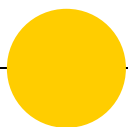


Phonemes or Allophones?

The phonological status of [tʃ, dʒ]
in Brazilian Portuguese



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Background

[tʃ, dʒ] are traditionally analyzed as allophones of /t, d/:

(Cagliari, 1997; Cristófar-Silva, 2003)

Complementary distribution:

	/t, d/	[tʃ, dʒ]
<i>Coronal High vowels</i>	✗	✓
<i>Other vowels</i>	✓	✗

/tigre/ [ˈtʃi.ɡɾɪ] ‘tiger’

/dinero/ [ˈdʒi.ne.ɾo] ‘money’

/tatu/ [ˈtaˈtu] ‘armadillo’

/dado/ [ˈda.do] ‘dice’

- No minimal pairs;
- Dialectal [t, d] ~ [tʃ, dʒ] variation.



Background

- ⊙ [tʃ, dʒ] result from a **Palatalization rule**;
- ⊙ Some dialects are more permissive, others don't have the rule:

<i>Dialect</i>	<i>São Paulo</i>	<i>Aracaju</i>	<i>Florianópolis</i>	Gloss
<i>Context</i>	_ [i, ɪ]	_ [i, ɪ]; [j, ʝ] _	*	
a. /tia/	[ˈtʃia]	[ˈtʃia]	[ˈtia]	‘aunt’
b. /tapete/	[taˈpe.tʃɪ]	[taˈpe.tʃɪ]	[taˈpe.tɪ]	‘rug’
c. /doido/	[ˈdoj.dʊ]	[ˈdoj.dʒʊ]	[ˈdoj.dʊ]	‘crazy’
d. /lido/	[ˈlĩ.dʊ]	[ˈlĩ.dʒʊ]	[ˈlĩ.dʊ]	‘beautiful’

(Cristófar-Silva, 2003)



The problem:

◎ New words in the language have [tʃ, dʒ] + [e, ε, a, ɔ, o, u]...

/tʃaw/ 'bye' /tʃe/ 'conversational mark'

/tʃεko/ 'Czech'

/tʃãⁿ/ 'musical group' /tʃõga/ 'moron'

/tʃutʃuka/ 'pretty woman'

◎ ...

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/tʃãⁿ/ 'musical group' /tʃõga/ 'moron' /tʃutʃuka/ 'pretty woman'

- ◎ ... That can even form minimal pairs with /t, d/:

/tʃaw/ x /taw/ 'such as' /tʃe/ x /te/ '2sp pronoun' /tʃεko/ x /tεko/ 'portion'
/tʃãⁿ/ x /tãⁿ/ 'flight company' /lindʒa/ 'ugly' x /linda/ 'pretty'

- ◎ ...

The problem:

- ☉ New words in the language have [tʃ, dʒ] + [e, ε, a, ɔ, o, u]...

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- ☉ ... That can even form minimal pairs with /t, d/:

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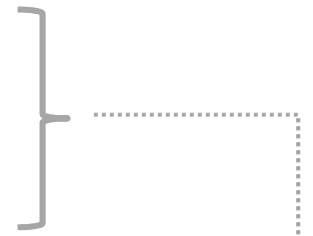
- ☉ Diphthong assimilation also can lead to [tʃ, dʒ] + /a, o/:

sítio ['si.tʃu] 'farm' rádio ['ha.dʒu] 'radio'
modéstia [mo'des.tʃɐ] 'modesty' comédia [co'mɛ.dʒɐ] 'comedy'



The problem:

- If [tʃ, dʒ] can occur with other vowels;
- If there are some [t, d] - [tʃ, dʒ] minimal pairs;
- If [t, d] → [tʃ, dʒ]/_ [i, ɪ] is categorical in SP dialect...



No local variation;
No complementary distribution;
Stop-Affricate contrast

... Could we consider [tʃ, dʒ] as phonemes in BP?

