Acquisition, Pathology and Phonological Markedness

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Overview

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- Binarism and Markedness
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Introduction

- Jakobson (1941[1968]) put forward the thesis that the distinctive segments of a language (the phonemes) are acquired in an order which reflects their structural complexity in terms of feature composition and basic syllabic structure, and lost in the opposite order in certain types of aphasia.
- He claimed that the complexity of segments that can be laid bare in the development and loss of language corresponds to universal or near universal laws which govern the sound systems of the world.
- Our presentation argues, with special reference to French and on the basis of aphasiological data an acquisition collected by one of us (TP), that despite valid criticisms of the Jakobsonian programme the notion of markedness is still relevant and, if built into our representational machinery, can provide an insightful account of some of the attested patterns in the development of phonology or its destructuring in aphasia.

Acquisition of French Phonological System

- As far as French is concerned, a body of fairly recent work on the emergence of phonology produces has yielded results which are by and large in agreement with a number of Jakobsonian predictions (cf. Demuth and Kehoe, 2006, Rose and Wauquier-Gravelines, 2007, Demuth and McCullough, 2009, Yamaguchi, 2012).
- Thus Rose and Wauquier-Gravelines (2007: 374) show that plosives are acquired before fricatives and nasals in French and that the stable appearance of liquids is posterior to the former. Voiceless plosives are also acquired before voiced ones, a pattern which has often been observed across languages of the world and which is also characteristic of many aphasic patients (particularly those suffering from Broca's aphasia).

Acquisition of French Phonological System [cdt]

- As far as the liquids are concerned, Rose and Wauquier-Gravelines (2007), Dos Santos (2007), Kehoe et al. (2008) and Yamaguchi (2012) all agree that in the acquisition of French phonology, a single liquid is initially present and of the two liquids, /ʁ/ is acquired later than /l/. Other authors such as Vihman (1993) and Beckman et al. (2003) present results for English which contradict Jakobson's claims and insist on the role of frequency and usage.

- While some of their examples are persuasive, it can be argued that in French the later acquisition of /ʁ/ in relation to /l/, for example, cannot be due to simple frequency given that /ʁ/ is more frequent than /l/. On the assumption that such observations are correct (and they will be reinforced by various observations on aphasia below), how should phonology reflect the complexity of certain sounds, their markedness?

Jakobson's approach: binarism & markedness

Oral vs. nasal vowels

/a/ = [+voc, -cons, +compact, -diffuse, -nasal, etc.]

/ã/ = [+voc, -cons, +compact, -diffuse, +nasal, etc.]

- Plus a statement (**external to the notation**) that nasality for vowels is a marked feature. Same problem in Chomsky and Halle's SPE (1968).
- Problem with binary features: the notation suggests that both features are equally accessible and active in the phonology. Consider, as an example of this problem, the feature [±strident]. It could just as well be expressed as [±mellow] (its opposite), without any consequences for the formulation of phonological generalizations.

Revising Jakobson's approach to bring out markedness

Two solutions

(1) Constrain the notation so that e.g. the value '+' is only used for MARKED features (see e.g. Hans Basbøll's *The Phonology of Danish*, Oxford University Press, 2005)

(2) Use only single-valued (unary, privative, monovalent) features. This is the solution we adopt here. Using provisionally Jakobsonian features, the representations might look like this:

/a/ = {voc, compact}

/ã/ = {voc, compact, nasal}

- Markedness is directly mirrored by the internal structure of segments.
- The more marked, the more complex.

Which framework?

- The two authors of this presentation do not work within the same framework and so have tried to converge on minimal assumptions. One of us (JD) follows Dependency Phonology (Anderson and Jones 1974, Anderson and Ewen 1987, Anderson 2010, Durand 2005). The other (TP) follows Government Phonology (Kaye, Lowenstamm and Vergnaud 1985, Scheer, 2004, Backley 2011, Prince and Tifrit 2013).
- In this presentation, we formulate our analyses in a vocabulary which is as neutral and transparent as possible for the audience. We nevertheless wish to stress that for us distinctive features or "elements", as they are often called in unary frameworks, are part of a universal set as in the Jakobsonian tradition.

