



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

Andressa Toni, University of São Paulo



[tʃ, dʒ] distribution in the language

[tʃ, dʒ] are traditionally analyzed as underlying /t, d/, derived by a palatalization rule:

/t, d/:	[t, d]	[tʃ, dʒ]	Example
Coronal High vowels	✗	✓	['tʃi.ɡɾi] 'tiger'
Other vowels	✓	✗	[tʰa'tu] 'armadillo'

/t, d/ surface forms: Palatalization rule

→ **Problem:** non-palatalization-derived [tʃ, dʒ]

- Unstressed diphthongs assimilation form [tʃ, dʒ]+/a, o/:
/sitio/ > ['si.tʃu] 'farm' /radio/ > ['ha.dʒu] 'radio'
- New words/minimal pairs with [tʃ, dʒ]+[e, ε, a, ɔ, o, u]:
['tʃaw] 'bye' x ['taw] 'such as' ['lin.dʒe] 'ugly' x ['lin.de] 'pretty'

Main question

- If some words can disobey the palatalization rule context;
- If some word pairs present Stop-Affricate contrast;
- If there is no [ti]~[tʃi] variation pointing to a rule...

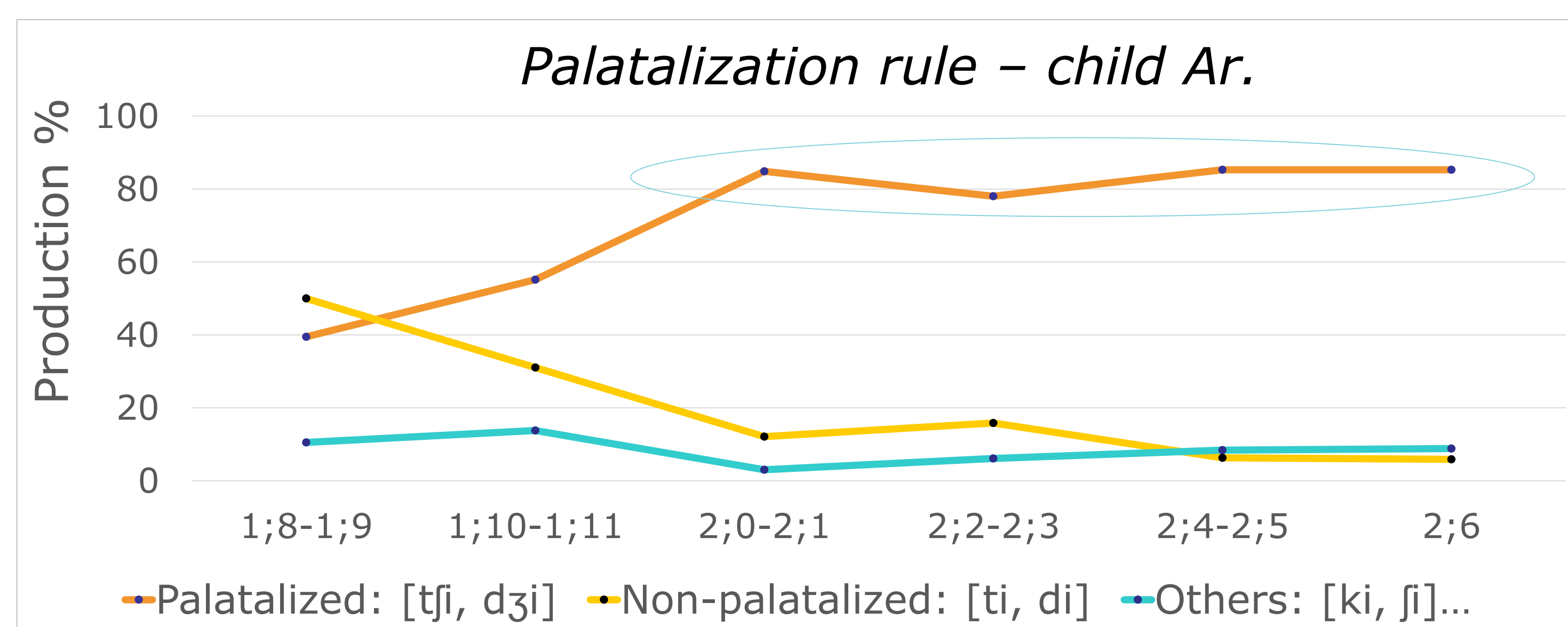
Could [tʃ, dʒ] have been reanalyzed as underlying phonemes in Brazilian Portuguese?

