The variability in child outputs

Is there a clue to phonological underspecification?
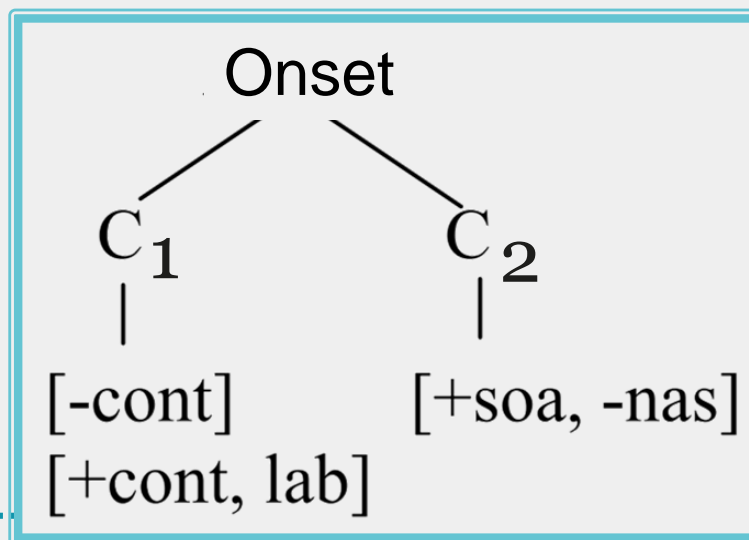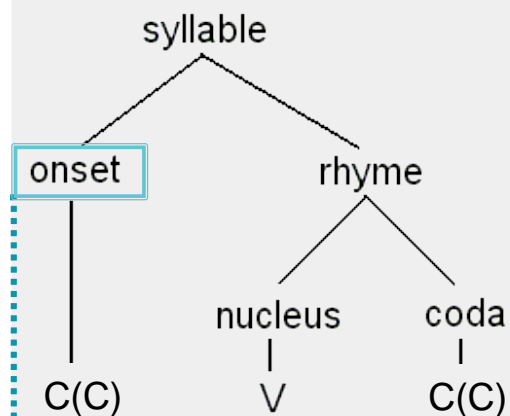
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Study object: *Complex onsets* - **C1C2V**

syllable
- onset → C(C)
- rhyme
  - nucleus → V
  - coda → C(C)

Onset
- C_1 → [-cont] [+cont, lab]
- C_2 → [+soa, -nas]

+ Consoant1: /p, b, t, d, k, g/
+ Consoant2: /l, ɾ/
Vowel: /i, e, ɛ, a, ɔ, o u/

brincar *to play*
dragão *dragon*

blusa *blouse*
in**gl**ês *English*

》 *Rare contexts:*
**dlim
*atleta *athlete*

o To explore patterns in the variability on child outputs;
o To discuss what this variability can reveal about the phonological system in development.

o Syllable types in Brazilian Portuguese;
o Syllabic development in BP children speech;
o A study on CCV syllables:

Methods

Patterns in children productions

Accounting the variability

'grudei' *I sticked*: [guˈdej],[gluˈdej],[guɾˈdej],[gu.ɾuˈdej], [gu.deˈɾej]…

Syllable types in Brazilian Portuguese

Basic syllable types in BP			target frequency
CV:	**be**bê	*baby*	*60.6%*
V:	**á**guia	*eagle*	*8.4%*
CVC:	**pai**	*father*	*15.4%*
CCV:	**bri**ncar	*play*	*4.4%*
Others (VC, VCC, CVCC, CCVCC…)			*11.2%*

CCV segmental combination frequency

/tr/	**34.8%**	/tl/	0.01%	/dr/	1.36%	/dl/	0%
/pr/	**26.1%**	/pl/	5.05%	/br/	**10.8%**	/bl/	1.81%
/kr/	5.24%	/kl/	2.72%	/gr/	6.56%	/gl/	0.39%