A representation of plosives in a unary framework

with classical features

[labials] (hereafter P)

/p/ = {closure, grave}

/b/ = {closure, grave, voice}

[coronals] (hereafter T)

/t/ = {closure}

/d/ = {closure, voice}

[velars] (hereafter K)

/k/ = {closure, dorsality, grave}

/g/ = {closure, dorsality, grave, voice}

Coronals: The Default-value

Data From French Aphasics

- As far as segmental transformations are concerned, Béland and Favreau (1991) conclude on the basis of a study of 29 aphasic patients (7 Broca's, 10 Wernicke's, 6 conduction, and 6 mixed) that labials are replaced by coronals in 56.25 % of the cases and the same type of substitution is true of velar sounds. (Coronals themselves are replaced in 50% of the cases by other coronals).
- Nespoulous et al. (1983) also point out that coronality is maximally used in substitutions. Béland and Favreau (1991) go further: while they confirm that coronals are the default as substitution for other sounds, they also note that coronals are the least resistant in initial and intervocalic position since they often delete, that they are the only segments to be clearly transparent in processes of vocalic harmony and lastly that they are the most frequent epenthetic consonants (Béland and Favreau 1991: 213).

Experimental Conditions

Methodology

Population

- 20 French children (2.1- 3.8 years) M_{age}=2.34 years
- 20 French aphasics recorded at the stroke unit (CHU Nantes)
- 7 Broca, 6 Wernicke, 4 conduction, 3 transcortical aphasia

Protocol

- 40 items with clusters
- clusters sC and rC in word initial, medial and final positions
- naming and repetition tasks