*What is the phonological status
of the affricates [tʃ, dʒ] in
Brazilian Portuguese?
Phonemes or Allophones?*





Main question

Phonemes /tʃ, dʒ/?

Allophones of /t, d/?

What is the phonological status of [tʃ, dʒ] in BP?

Possible cues:

- Minimal pairs
- Complementary distribution
- ...



Main question

Phonemes /tʃ, dʒ/?

Allophones of /t, d/?

What is the phonological status of [tʃ, dʒ] in BP?

Possible cues:

- Minimal pairs
- Complementary distribution
- Priming effects
- Phonological acquisition patterns
- Literacy learning patterns

(Ernestus & Baayen, 2007)

(Matzenauer, 2008)

(Juzcyk, 1981)

1

Priming effects

Would /t/ be able to prime [tʃ]?

1 Priming effects

Predictions:

	Phoneme [tʃ, dʒ]	Allophone [tʃ, dʒ]
Prime [t, d]	No priming effect	Priming effect
Prime [tʃ, dʒ]	Priming effect	Same as the [t, d] effect


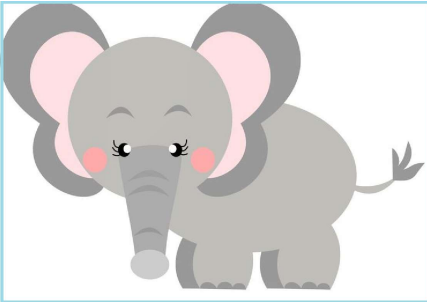

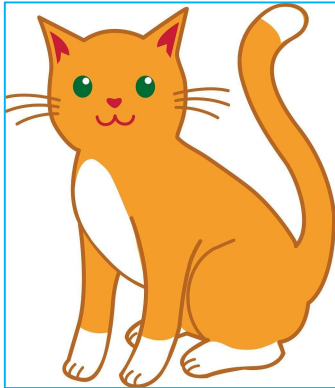
Methods:

- Primes: Spoken words; Test: pictures;
- 40 stimuli + 30 distractors; 3 test blocks on PsychoPy
- Participants:
- SP dialect

<i>Adults</i>	<i>School children</i>	<i>Preschool children</i>
9	6	10

1 Priming effects

Conditions: 10 stimuli per condition

Prime	Affricate-Affricate	Stop-Affricate	NoPrime	Stop-Stop
	['kẽj.tʃɪ] 'hot'	[a.do'sã.te] 'sweetener'	[ga'ha.fɐ] 'bottle'	['za.tu] 'squirt'
Stimuli	['pẽj.tʃɪ] 'comb'	[e.le'fã.tʃɪ] 'elephant'	[pre'zẽj.tʃɪ] 'gift'	['ga.tu] 'cat'
				

1 Priming effects: Results

	Adults		School children		Preschool children	
	<i>Reaction Time</i>	<i>Error Rate</i>	<i>Reaction Time</i>	<i>Error Rate</i>	<i>Reaction Time</i>	<i>Error Rate</i>
Affr-Affr	1,027 ms	2.5%	1,472 ms	18%	1,356 ms	43%
Stop-Affr	1,050 ms	2.5%	1,331 ms	21%	1,496 ms	43%
Stop-Stop	888 ms	0.8%	1,079 ms	14%	1,189 ms	15%
NoPrime	1,444 ms	6.1%	1,841 ms	24%	1,676 ms	59%