Syllabic development in BP
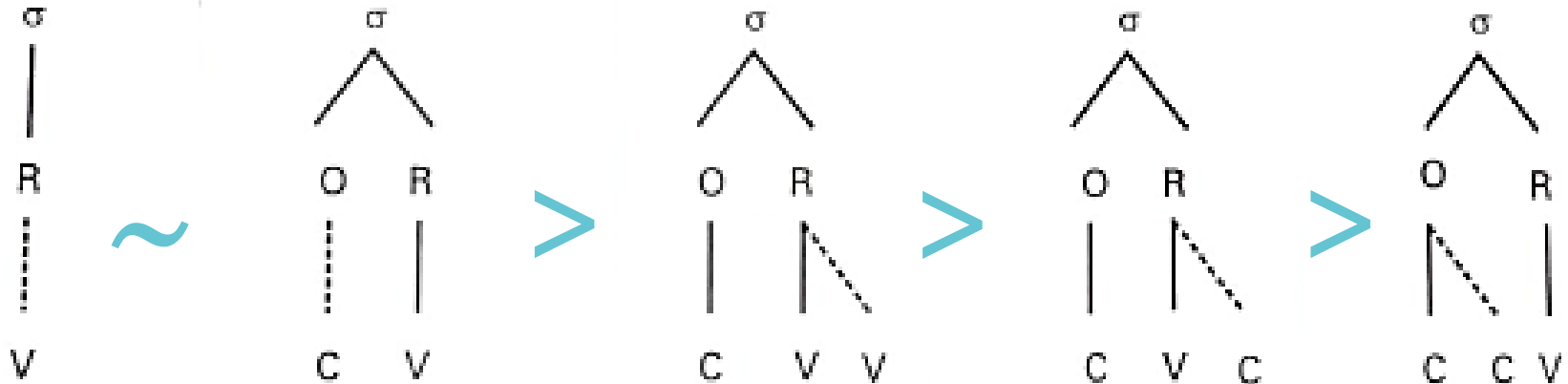
o CCV syllables are the last ones acquired by children;

~5 or 6 years old

o But children do not avoid words with this kind of syllable: **brin**car *to play*, **cri**ança *child*, **tris**te *sad*, **bra**ço *arm*...

~before 2 years old

How do children manage to speak this late structure in these early words?

Syllabic development in BP: CCV

How can children produce complex onsets?

> By avoiding the CCV structure (not the word).

But how?

o By deleting the CCV syllables.

o Yes. But also...

/**pra**to/ > ['**pa**.tʊ]

/**kla**se/ > ['**a**.sɪ]

How can children produce complex onsets?

❯ By avoiding the CCV structure (not the word).

But how?

/**pra**to/ > [ˈ**pa**.tʊ]

○ By deleting the CCV syllables.   - - - - - - - -   /**kla**se/ > [ˈ**a**.sɪ]

○ Yes. But also…

By changing the consonant in C2: witch   /**bru**ʃa/ > [ˈ**blu**.ʃe̞]

By changing the consonant in C1: goalpost   /**tra**ve/ > [ˈ**kra**.vɪ]

By changing the CCV position: goalpost   /**tra**ve/ > [ˈ**ta**.vɾɪ]

By changing CCV to CVC: thin   /ma**gro**/ > [ˈma.**goɾ**]

By changing CCV to CV.CV: Pluto   /**plu**to/ > [pu'**lu**.tʊ]

Syllabic development in BP: **CCV**

How can children produce complex onsets?

> By avoiding the CCV structure (not the word).

o In BP there is a wide range of ways to avoid CCV;

– *as in Czech, English, Dutch, French, EP, Serbian...* (GREENLEE, 1974)

o Children can ***delete*** or ***modify*** a structure to avoid it – and these strategies can coexist in a child's output;

o Even when a child already can produce target CCVs, deleted and modified outputs are still used.

Why is that?

Why a structure would have different possible outputs?

Methods

How can we access children syllabic knowledge in production data?

Selkirk (1982:340): Phonological and phonotactic rules can point to the internal structure in the syllable.

Methods

How can we access children syllabic knowledge in production data?

◇ Repair strategies - phonotatic and segmental manipulations:

'grudei' / *sticked*:   [guˈdej],[gluˈdej],[gurˈdej],[gu.ruˈdej],[gu.deˈrej]...

◇

How can we access children syllabic knowledge in production data?

◇ Repair strategies - phonotatic and segmental manipulations:

'grudei' / *sticked*: [guˈdej],[gluˈdej],[gurˈdej],[gu.ruˈdej],[gu.deˈrej]...