Verifying the phonological status of [tʃ, dʒ]

Three clues were used:

1) SEGMENTAL DEVELOPMENT OF [tʃ, dʒ]:

- Longitudinal production of [tʃ, dʒ]:



- Most common error: failure to apply palatalization:
/eskõdidiɲo/ → [ɪs.kõ.dʒi di.ɲu] 'hidden'
- [t, d] are the most common substitutes for [tʃ, dʒ]; but
- [tʃ, dʒ] are **not** common substitutes for [t, d];

→ **Children know when NOT to use [tʃ, dʒ]**

2) LITTERACY LEARNING OF [tʃ, dʒ] CONTEXTS:

- Notebooks from First Year of Elementary School (Ar.):

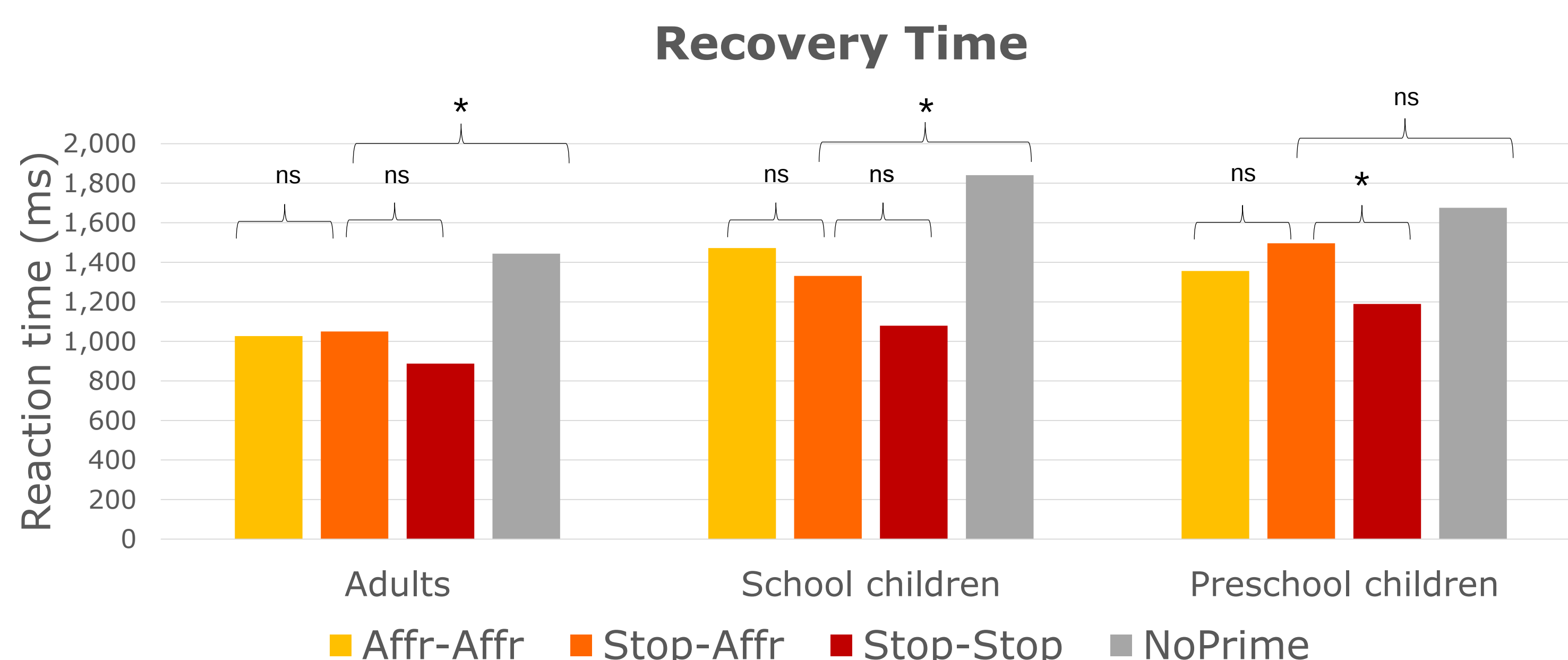
Year	Pages	Total [tʃ, dʒ]	Errors [tʃ, dʒ]	Total [t, d]	Errors [t, d]
2013	412	234	2.56%	850	2.47%
2014	704	263	3.42%	916	1.42%