1

Priming effects: Results

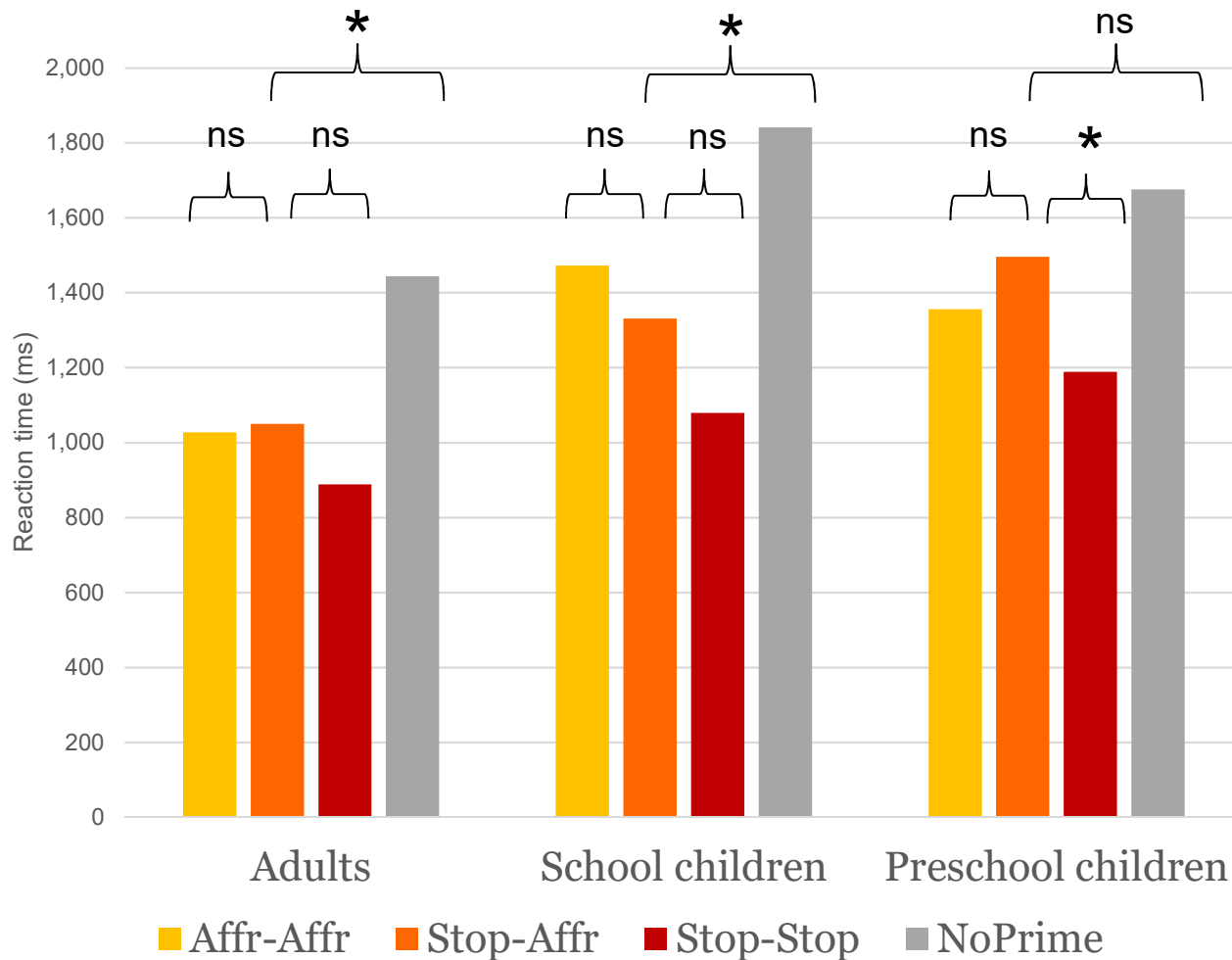
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Error rates:

- Stop-Stop has the highest accuracy in all groups;
- NoPrime has the lowest accuracy in all groups;
- Aff-Aff and Stop-Aff have similar patterns;
- Aff-Aff and Stop-Aff have different patterns than Stop-Stop.

[tʃ] ≠ [tV]

Recovery Time



Allophone:

If $[tʃ] = /t/$, then:

- Aff-Aff = Stop-Aff;
- Stop-Aff = Stop-Stop;
- Stop-Aff ≠ NoPrime.