◇ Palatalization in /tɾi, dɾi/ contexts:

Canonical rule: CV /t, d/ → [tʃ, dʒ] / _ [coronal high vowel]ω

/tigɾe/ → [ˈtʃi.gɾɪ] /sede/ → [ˈse.dʒɪ]

mons**/tɾi/**nho → mons**/tØi/**nho → mons**[ti]**nho

mons**/ti/**nho → mons**[tʃi]**nho

How can we access children syllabic knowledge in production data?

◇ Repair strategies - phonotatic and segmental manipulations:

'grudei' / *sticked*:   [guˈdej],[gluˈdej],[gurˈdej],[gu.ruˈdej],[gu.deˈrej]...

◇ Palatalization rule in /tɾi, dɾi/ contexts:

If CCV is specified in Phonology, /tɾi, dɾi/ palatalization is blocked;

If CCV isn't specified in Phonology, palatalization applies in /tɾi, dɾi/.

mons**/tri/**nho → mons**/ti/**nho → mons**[ʧi]**nho

mons**/tØi/**nho → mons**[ti]**nho

Methods

Naturalistic/Longitudinal data:

- 3 children aged from 1;7 to 5;6 years old recorded biweekly;
- 203 sessions of 30 minutes each with mother/child interaction;
- Total of **4,330** CCV syllables collected.

Transversal/Experimental data:

Data accoustically verified with Praat

Methods

Naturalistic/Longitudinal data:

- 3 children aged from 1;7 to 5;6 years old recorded biweekly;
- 203 sessions of 30 minutes each with mother/child interaction;
- Total of **4,330** CCV syllables collected.

Transversal/Experimental data:

- 49 children aged from 2;4 to 5;10 years old;
- Repetition task with words and nonwords;
- Total of **3,062** CCV syllables collected.

['CCV.CV]

→ /i, a, u/

→ /l, r/

→ /p, b, t, d, k, g/

Data accoustically verified with Praat

Data classification

1. **By % of CCV target productions:**

Group 1	Group 2	Group 3	Group 4	Group 5
0-5%	6-40%	41-60%	61-75%	75-100%

2. **By CCV way of production:**

- Target production;
- Repair strategies;
- C_2 deletion

3. **By structural type of production:**

- **Structural maintaining** productions;
- **Structural changing** productions.

CCV production in child speech: Examples

- Target production: *witch* /ˈbruʃa/ [ˈ**bru**.ʃɐ]
- C1 Substitution: *goalpost* /ˈtrave/ [ˈ**kra**.vɪ]
- C2 Substitution: *witch* /ˈbruʃa/ [ˈ**blu**.ʃɐ]
- Transposition: *goalpost* /ˈtrave/ [ˈ**ta**.vɾɪ]
- Reciprocal movement: *Drigo* /ˈdrigo/ [ˈ**gri**.**d**ʊ]
- C1 Deletion: *Dlato* /ˈdlato/ [ˈ**la**.tʊ]
- C2 Deletion: *witch* /ˈbruʃa/ [ˈ**bu**.sɐ]
- CCV Palatalization: *rail* /ˈtriʎo/ [ˈ**tʃi**.ʎʊ]
- Onset deletion: *class* /ˈklase/ [ˈ**a**.sɪ]
- Epenthesis: *money change* /ˈtroko/ [**to**ˈ**ro**.kʊ]
- Metathesis: *thin* /ˈmagro/ [ˈma.**gor**]
- Coalescence: *Pluto* /ˈpluto/ [ˈ**fu**.tʊ]

CCV production in child speech: Examples

Target production:	/bruʃa/	[ˈ**bru**.ʃɐ]
C1 Substitution:	/trave/	[ˈ**kra**.vɪ]
C2 Substitution:	/bruʃa/	[ˈ**blu**.ʃɐ]
Transposition:	/trave/	[ˈ**ta**.v**r**ɪ]
Reciprocal movement:	/drigo/	[ˈ**gri.d**ʊ]

Structural maintaining productions

C1 Deletion:	/dlato/	[ˈ**la**.tʊ]
C2 Deletion:	/bruʃa/	[ˈ**bu**.sɐ]
CCV Palatalization:	/triʎo/	[ˈ**ʧi**.ʎʊ]
Onset deletion:	/klase/	[ˈ**a**.sɪ]
Epenthesis:	/troko/	[**to'ro**.kʊ]
Metathesis:	/magro/	[ˈma.**gor**]
Coalescence:	/pluto/	[ˈ**fu**.tʊ]

