).

These tables show the number of substitutions for each place. We can see that, for children, the [dorsal] class is the most substituted class – 56.02%. For PwA the percentage is 35.09%. The [coronal] class is the most common substitute – at 62.77% for PwA and 60.98% for children. Tables show this information in the form of a graph:



Graph 2. Substitutions depending on PoAs[14]

Comparing the two groups of participants, the chi-square test is significant: $X^2_{[1]}= 16.25$, $p < 0.001$. There is a difference between the substitutions produced by children and those realized by F-PwA[15]. We note that the [dorsal] class is mostly replaced by the [coronal] class (44.68% for children and 28.95% for PwA). [Labial] class is replaced 6.38% of the time by coronals, but labials replace other labials more often: in 7.09% of cases for children. The most interesting thing is that, for PwA, labials are mostly substituted by the [coronal] class (17.54%).

The [coronal] class is the most common segment used as a substitution outcome, irrespective of the nature of the consonant (62.71% for PwA, 60.99% in phonological acquisition). In acquisition, [dorsal] class is most often the target of substitution. Coronals are most often realized as dorsals, in 17.73% of the cases for children. Coronals also become [dorsal] in 14.91% of the cases for PwA.

To explain this phenomenon, we analyse each coronal-into-dorsal substitution. We note that these cases may be considered cases of assimilation/consonantal harmony – similar to previous analysis Stemberger and Stoel-Gammon (1991), Fikkert (1994), Pater and Werle (2003), Rose (2009) and Rice (2009). For example, children replace /t/ with /k/, (see (10)), when another dorsal (or uvular) is present in the environment:

(10) [coronal] → [dorsal]

shoe	'basket'	/baskɛt/	→ [bakɛk]
satchel	'cartable'	/kaʁtabl/	→ [kaʁkwab]
card	'carte'	/kaʁt/	→ [kaʁk]
watermelon	'pastèque'	/pastɛk/	→ [paskɛk] [pakɛk]
tortoise	'tortue'	/toʁty/	→ [kɔʁty]
pen	'stylo'	/stilo/	→ [skilo]
cap	'casquette'	/kaskɛt/	→ [kakɛk]

These cases involve consonantal harmony. This tends to support the view that coronals have a special status not only in typology (Jakobson (1968), Avery and Rice (1989), Paradis and Prunet (1991), Backley (1993), Scheer (1998), Pagliano (2003), Rice (1996, 2009)), but also in acquisition or/and aphasia (Stemberger and Stoel-Gammon (1991), Morrissette and al. (2003), Kirk (2008), Prince and Tifrit, 2012).

Furthermore, specific studies on French (e.g. Yamaguchi (2012), Rose and Wauquier-Gravelines (2007) and Rose (2003, 2009)) have shown that coronal stops are less complex

[14] The substitutions correspond to only the substituted consonants, e.g. the percentage of substitutions that affect place.

because they are acquired earlier and appear less marked. In the same way, coronals have a particular behaviour in aphasia, as Béland and Favreau (1991) have shown. These results are congruent with the literature review mentioned in 2.
As noted by Harris and Lindsey (1995:30):

> There is a growing body of evidence indicating that specific representational provision needs to be made for the special status of coronals […]. Coronals are more prone to assimilation than other classes; consonant harmony exclusively affects coronals (at least in adult language); and coronals, unlike other resonance classes, behave transparently with respect to many processes. Facts such as these have prompted a variety of analyses in which coronals are represented as 'placeless' consonants.

In the last part, we will develop our proposal about the nature of complexity and markedness between PoAs on the basis of our analysis.