Data

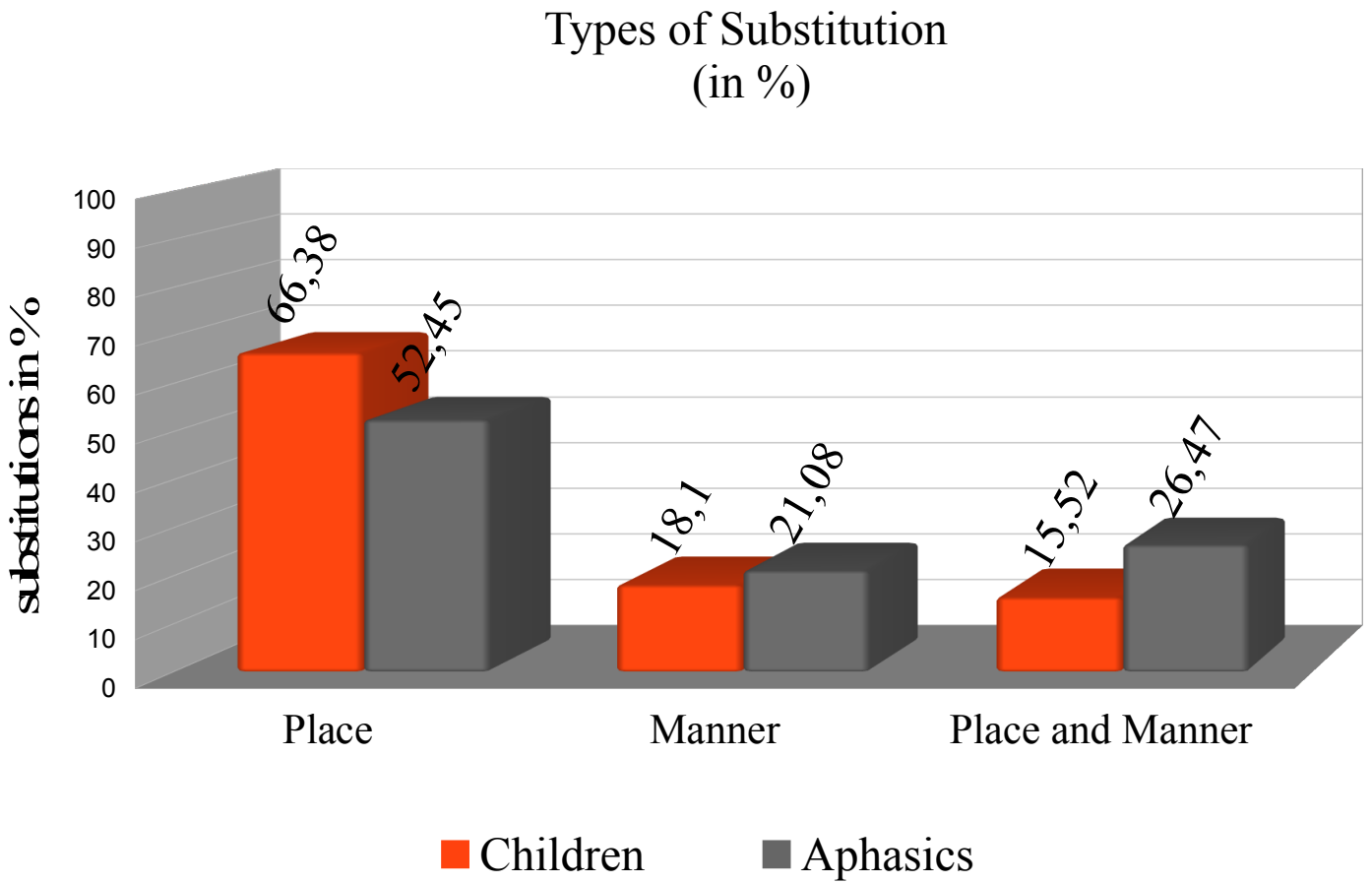
Substitutions

Productions

Target	labial	coronal	velar
labial	*serpent* 'snake': /sɛʁ**p**ɑ̃/ [sɛʁ**m**ɑ̃] *barbe* 'beard': /baʁ**b**/ [baʁ**p**]	*pomme* 'apple': /pɔ**m**/ [pɔ**n**] *sport* 'sport': /s**p**ɔʁ/ [s**t**ɔʁ]	*aspirateur*'vacuum': /as**p**iʁatœʁ/ [askyʁa] *remorque* 'trailer': /ʁømɔʁk/ [mɔ̃kɔʁ]
coronal	*corde* 'rope': /kɔʁ**d**/ [ʃɔ**p**] *stade* 'stadium': /sta**d**/ [ta**b**] *tortue* 'tortoise': /tɔʁ**t**y/ [tɔʁ**p**]	*chaussure* 'shoe': /**ʃ**osyʁ/ [**s**osyʁ] *serpillière* 'mop': /**s**ɛʁpijɛʁ/ [**t**ɛʁpijɛʁ] *tortue* 'tortoise': /tɔʁ**t**y/ [tɔʁ**d**y]	*pastèque* 'watermelon': /pas**t**ɛk/ [pa**k**ɛk] *cartable* 'satchel': /kaʁ**t**ablə/ [kaʁ**k**wab] *tarte* 'pie': /taʁ**t**/ [ta**k**]
velar	*crocodile* 'crocodile' /kʁokodil/ [pokʁodil] *scarabée* 'beetle': /skaʁabe/ [paʁape]	*cartable* 'satchel': /**k**aʁtablə/ [**t**aʁtablə] *capuche* 'hood': /**k**apyʃ/ [**t**apyʃ]	*aspirateur*'vacuum': /aspi**ʁ**atœʁ/ [**k**atœʁ] *escargot* 'snail': /ɛs**k**aʁgo/ [ge**g**ago]

Data

Substitutions



Results

Children substitutions (in %)

Target \ Productions	labial	coronal	velar	sum (%)
labial	8.62	7.76	0.86	17.24
coronal	0.86	6.90	17.24	25.00
velar	3.02	49.57	5.17	**57.76**
sum (%)	12.50	**64.62**	23.28	100

- Velars present the highest number of substitutions: 57.76%
- Coronals are the most frequent substitute: 64.62%