Structural changing productions

Questions

1. Is there a preference between deleting or modifying the CCV structure?

2. Is there a specific segmental context avoided in CCV?

3. Which type of CCV production children prefer – *Structural maintaining* or *Structural changing*?

4. Do CCV productions vary according to the developmental moment?

Results: Target, repaired and palatalized CCVs

Phonotatic and Phonological clues

Results

1. Is there a preference between deleting or modifying the CCV structure?

YES

Naturalistic						
Child	**Lz**				**Am**	**Ar**
Groups	**G1** (365)	**G2** (1085)	**G3** (431)	**G4** (211)	**G1** (714)	**G1** (1510)
Target production	6.03%	28.76%	**51.51%**	**66.35%**	1.82%	1.52%
Deletion	**90.41%**	**66.54%**	**44.78%**	**27.96%**	**89.78%**	**99.56%**
Modification	3.56%	4.7%	3.71%	5.69%	8.4%	1.92%
Experimental						
Groups	**G1** (884)	**G2** (441)	**G3** (328)	**G4** (824)	**G5** (585)	
Target production	0.79%	28.34%	**49.7%**	**63.71%**	**75.38%**	
Deletion	**70.59%**	26.76%	5.79%	10.8%	6.33%	
Modification	28.62%	**44.9%**	**44.51%**	**25.49%**	**18.29%**	

G1: Deletion is preferred | G2-G5: Deletion is preferred in NATURALISTIC; Modification in EXPERIMENTAL.

Results

2. *Is there a specific segmental context avoided in CCV?*

Chi-square test	G1	G2	G3	G4	G5
	p-value	p-value	p-value	p-value	p-value
Liquid type	**< 0.001**	0.226	**0.001**	0.05484	**< 0.001**
Plosive PoA	**< 0.001**	0.5886	0.1257	**< 0.001**	**< 0.001**
Vowel type	0.9976	0.5635	0.3945	0.6411	0.1296

More targetable to changes:

Coronals > Dorsal > Labial

Laterals > flaps

Results

Naturalistic	Lz				Am	Ar
Grupos	G1	G2	G3	G4	G1	G1
/l/→ /ɾ/	1/2	0/25	0/4	0/4	0/7	0/8
/l/→ glide	0/2	0/25	0/4	0/4	0/7	0/8
/ɾ/→ /l/	**0/2**	**18/25**	**4/4**	**4/4**	**6/7**	**0/8**
/ɾ/→ glide	1/2	7/25	0/4	0/4	1/7	8/8
Experimental	G1	G2	G3	G4	G5	
/l/→ /ɾ/	3/27	**51/108**	**58/71**	**34/53**	**15/23**	
/l/→ glide	**13/27**	5/108	2/71	0/53	4/23	
/ɾ/→ /l/	7/27	**50/108**	4/71	16/53	4/23	
/ɾ/→ glide	4/27	2/108	7/71	3/53	0/23	

G2: random direction of C2 Substitution | +G2: trend for /l/→ /ɾ/

→ C/ɾ/V more productive than C/l/V in BP

Results

3. *CCV child productions: Maintaining or Changing CCV?*

Naturalistic						
Groups	**Lz G1**	**Lz G2**	**Lz G3**	**Lz G4**	**Am G1**	**Ar G1**
CCV Maintaining	**24** 6.57%	**345** 31.77%	**226** 68.49%	**145** 68.4%	**22** 3.08%	**32** 2.12%
CCV Changing	**341** 93.43%	**741** 68.23%	**104** 31.51%	**67** 31.6%	**692** 97.92%	**1477** 97.88%
Experimental						
Groups	**G1**	**G2**	**G3**	**G4**	**G5**	
CCV Maintaining	**41** 4.54%	**273** 55.49%	**266** 75.14%	**660** 77.74%	**521** 87.56%	
CCV Changing	**864** 99.56%	**219** 44.51%	**88** 24.86%	**189** 22.26%	**74** 12.44%	

G2 to G5 data show a growing trend to maintain CCV structure

Questions

1. Is there a preference between deleting or modifying the CCV structure?

Yes! But it depends on the developmental moment and on the nature of the data;