Phoneme:

If $[tʃ] \neq /t/$, then:

- Aff-Aff ≠ Stop-Aff;
- Stop-Aff ≠ Stop-Stop;
- Stop-Aff = NoPrime.

1

Priming effects: Results

	<i>Adults</i>	<i>School</i>	<i>Preschool</i>
[tʃ]-[tʃ] x [t]-[tʃ]	ns	ns	ns
[t]-[tʃ] x [t]-[t]	ns	ns	*
[t]-[tʃ] x NoPr	*	*	ns

- Adults and School kids: no difference between St-St, Aff-Aff and St-Aff:
 ['kẽj.**tʃ**i] or ['kẽj.**te**] would prime ['pẽj.**tʃ**i] the same way ['ʒa.**tu**] primes ['ga.**tu**]

[tʃ] is an allophone of /t/



1

Priming effects: Results

	<i>Adults</i>	<i>School</i>	<i>Preschool</i>
[tʃ]-[tʃ] x [t]-[tʃ]	ns	ns	ns
[t]-[tʃ] x [t]-[t]	ns	ns	*
[t]-[tʃ] x NoPr	*	*	ns

- Adults and School kids: no difference between [tʃ]-[tʃ] x [t]-[tʃ] x [t]-[t]
 -----> [tʃ] is an allophone of /t/
- Preschoolers: no difference between [tʃ]-[tʃ] x [t]-[tʃ]; but there is a
 difference between them and control [t]-[t].
 -----> [tʃi] = [ti], but different than /tV/

1

Priming effects: Results

- ◎ Preschoolers recognize the absence of contrast between [tʃi] and [ti], so [tʃi] could be an allophone of /ti/...
- ◎ ... But they treat /ti/ and /tV/ differently.

/t/ + /ɛ, a, ɔ, o, u/



/t/ + [i, ɪ]



2

Phonological Acquisition

How is the development path of the affricates ?

What is the relation between [t] and [tʃ]?

[tʃ, dʒ] acquisition

Predictions:

- If [tʃ, dʒ] are **allophones** of /t, d/, we would expect [t, d] as the major substitute for [tʃ, dʒ]; (Matzenauer, 2008)
- If [tʃ, dʒ] are considered **phonemes**, we would expect that both stops and fricatives would be possible substitute candidates.
- Do children use [tʃ, dʒ] as substitutes of [t, d]?

● [tʃ, dʒ] acquisition

Method

- Biweekly longitudinal data (Santos, 2005);

- 3 children from São Paulo:

- Classification:
 - [tʃ, dʒ] → STOP
 - [tʃ, dʒ] → FRICATIVE
 - [tʃ, dʒ] → AFFRICATE
 - [tʃ, dʒ] → OTHERS

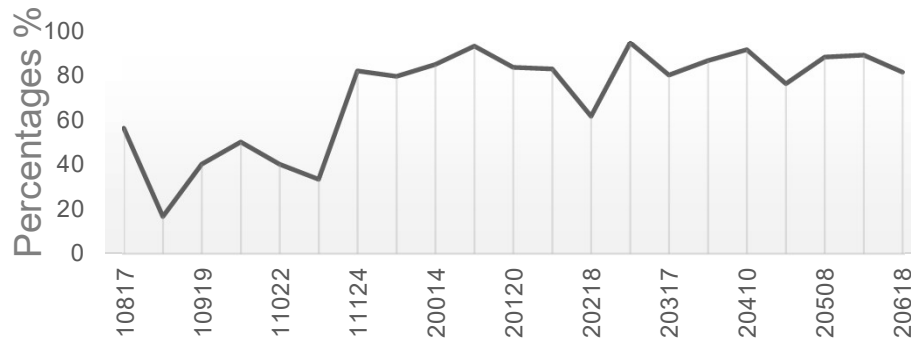
Subjects age		
Lz (girl)	Am (girl)	Ar (boy)
1;8-3;3	1;10-3;0	1;8-2;6
N= 346	N= 461	N= 377

- Data verified with Praat.