Results

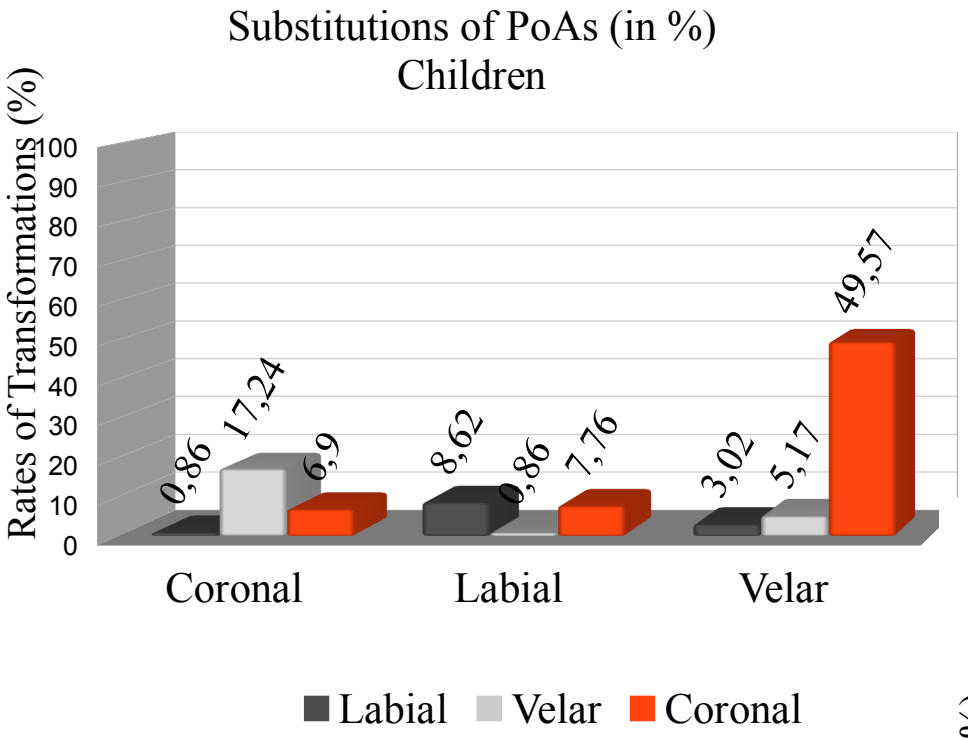
Aphasics substitutions (in %)