4.2 About the Scale of Complexity: revision of Element Theory

From the data presented above, we saw that some classes are most prone to substitution, like [dorsal], while another class is most prone to substitute them, [coronal]. We also note that [labial] remain stable, especially in acquisition, while they become [coronal] in aphasic speech. Following Backley's model, children and PwA should not be able to handle [labial] segments because they are the most complex due to headedness, compared to [coronal] or [dorsal] segments which according to Backley has a single unheaded PoA. This proposal in ET is not in line with the data. In Cyran's model, the main difference we saw is that the dorsal stop is considered as a placeless consonant. Following the definition of complexity, [dorsal] segments are less complex. However, the literature review of acquisition and speech pathology as well as our results reflect that [dorsal] are the most marked PoAs. Harris argues for an interesting scale of complexity between the different natural classes but not for the place of articulation. This model would not help us with our data.

We assume that these substitutions are related to the internal constitution of segments: any change should imply the loss or gain of an element. However, our French data show that assimilation mostly affects [coronal] segments, which is an argument in favour of the coronal being placeless: the placeless nature of coronals explains why coronals attract other elements from other segments. At the same time, Scheer's model proposes that [dorsal] stops are more complex, which is congruent with our data, though in his ET Scheer does not explain why [labial] and [coronal] should have the same complexity. Unfortunately, these approaches in ET do not reflect the differing degree of complexity between [coronal], [labial] and [dorsal] segments which we observed in the data in typical acquisition and speech pathology of French. We suggest that this complexity results from the number of elements involved *and* the nature of the specification used to define segments. As suggested by Den Ouden (2002) or Romani and Galluzzi (2005:819), we suggest that markedness can directly reflect complexity.

Regarding the previous approaches, a representation where elements are marked by acoustic and articulatory properties (like Jakobson, 1968) is adopted in order to offer a solution to justify the behaviour of [labial], [coronal] and [dorsal] segments in our data. As suggested by Paradis and Prunet (1991), Scheer (2004) or Rice (2009) as long as we consider that coronal stops, especially dentals, are a default value, we can explain the above cases. Coronals are not specified because they do not contain an element which represents the articulatory property. As proposed by Scheer (1998), [coronal] does not contain a melodic substance/element of place, so it is less complex and unmarked (see also Baroni, this volume). Moreover, this is the reason why [coronal] segments are acquired earlier by French children and why they are most often the target of phonological processes such as epenthesis or assimilation for example (Pagliano,

2003, Rice, 2009, *inter alia*). For these reasons, we assume that coronals are 'unspecified'. [Dorsal] appear to be more marked and more specified for children and F-PwA. They cannot be only composed of {U} otherwise it would be expected that French children/ PwA transform [dorsal] segments into [labial] (with the lost of the head in order to reduce the degree of markedness), which is not the case. To reflect the fact that [dorsal] segments could turn mostly into [coronal] or [labial] and [palatal] in few cases, we argue, following Tifrit (2013:174), that they contain two element PoAs: the union of |I| and |U|[16]. This representation corresponds to the specific case of French. We will see in the next section that the data in French diachrony also supports this representation. The [labial] class is less complex than [dorsal] class, but it is specified and includes only one element of PoA, which is |U| for labiality. As such, they are more stable than dorsals in acquisition and in pathology. In line with this, we will adopt the following representation of elements (in 11), which can reflect the different phenomena (Tifrit and Prince, 2013):

(11)

	coronal	labial	dorsal
stops	{_ʔh}	{Uʔh}	{IUʔh}

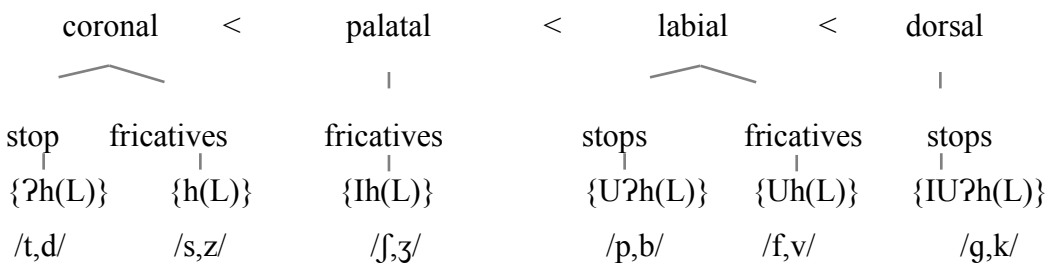
Scale of complexity for French

Hence the representation for the French system is as follows:

Elements

|I|	palatality/acute	|N|	nasality
|U|	labiality/graveness	|ʔ|	occlusion
|IU|	velarity	|h|	noise
-	coronality	|L|	voice

(12) Elements for French obstruents



Following the lenition trajectory (as Harris for English, 1990, 1994), in French, coronals are less complex and unspecified, labials are less complex but specified and dorsals are more complex and more fully specified. As suggested by Cyran (2010:13):

> There is a logical connection between the fact that lenition is a weakening process and the idea that decomposition leads to progressively less complex structures.

This weakening process is visible when a [dorsal] turn into a [coronal]. Children and PwA produce less complex structures before more complex ones:

(13) [dorsal] → [coronal]

(a) *beetle* 'scarabée' /s**k**aʁabe/ → [s**t**aʁabe]
{IU} > Ø

(b) *porcupine* 'porc-épic' /poʁ**k**epik/ → [poʁ**t**epik]
{IU} > Ø

Fewer cases of fortition like Ø > |U| or Ø > |IU| correspond to CH or reduplication.

[16] For us, as Jakobson (1968), {U} element stands for labiality/graveness and {I} for palatality/acute.

(14) [coronal] → [dorsal]

(a) *satchel* 'cartable' /kaʁ**t**ablə/ → [kaʁ**k**wab]
Ø > {IU}

(b) *mosquito* 'moustique' /mu**s**tik/ → [mu**ʃ**tik]
Ø > {I}

We suggest that our proposal is language specific and that the composition of the phonological system in ET depends on the language observed. Lastly, another type of data can improve our theoretical proposal: data from French diachrony.

4.3 Evidence from French diachrony

Data in diachrony also confirms the lenition trajectory of French and especially the representation of the [dorsal] class. As suggested by Tifrit (2013:171), data in French diachrony showed that [dorsal] class contain |IU|, most cases of velar shift into |I|, |U| or Ø (Bourciez E. and J. Bourciez, [1967]2006: 128-191, Anglade, J.,1949:35).

(15) k > t̬ > ts > [s]

Latin	**French**	
porcellu	pourceau	*swine*
mercede	merci	*thank you*
provincia	provence	*provence*
Francia	France	*france*

[k] > [ʃ]

Latin	**French**	
carru	char	*tank*
caballu	cheval	*horse*
calidu	chaud	*warm*
bucca	bouche	*mouth*
furca	fourche	*fork*
caritatem	charité	*charity*
capu	chef	*chief*

[g] > [ʒ]

Latin	**French**	
purgare	purger	*purge*
gaudia	joie	*joy*
gamba	jambe	*leg*
galbinu	jaune	*yellow*
virga	verge	*stick*

(16) [p]/[b] > [p]/[b]

Latin	**French**	
patre	père	*father*
barba	barbe	*beard*
duplu	double	*double*
pruna	prune	*plum*

[v] > [f]

Latin	**French**	
ripa	rive	*shore*
novu	neuf	*new*
cervu	cerf	*deer*
bove	boeuf	*beef*

[labial] shift to other [labial] consonants because it is a more robust structure or it becomes a hierarchically less complex segment.
Most of the cases correspond to a spirantization:

(17) [b] > [v]

Latin	**French**	
habere	avoir	*have*
capra	chèvre	*goat*
febre	fièvre	*fever*
aprile	avril	*april*
labra	lèvre	*lip*

Finally, [coronal] is placeless in the previous discussion and in diachrony. Coronals undergo shift to other [coronal] consonants or disappear (total lenition):