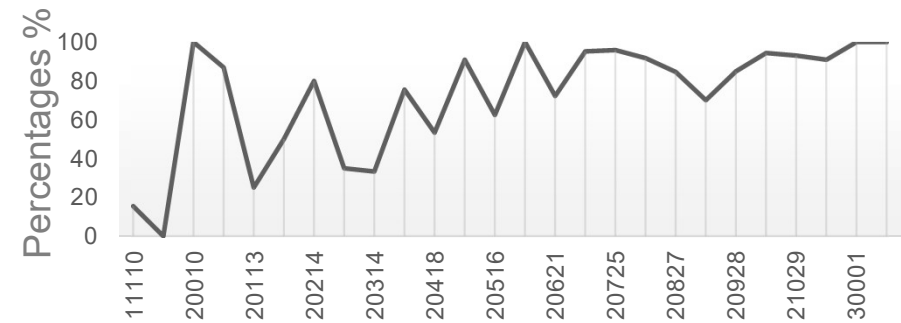


[tʃ, dʒ] acquisition

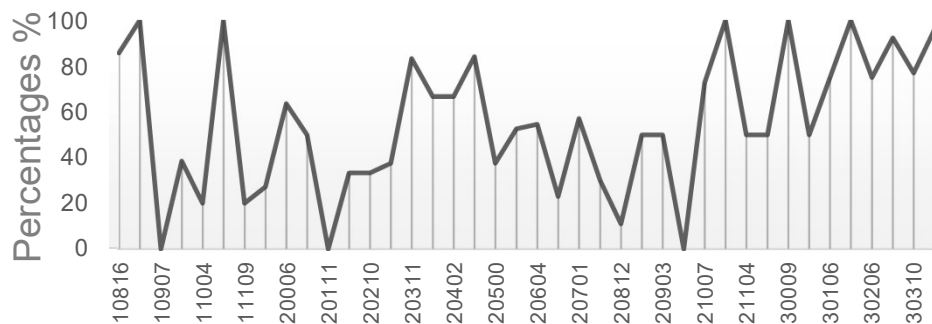
Palatalization - Ar



Palatalization - Am



Palatalization - Lz



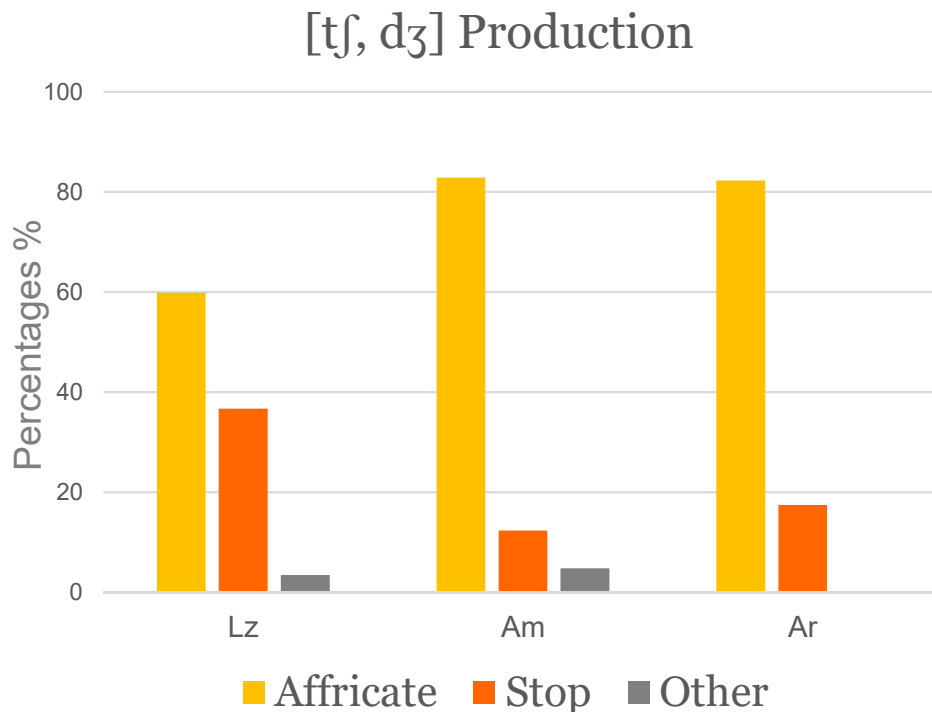
- Ar and Am more stable than Lz;
- Lz substitutions: stops ~ fricatives;
- Guimarães (2008): same pattern