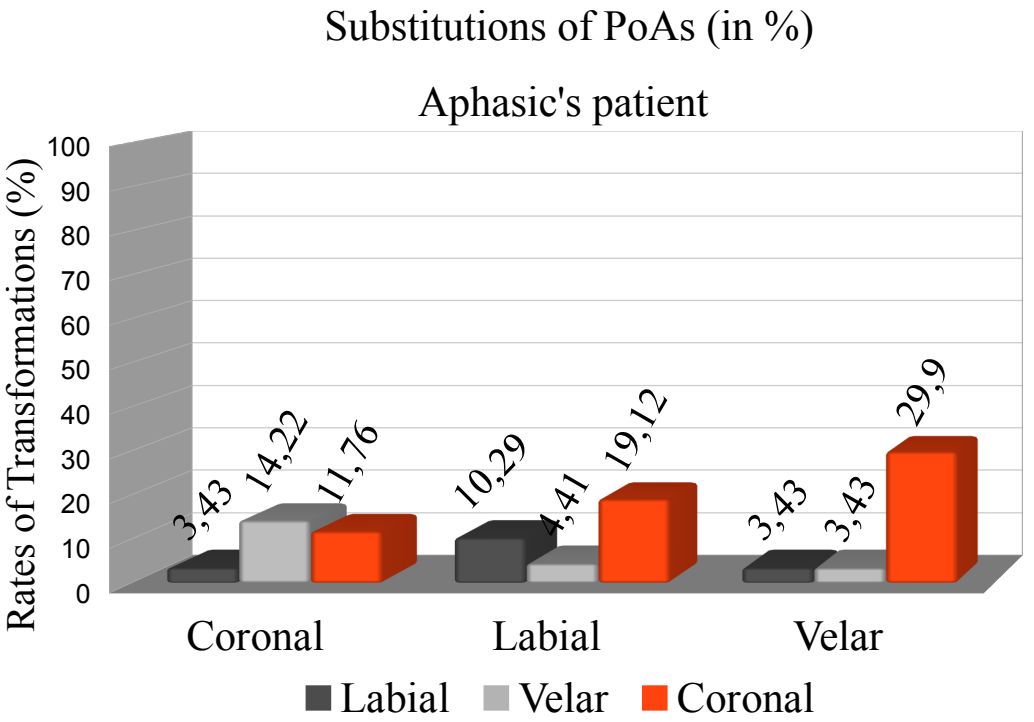
Productions

Target	labial	coronal	velar	sum (%)
labial	10.29	19.12	4.41	33.82
coronal	3.43	11.76	14.22	29.41
velar	3.43	29.90	3.43	**36.76**
sum (%)	17.16	**60.78**	22.06	100

- Velars present the highest number of substitutions: 36.76%
- Coronals are the most frequent substitute: 60.78%

Results


Substitutions of PoAs (in %)
Children
Rates of Transformations (%)
100
90
80
70
60
50
40
30
20
10
0
0,86
17,24
6,9
8,62
0,86
7,76
3,02
5,17
49,57
Coronal
Labial
Velar
Labial
Velar
Coronal


Substitutions of PoAs (in %)
Aphasic's patient
Rates of Transformations (%)
100
90
80
70
60
50
40
30
20
10
0
3,43
14,22
11,76
10,29
4,41
19,12
3,43
3,43
29,9
Coronal
Labial
Velar
Labial
Velar
Coronal

Results

- Coronals have a *special status*

- Target of phonological processes

Avery & Rice: 1989, Paradis & Prunet: 1991, Backley: 1993, Scheer: 1998, Pagliano: 2003, Kirk: 2008, Rice: 2009 *inter alia*

But sometimes … coronals are most often realized as dorsals ☹

Surprising behavior!

Results

- Cases of assimilation

  Stemberger & Stoel-Gammon: 1991, Rose, 2009, Rice, 2009

/t/ becomes/k/

(a)	*tortue* 'tortoise'	/tɔʁty/ → [kɔʁty]
(b)	*cartable* 'satchel'	/kaʁtablə/ → [kaʁkwab]
(c)	*pastèque* 'watermelon'	/pastɛk/ → [paskɛk] [pakɛk]
(d)	*carte* 'card'	/kaʁt/ → [kaʁk]
(e)	c*asquette* 'cap'	/kaskɛt/ → [kakɛk]

Results

In typology, acquisition and in aphasia: coronals are universal

- coronals appear less complex

- coronals are acquired earlier by children and kept in aphasia

- coronals constitute, mostly, the target of phonological processes

Jakobson: 1941[1968], Avery & Rice: 1989, Béland & Favreau: 1991, Backley: 1993, Scheer: 1998, Rose & Wauquier-Gravelines: 2007, Rose: 2009, Rice: 2009, Yamaguchi: 2012

Our claim

➡ Complexity results from **the number of elements/features involved**

AND **the nature of the specification** used to define segments

[coronal] > [labial] > [dorsal]

Our claim

the representation of plosives presented earlier nicely links up with the observations

[coronals]

/t/ = {closure}

/d/ = {closure, voice}

[labials]

/p/ = {closure, grave}

/b/ = {closure, grave, voice}

[velars]