(18) [t] > Ø

Latin	French		Latin	French	
mutare	muer	*transform*	crudam	crue	*raw*
grande(m)	grand	*tall*	vitam	*vie*	*life*
plat(a)nu	platane	*plane*	dente	dent	*tooth*
responsa	réponse	*answer*	poldre	poudre	*powder*
advenire	avenir	*future*	padre	père	*father*
strangulare	étrangler	*choke*	scala	échelle	*ladder*

There is also a phenomena where the coronal disappears by assimilation:

(19) lat. mast(i)care > fr. mâcher *chew*
lat. pant(i)ce > fr. panse *rumen*
lat. vind(i)care > fr. venger *revenge*

Diachronic data also support our representation for the consonantal PoA system in French. There is a parallel between phenomena applied in French diachrony and experimental data from acquisition and adult pathology where the same processes are involved.

5. Conclusion

In this paper, we have investigated the behaviour of consonants in the French acquisition system and adult aphasia. We have focused on the PoAs through the observation of cases of substitutions. We have shown that a framework like ET is able to bring forth new views of markedness and complexity. In light of the different approaches in ET, we have argued that these data are in line with an approach were markedness corresponds to the number of elements and the degree of specification on a markedness scale.

Supporting the data in typical acquisition, adult speech pathology and French diachrony, we have offered an additional solution to justify the behaviour of PoAs in French. We have proposed a scale to define the [labial], [coronal] and [dorsal] classes where the labials are specified with |U|, coronals are unspecified and unmarked in terms of place, and dorsals contain |IU|. We have seen how coronals behave and how dorsals are more complex under the analysis of consonantal harmony. To support this point, we considered that there are two types of patterns during acquisition and phonological deficit of PoAs in aphasia

- Firstly, PoAs are not acquired yet or inaccessible: in this context, coronals are supposed to surface instead of other PoAs because they are like a default value – they are placeless. They can assimilate to segments with specified elements. This corresponds to the first parameter setting for acquisition or last for PwA.
- Secondly, when the other PoAs constitute a parameter, the children test the different PoAs and produce errors. These errors affect mostly [dorsal] which are more prone to substitution. For this reason, we have suggested they are more complex in terms of internal structure.

The data exposed in this paper are also congruent with the literature presented in the first part of this paper. However, the scale of complexity does not take the nature of the consonant into account – stop, fricative, glide or liquid (we refer to Jakobson, 1968; Jakobson and Waugh, 1980, Rose and Wauquier-Gravelines, 2007 proposals). It will thus be a goal in future research of paraphasias in aphasia and errors in phonological acquisition to obtain, through the analysis of the other errors (deletions, metathesis, epenthesis) to confirm this scale of complexity though a first step has already been made a first step towards.

As suggested by Van Oostendorp (2013:289), this paper represents a straight continuation of the idea below:

> Our most important task is to integrate all the new types of data that are nowadays being unearthed into the carefully designed theories of our predecessors. We should be sufficiently conservative – our theories have proven themselves right when checked against a large number of data – and at the same time we should not be too reactionary – more data are available to us now than ever before, and it is unlikely that all of our theories will stand their test.

We have seen that acquisition data and data in adult aphasic speech can be a valuable source of information about the notion of complexity in phonology. Children and PwA were recorded at a time when they had acquired all phonological classes, but their parameters were not set (acquisition) or inaccessible (aphasia): substitutions result from adjustments, parameter setting and repair strategies. They correspond to a transformation which disrupts the internal constitution of segments. At this stage, some PoAs, like labials, are more stable than others (see also Baroni for more examples, this volume). To our knowledge, there is no paper which has been devoted to an analysis of phonological deficit and typical acquisition under element theory. Still, this kind of analysis can improve both the theoretical framework and bring new analyses to French phonology. Particularly, these data highlighted some important aspects of ET. We have offered a solution to reflect the complexity of different places of articulation. Thus, we hope that this type of analysis, examining data in acquisition and adult pathology will improve the current theoretical models based on unary elements.

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