- No quantitative or qualitative differences between the written contexts of [tʃ, dʒ] and [t, d];
- No specific learning activities acknowledging the phonetic differences between <TI> and <TA, TE, TO, TU>;

→ **No written differences between [tʃ, dʒ] - [t, d]**

3) PRIMING: [tʃi] x [ti] x [tʌ] x NoPrime

- Participants: 9 Adults; 6 School kids; 10 Preschoolers
- 4 conditions Prime-Target:



- Adults, School kids: → [tʃi] = [ti]; [ti] = [tʌ]
- Preschoolers: → [tʃi] = [ti], but [ti] ≠ [tʌ]

1), 2), 3) Findings:

[tʃi, dʒi] are still derived from underlying /ti, di/

What is guiding the palatalization acquisition?

- How children learn that [tʃ, dʒ] are underlying /t, d/?
→ **Variation [t, d]~[tʃ, dʒ] triggered by Morphology**
- When -/i/ suffixes are added to a [t] base, [t] → [tʃ]:
[pa.to] ~ [pa.tʃi.no] 'duck' ~ 'duck.DIM'
- When non-/i/ suffixes are added to a [tʃ] base, [tʃ] → [t]:
[sor.ve.tʃi] ~ [sor.ve.tʌw] 'ice cream' ~ 'ice cream.AUG'

Is this enough to guide the rule acquisition?

→ **Tolerance Principle** (Yang 2016): a rule will be generated if doing so is more productive than storing a list of words.

- If [tʃ, dʒ] are first considered /tʃ, dʒ/, the morphovaryable [t, d]~[tʃ, dʒ] contexts would be listed as exceptions.

$$e \leq \theta_N = \frac{N}{\ln N}$$

N = total [tʃ, dʒ] words
 e = total variable [t, d]~[tʃ, dʒ] words
 θ_N = max number of exceptions tolerated

- N and e are estimated from Child Directed Speech's most frequent types (CDS frequent types ≈ child vocabulary)

Frequent CDS types	N = Total [tʃ, dʒ]	e = [tʃ]~[t]	Tolerable θ_N for /tʃ, dʒ/	Are [tʃ]~[t] tolerable?
100	8	1	3.85	Yes
300	22	6	7.12	Yes
500	38	17	10.45	NO
750	59	25	14.47	NO
1500	148	56	29.62	NO

- By the time of 500 words vocabulary (≈ 2;0-2;6y.o.), storing [tʃ, dʒ] as /tʃ, dʒ/ won't be as productive as generating a rule: too many [t, d]~[tʃ, dʒ] variation

How many exceptions are too many exceptions?