2. *Is there a specific segmental context avoided in CCV?*
Yes! Coronals and laterals are avoided;

3. Which type of CCV production children prefer – *Structural maintaining* or *Structural changing*?
Children start changing the structure, and then modifies CCV segmental content, maintaining the structure;

4. Do CCV productions vary according to the developmental moment?
YES!

What about palatalizing CCV contexts?

o **Naturalistic data:**

G1: All children sometimes palatalized reduced CCVs;

G2-G4: 1 child sometimes palatalized CCV; No /tɾi, dɾi/ contexts with the other 2 children.

o **Experimental data:**

G1:   1 child categorically palatalized the reduced CCVs;

   6 children categorically blocked the palatalization in CCV;

   8 children sometimes applied the palatalization in CCV;

G2-G4: 3 children sometimes applied the palatalization in CCV;

   All other children blocked CCV

What about palatalizing CCV contexts?

G1	1	2	3	4	5	6	7	8	9	10
/tri, dri/ >> [tʃi, dʒi]	100% (18)	0%	0%	23.08% (3)	41.67% (5)	14,29% (1)	80% (8)	0%	0%	20% (1)
/tri, dri/ >> [ti, di]	0%	100% (9)	100% (10)	76.92% (10)	58.33% (10)	85.71% (7)	20% (2)	100% (7)	100% (7)	80% (4)
/tr, dr/ produced	0%	0%	0%	23.08% (3)	0%	0%	0%	0%	0%	0%
Canonical Palat. rule	75%	60%	33.3%	100%	50%	100%	100%	0%	75%	75%

G1	11	12	13	14	15	16 (G2)	17 (G3)	18 (G4)
/tri, dri/ >> [tʃi, dʒi]	12.5% (1)	36.8% (7)	0%	0%	14.29% (1)	75% (12)	83.33% (5)	80% (8)
/tri, dri/ >> [ti, di]	87.5% (7)	63.2% (12)	100% (2)	100% (9)	85.71% (6)	25% (4)	16.67% (1)	20% (2)
/tr, dr/ produced	0%	0%	100% (1)	1.59% (1)	3.7% (2)	41.67% (5)	26.47% (9)	27.5% (11)
Canonical Palat. rule	66.67%	100%	50%	100%	20%	100%	100%	100%

What about palatalizing CCV contexts?

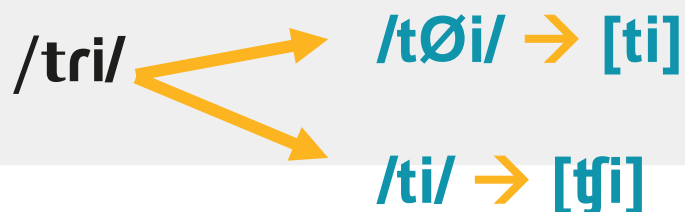o **Palatalization in /tɾi, dɾi/ contexts can be:**
> Blocked;
> Applied;
> Sometimes applied.

→ *Distribution: CCV palatalization ≠ CV palatalization*

→ [tɾi,dɾi] *target articulation did'nt blocked CCV palatalization*

→ **So, sometimes in the outputs of the same child,**

/tɾi/ → /tØi/ → [ti]

/ti/ → [ʧi]

Turning back to our main question

Variability in CCV child outputs:

- Are there patterns in the variability?

Yes!   *Structural patterns*

Developmental patterns

o Repair strategies in CCV starts changing the syllabic structure;

o Then the outputs tend to keep the complex onset structure, with modifications in its segmental content;

o Palatalization in CCV contexts tend to be blocked after G1; in G1, CCV can sometimes be palatalized.

Turning back to our main question

Variability in CCV child outputs:

- What it can reveal about the phonological system in development?

o Repair strategies distribution tend to keep the complex onset structure, modifying its segmental content;

Sometimes a structural change appears in the output;
Sometimes the target output appears.

o Palatalization sometimes apply, sometimes don't;

Variability points to a gradual specification in the Phonology

Structure properties   **Segmental C2 properties**

Future research

◇ To test production, perception and error detection of children;

◇ To test the underspecification in properties as:

      liquid quality;

      plosive PoA;

      structure: CV or CVC;

      phonological neighborhood.

děkuji moc!
[ˈmuj.to.bɾiˈga.dɐ]!

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