/k/ = {closure, dorsality, grave}

/g/ = {closure, dorsality, grave, voice}

But part of the story is missing

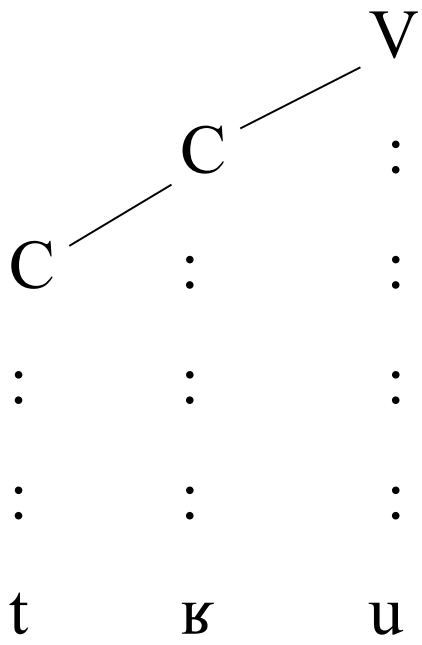
- Jakobson's work on child language acquisition and aphasia stressed more the paradigmatic dimension (opposition between phonemes, hence distinctive features) than the syntagmatic one (syllable structure and constituents beyond the syllable). Yet, there is a need to pay attention to both in linguistic research and indeed to go beyond too linear a view of language.
- As a simple example, we will take the case of syllable onsets of the form Obstruent + Liquid (e.g. pʁ, fʁ, kl, gʁ, gl, etc.).

The cases of Obstruent+Liquid (OL)

- In research on aphasia, it has often been observed that initial CCV clusters are regularly simplified to CV clusters. Moreover, when an initial CC cluster is made up of Obstruent + Liquid (e.g. /pʁ-/, /fʁ-/, /gl-/, etc.), it is overwhelmingly the liquid that drops leaving the obstruent as the sole onset of the syllable.
- Thus Nespoulous and Moreau (1997: 76) observe that it is always C_2 which is omitted within initial /fricative + liquid/ clusters, whereas it is C_1 within clusters of the form /s/ + Obstruent. Prince (2013), in a study examining 15 aphasic patients (6 Broca, 7 Wernicke and 2 conduction) shows that 37.8% of the transformations of an OL group involve the deletion of C_2 (e.g. prune /pʁyn/ > [pyn]). By contrast, only 3.7% involve the deletion of C_1 (e.g. [bʁɔs] > [ʁɔs]).

The sonority curve is not enough

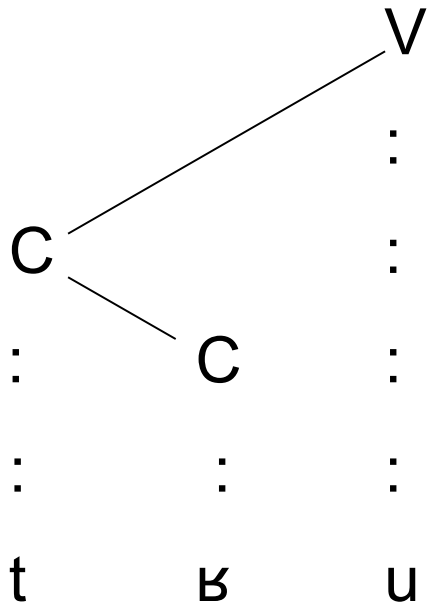
A classical dependency graph for *trou* (e.g. Durand 1990)



If /ʁ/ heads the subconstituent /tʁ/

why does it delete preferentially?

A solution: treat the obstruent as the head



See Anderson (1986) and, in a different formalism, representations advocated in Government Phonology in the wake of Kaye, Lowenstamm and Vergnaud (1985)

How does our work relate to general issues in phonology?

(1) Distinctive features are central to research in phonology.

(2) The features have phonetic content. Distinctive phonological units are not substance-free (Jakobson vs. Hjelmslev).

(3) Markedness is not a circular concept but has explanatory power and needs to be integrated to the notation.

(4) Paradigmatic and syntagmatic aspects must be combined.

(5) Expanding our data base is important and research on language acquisition and impairment have a vital role to play in linguistics as demonstrated by Jakobson's work.

(6) Constructing computerized tools for research is one of the ways forward (PFC et IPFC are going in the right direction!).

Conclusion

- Our data can provide new evidence for the notion of complexity

Thanks

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