- Why /tʃV, dʒV/ are not posing a problem here?
→ **/tʃV, dʒV/ are tolerable exceptions ($e < \theta_N$):**
when $N_{(\text{total [tʃ, dʒ]})} = 148$, $e_{(/tʃV, dʒV/)} = 7$; Tolerable $\theta_N = 29$

Acknowledgements

I would like to thank professors Charles Yang, Rolf Noyer, and the WsK/DIG study group at Upenn for their valuable suggestions. Funding: CNPq, CAPES, Brazil.



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Coronal High vowels	✗	✓	[ˈtʃi.ɡɾi] 'tiger'
Other vowels	✓	✗	[ˈta.tu] 'armadillo'

Complementary distribution of [t]~[tʃ], [d]~[dʒ]

→ **Problem:** emergency of [tʃ, dʒ] + Other vowels

- Unstressed diphthong assimilation form [tʃ, dʒ] + /a, o/:
/sitio/ > [ˈsi.tʃu] 'farm' /hadio/ > [ˈha.dʒu] 'radio'
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[ˈtʃaw] 'bye' x [ˈtaw] 'such as' [ˈlin.dʒe] 'ugly' x [ˈlin.de] 'pretty'

Main question

- If words disobey the complementary distribution⁽¹⁾;
- If there is Stop-Affricate contrast⁽¹⁾;
- If there is no variation between [ti]~[tʃi]...

Could [tʃ, dʒ] have been reanalyzed as phonemes in Brazilian Portuguese?

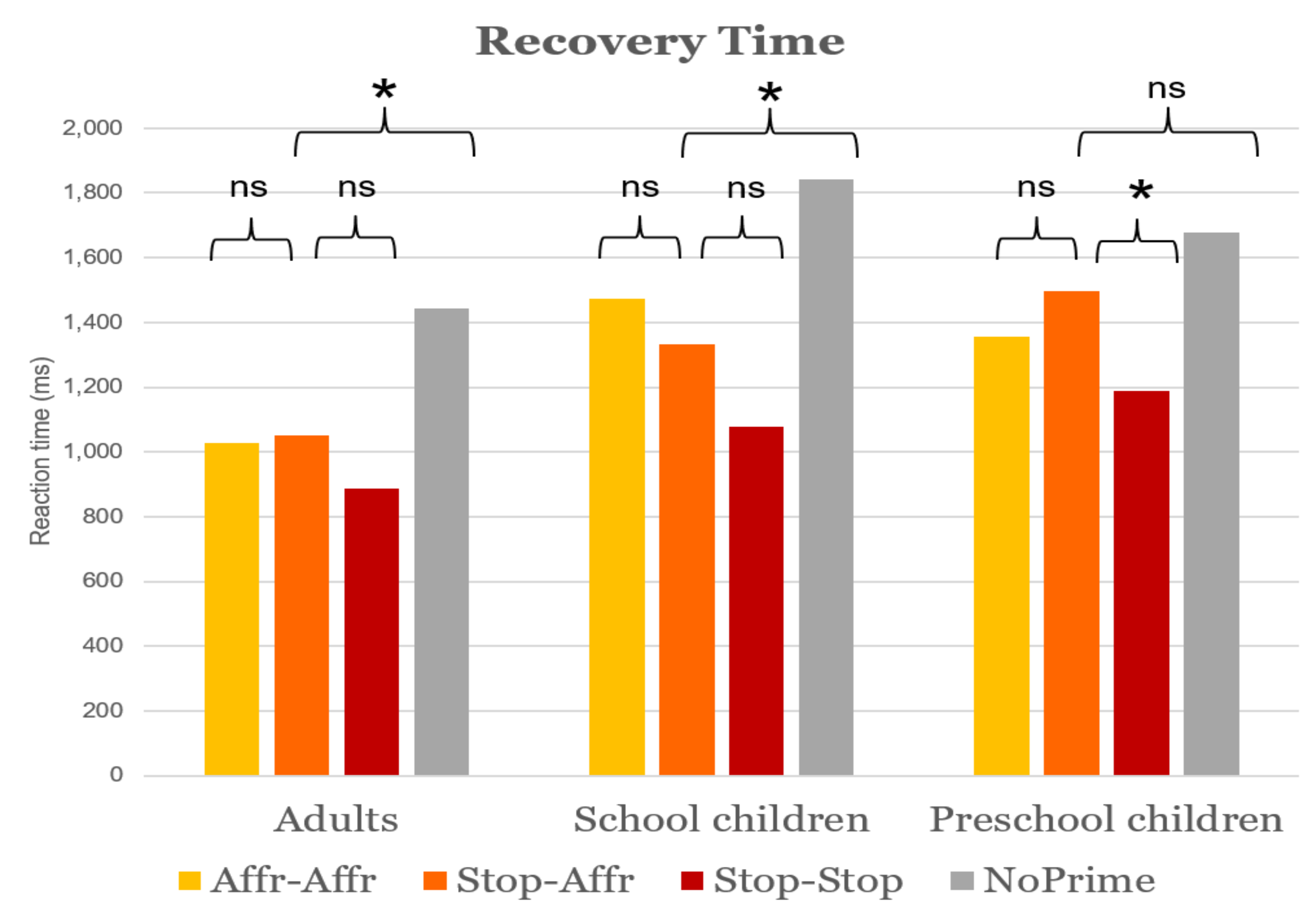
Verifying the phonological status of [tʃ, dʒ]