instability ↔ fricatives substitutions



[tʃ, dʒ] acquisition

Goal: To observe the substitution patterns on [tʃ, dʒ] acquisition



Other substitutions:

fricatives /s, ʃ/, velar /k/

/ʒinastika/ → [ʒi'na.ʃi.kə] 'gymnastics'

/tigre/ → ['si.gɪ] 'tiger'

/nojte/ → ['noj.kɪ] 'night'

Alveolar stops [t, d] are the major substitute for [tʃ, dʒ]

/eskõdidino/ → [ɪs.kõ.dʒi'di.ɲʊ] 'hidden'

[tʃ, dʒ] acquisition

◎ Diverse developmental patterns:

[tʃ, dʒ] → [t, d] preference ↔ more stable path, faster acquisition

[tʃ, dʒ] → stops ~ fricatives ↔ less stable path, slower acquisition

→ [tʃ, dʒ] are **not** reported as common substitutes for [t, d] or [s, z, ʃ, ʒ] targets → Children know the contexts for [tʃ, dʒ]

(Lamprecht et al, 2004)

Maybe different children can interpret the relation between [tʃ, dʒ] ~ [t, d] differently?

3

Literacy learning patterns

Do children need explicit practice to accept [t, tʃ] as <T>?
Would [tʃ, dʒ] be written differently than [t, d]?

● Learning to write [tʃ, dʒ]

Goal: To observe the writing patterns of [tʃ, dʒ] and [t, d]

Method

- Ar's notebooks;
- First year of Elementary School;
- 2013 and 2014.

↓
Child failed the first year in 2013

2013	412 pages	234 [tʃ, dʒ]	850 [t, d]
2014	704 pages	263 [tʃ, dʒ]	916 [t, d]

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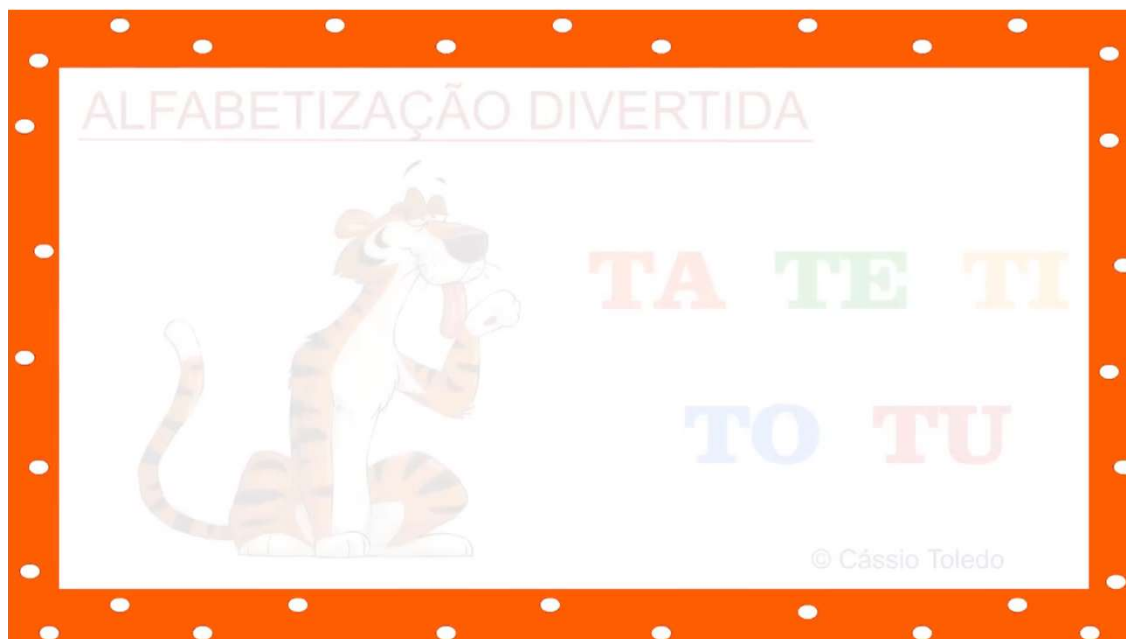
● Learning to write [tʃ, dʒ]