Three clues were used:

- Priming effects [tʃ, dʒ] x [t, d]⁽²⁾
- Literacy learning of [tʃ, dʒ]⁽³⁾
- Segmental development of [tʃ, dʒ]⁽⁴⁾

1) PRIMING: [tʃi] x [ti] x [tʋ] x NoPrime

- Participants: 9 Adults; 6 school children; 10 preschoolers
- 4 conditions Prime-Target:



2) LITERACY LEARNING OF [tʃ, dʒ] CONTEXTS:

- Notebooks from First Year of Elementary School (Ar, boy);

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- No quantitative or qualitative differences between the written contexts of [tʃ, dʒ] and [t, d];
- No specific activities acknowledging the phonetic differences between <TI> and <TA, TE, TO, TU>;

→ **No written differences between [tʃ, dʒ] and [t, d]**

3) SEGMENTAL DEVELOPMENT OF [tʃ, dʒ]:

- Longitudinal data from 3 children (1;8-3;3 years old);

- Early acquisition: <3;0 y.o; 30% non-affricate repairs:

/eskõdidino/ → [ɪs.kõ.dʒiˈdi.nu] 'hidden'

- [t, d] are the most common substitutes for [tʃ, dʒ]; but
- [tʃ, dʒ] are **not** reported as common substitutes for [t, d];

→ **Children know when NOT to use [tʃ, dʒ]**

1), 2), 3) Finding:

[tʃ, dʒ] are still categorized as allophones of /t, d/

How?

	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

References & Acknowledgements

(1)CRISTÓFARO-SILVA, T. Palatalisation in Brazilian Portuguese. ReVEL. V. 4, n. 7, August 2006; (2). (3) JUSCZYK, P. Developing phonological categories from the speech signal, 1992. p.17-63; (4) MAZTENAUER, C.

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Complementary distribution of [t]~[tʃ], [d]~[dʒ]

- ➔ **Problem:** emergency of [tʃ, dʒ] + Other vowels
- Unstressed diphthong assimilation form [tʃ, dʒ] + /a, o/:
/sitio/ > [ˈsi.tʃu] 'farm' /hadio/ > [ˈha.dʒu] 'radio'
- New words and slangs with [tʃ, dʒ] + [e, ε, a, ɔ, o, u]:
[ˈtʃaw] 'bye' [ˈtʃõ.ɡe] 'moron' [tʃuˈtʃu.ke] 'pretty woman'
- ➔ Even forming minimal pairs with /t, d/:
[ˈtʃaw] 'bye' x [ˈtaw] 'such as' [ˈlin.dʒe] 'ugly' x [ˈlin.de] 'pretty'

Main question

- If words disobey the complementary distribution⁽¹⁾;
- If there is Stop-Affricate contrast⁽¹⁾;
- And if there is no variation between [ti]~[tʃi] within a dialect...