Exception: **Atchim!** ‘Achoo!’

● BP standard orthography: [tʃi, dʒi] are written as <TI, DI>

[tʃV, dʒV] are written as <TCH, DJ>

Tchau! ‘Bye!’



Phonetic difference
[**ta**], [**te**], [**to**], [**tu**] x [tʃi]:
not targeted by school



Learning to write [tʃ, dʒ]

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Phonetic difference

[**ta**], [**te**], [**to**], [**tu**] x [tʃi]:

not targeted by school

● Learning to write [tʃ, dʒ]

2013		2014	
[tʃ, dʒ]	[t, d]	[tʃ, dʒ]	[t, d]
2.56%	2.47%	3.42%	1.42%

- [tʃ, dʒ] x [t, d]: Similar number of errors;
- No occurrences of TCH, DJ or other ways to write [tʃ, dʒ];
- Same error types (major error: deletion of the vowel)

‘FOGUETE’ foquet UBATBA ‘UBATUBA’

- Other speech influences were observed (like epenthesis)

PENEU ‘PNEU’ SUBYMARINO ‘SUBMARINO’



Summary

- Priming effects: $[tʃi, dʒi] = [ti, di]; \neq [tV, dV];$
- Phonological development: $[tʃi, dʒi]$ is mainly replaced by $[t, d];$ oppose direction does not happen;
- No explicit instructions and no orthographic errors for $[tʃ, dʒ] \times [t, d].$



Summary

- ◎ Priming effects: [tʃi, dʒi] = [ti, di]; ≠ [tV, dV];
- ◎ Phonological development: [tʃi, dʒi] is mainly replaced by [t, d];
oppose direction does not happen;
- ◎ No explicit teaching and no orthographic errors for [tʃ, dʒ] x [t, d].

*Affricates [tʃ, dʒ] are still analyzed as allophones of /t, d/ in
Brazilian Portuguese (SP dialect)*

[tʃV, dʒV] occurrences are still not sufficient to trigger reanalysis
of the affricates as phonemes in /t, d/ + /i, ɪ/ contexts



Future research



- How children learn that [tʃ, dʒ] are allophones?



Variation between [to, ta] ~ [tʃi] in diminutives and augmentatives

['pa.to] ~ [pa'tʃi.no] 'duck' ~ 'duck.DIM'

[ta'pe.tʃi] ~ [ta.pe'tõw̃] 'rug' ~ 'rug.AUG'

- Why the minimal pairs and the [tʃV] distribution are not posing a problem for the child?



Kids palatalize the way through
From São Paulo to Aracaju
With no way of telling
Except for the spelling
Of just the words 'bye!' and 'achoo!'
by Ollie Sayeed

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