Could [tʃ, dʒ] have been reanalyzed as phonemes in BP?

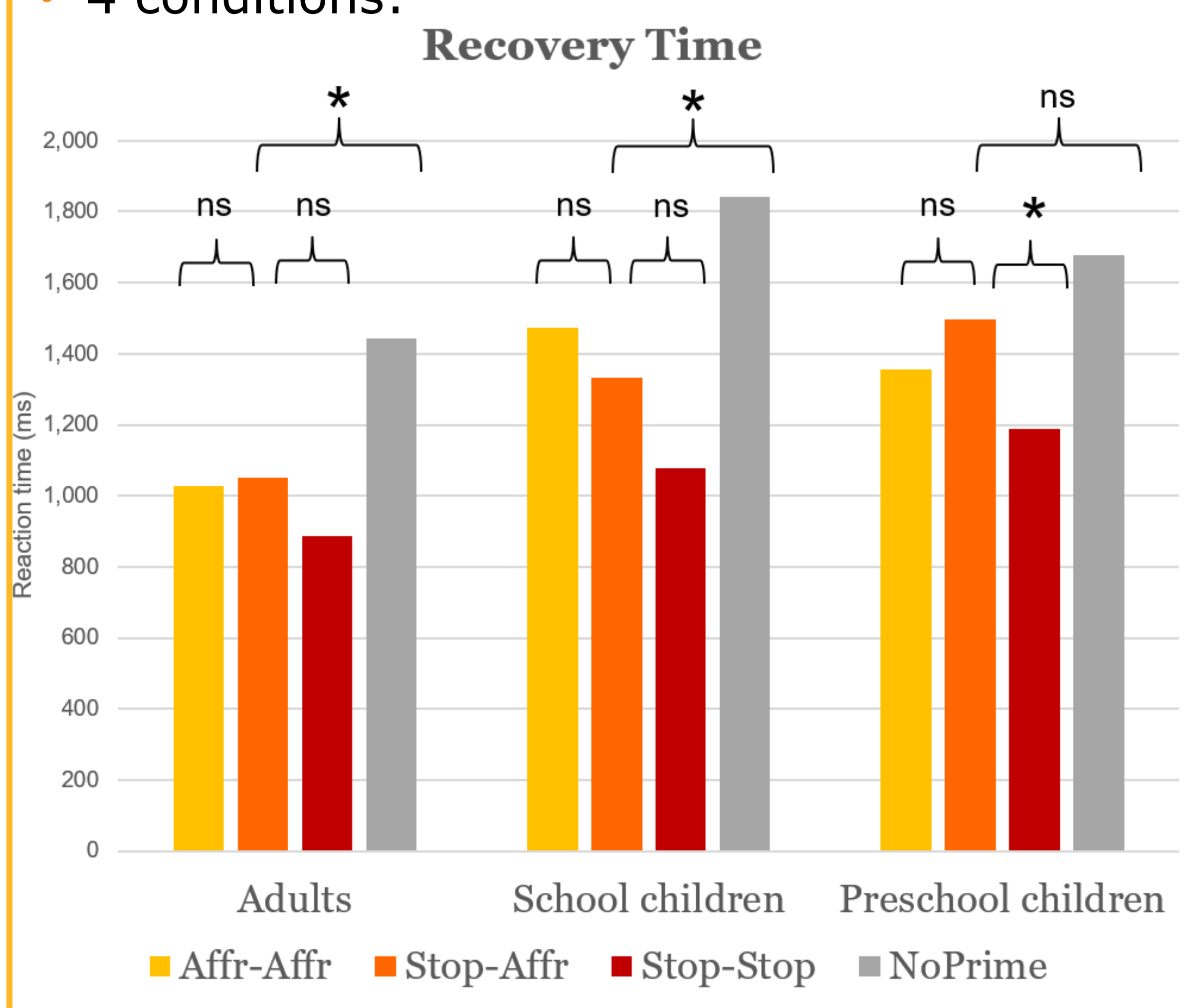
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- ➔ Segmental development of [tʃ, dʒ] ⁽⁴⁾

1) PRIMING:

- Participants: 9 Adults; 6 school children; 10 preschoolers
- Psychopy; 40 stimuli; Audio prime, Picture target;
- 4 conditions:



2) LITERACY LEARNING:

- Notebooks from First Year of Elementary School (Ar, boy):

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- No quantitative or qualitative difference on the writing of [tʃ, dʒ] contexts compared to [t, d];
- No specific activities acknowledging the differences between <TI> and <TA, TE, TO, TU>

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Why it ma

	Phoneme [tʃ, dʒ]	Allophone [tʃ, dʒ]
Prime [t, d]	No priming effect	Priming effect
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Main question

- No local variation;
- No complementary distribution;
- Stop-Affricate contrast
- Could we consider [tʃ, dʒ] as phonemes in BP?

Verifying the phonological status of [tʃ, dʒ]

Observar como a sílaba CCV é percebida, representada, categorizada e interpretada pela criança pode fornecer evidências sobre a organização de seu sistema fonológico.

Acerca desta relação entre estratégias de reparo e a adaptação da língua-alvo à Fonologia da criança, a questão que esta pesquisa se propõe a discutir é:

POR QUE a criança emprega tais estratégias?

- Priming effects [tʃ] x [t]; [dʒ];
- Segmental development of [tʃ, dʒ]; ← FONOLOGIA
- Literacy learning of [tʃ, dʒ]

Main question

Verifying the phonological status of [tʃ, dʒ] why it matters?

[tʃ, dʒ] distribution in the language

Como a estrutura CCV é especificada pela criança durante seu desenvolvimento?

Como os segmentos de CCV são especificados durar desenvolvimento?



Motivação fonética

Motivação fonológica

- Goldstein; contraste encoberto; produção l-r CV
- Nos primeiros meses há articulação, então se espera que pela percepção observe-se diferenciação entre CCV e CV
- As consoantes líquidas em C₂ seriam plenamente especificadas na representação subjacente infantil?

→ Possível causa: **Fonética: é o segmento A, r? É a articulação de duas consoantes? E se fossem duas vogais?**

Molde CCV: subespecificação de C2: CV = CCV será que CCV é interpretado como CV inicialmente? Será CCV e CV seriam intercambiáveis? Será que a manutenção da camada temporal de CCV pelo alongamento vocálico afetaria a percepção estrutural?

Filtros segmentais: subespecificação das laterais: há default? Há efeito mismatch?

→ que não pensar subespecificação de oclusivas? Porque são elas que ocorrem em reparo a CCV

- Possível causa:
- Resultado esperado: **Fonologia: é a estrutura CCV? É a especificação do segmento em C2?**

Metodologia

Tipo de coleta: Experimental (transversal + longitudinal);
Tipo de dado: Produção + Percepção; → Distinguir reparo fonético de reparo fonológico
Tipo de resposta e de teste:
Resposta verbal: Nomeação + repetição;
Resposta não-verbal: Priming + Discriminação lexical
Resposta não-verbal + verbal: Julgamento de aceitabilidade + correções ao fantoche;

References

- ♦Cristófarro-Silva, T. Palatalisation in Brazilian Portuguese. Revista Virtual de Estudos da Linguagem – ReVEL. V. 4, n. 7, August 2006.
- ♦Cagliari, L.C. Alfabetização e linguística. Pensamento e ação na sala de aula. São Paulo: Scipione, 2009

I would like to thanks

