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Consonant Harmonies and Acquisition of Natural Classes

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INTRODUCTION

Consonant harmony (CH): definition

- Relatively theory neutral definition from Hansson (2010):

Any assimilatory effect of one consonant on another consonant, or assimilatory co-occurrence restriction holding between two consonants, where:

- the two consonants can be separated by a string of segmental material consisting of at the very least a vowel; and*
- intervening segments, in particular vowels, are not audibly affected by the assimilating property.*

Adult language

Child language

Ineseño Chumash (McCarthy, 2007)

Jul - 01;10 (Yamaguchi et al., 2015)

/ha-s-xintila/ [hasxintila] 'his gentile'

/ʒu/ [zu] 'play'

/ha-s-xintila-waʃ/ [haʃxintilawaʃ] 'his former gentile'

/ʒənu/ [nunu] 'knee'

CH: Typology (from Hansson 2010)

- CH – Place of Articulation
 - CH seems to exist only between two consonants sharing the same major Place of Articulation: Labial, Coronal, Dorsal
- CH – Manner of Articulation
 - CH Stop-Fricative (extremely rare)
 - CH Nasal-Oral (mainly in Bantu languages)
 - CH Lateral-Rhotic (rare)
- CH – Directionality
 - Regressive in the vast majority of cases
- CH – Prosodic structure
 - « ...consonant harmony never interacts with prosodic factors. For example, consonant harmony is never affected by stress, syllable weight or segmental length, and *is never confined to prosodically-defined domains such as the foot.* » (p. 137)

CH: Language acquisition

- CH – Place of Articulation
 - All type attested (frequent)
- CH – Manner of Articulation
 - All type attested (less frequent to rare)
- CH – Directionality
 - For Place of Articulation: in general regressive (Pater, 1997; Rose, 2000; Gerlach 2010) or bidirectional
- CH – Prosodic structure
 - For Place of articulation: Prosody can play a role (Rose et dos Santos, 2006; Gerlach 2010)

CH: Language acquisition

- CH – Prosodic structure: Examples from Rose (2000) and Rose & dos Santos (2006)
 - Clara’s regressive Labial harmony pattern

	Form	Word	IPA target	Child’s output	Age	Gloss
a.	CVCV	chapeau	[ʃapo]	[pæpo]	1;07.06	‘hat’
	CVC	table	[tab]	[tæb]	1;10.04	‘table’
b.	CVCV	café	[kafe]	[pəfe]	1;10.04	‘coffee’
	CVC	cube	[kyb]	[kyb]	1;09.29	‘cube’

CH: Language acquisition

- CH does not seem to be a universal phenomenon (Stoel-Gammon & Stemberger 1994)
 - Some children seem to not produce CH
- Pater & Werle (2003) proposed the same constraint family for taking into account all types of CH : AGREE
- Pater (2002) proposed generalizations for CH of place of articulation
- Nothing is said about CH of manner of articulation (scarce phenomenon)

Acquisition of Natural Classes

- The study of the acquisition of natural classes needs:
 - Longitudinal data
 - To take into account the prosodic position of the segment (onset, coda,...)
 - To select words whose structure restricts the occurrence of possible phonological processes:
 - Assimilation: *train* /tʁɛ̃/ → [kʁɛ̃] ‘train’
 - Harmony: *cadeau* /kadɔ/ → [kako] ‘gift’

CH and Natural Classes

- To the best of our knowledge no studies on CH have combined **ALL** the following methodological criteria:
 - Restriction on the word under scrutiny based on their phonological structure
 - Combined the study of CH with the acquisition of natural classes
 - Using quantitative data for studies on CH **AND** on acquisition of natural classes
 - Study more than one child

References	Collecte	Language	# children	# HC	Selection	Seg. Acqu.
Vihman (1978)	Mixed (several sources)	6 languages	13	347	No	No
Berg (1992)	Diary	German	1	65	No	Qualitative
Goad (1997)	Diary (Smith, 1973)	English	1	?	No	Qualitative
Pater (1997)	Diary (Compton et al., 1977)	English	2	73	No	No
Berg et al. (2000)	Diary (Deville, 1891)	French	1	37	No	No
Pater et al. (2003)	Diary (Compton et al., 1977)	English	1	400	Stops C1(C)V1(C)C2(C)(V)(C)	No
Gormley (2003)	Recordings - Induced prod.	English	1	5 (same word)	No	Yes
Rose et al. (2006)	Recordings – Spontaneous prod.	French	2	317	2 consonants in the same foot or not	Yes
Bat-El (2009)	Recordings – Spontaneous & induced prod.	Hebrew	11	?	Onset-Onset	No

RESEARCH QUESTIONS

Goal:

To combine the study of CH with the acquisition of the consonant system by children → less unexplained variation

Question:

In child production, are all instances of CH part of the same phenomenon ?

Hypothesis

At least, two types of CH

- **‘Filling’** CH: Harmonized consonants belong to natural classes which are **in the process of being acquired** by the child
- **‘Uniformizing’** CH: Consonants are harmonized **because they belong to a different** (but already acquired) **natural class** than other consonants in the same word

Hypothesis: Filling CH

- Filling CH: harmony trigger= an acquired natural class; harmony target = a natural class in the process of being acquired
 - Linked with the **natural class acquisition process** in the child's phonological system (paradigmatic axis)
 - No preferred direction for CH

Hypothesis: Uniformizing CH

- Uniformizing CH: 2 different natural classes (which are already acquired) in the same target word
 - Linked with the **acquisition of a sequence of 2 different natural classes** in the same word (syntagmatic axis)
 - CH feature determined by the harmonizing natural class position → direction always regressive
 - These natural classes are already acquired by the child

METHODOLOGY

Participants

- 4 monolingual French speaking children from the French project PREMS (ANR n°11-BSH2-0009)
- Longitudinal study: 1h video recording at home of parent-child interaction, every two weeks

- Transcription: Phon

	Emm (F)	Bap (M)	Est (M)	Jul (M)
Session start	01;00.08	01;00.27	01;01.03	01;03.01
Session end	02;01.08	02;00.12	02;00.24	02;00.28
# sessions	29	24	21	18
# utterances	4513	4730	1478	3768

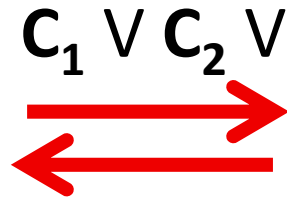
Natural class

Natural classes studied :

- Manner of Articulation (MoA):
 - Stop: /p, t, k, b, d, g/
 - Fricative: /f, s, ʃ, v, z, ʒ/
 - Nasal : /m, n, ŋ/
- Place of Articulation (PoA):
 - Labial : /p, b, f, v, m/
 - Coronal : /t, d, s, z, ʃ, ʒ/
 - Dorsal : /k, g/

Word selection

- For the acquisition of natural classes:
 - CV words
 - C_1 in C_1VC_2 (V) where C_1 and C_2 share the same natural class
- For CH:
 - Only 2 syllable words when there is a CH between the 2 onsets :



- Harmonized **CVC** words were excluded → same prosodic position comparison

Data

- Acquisition of natural classes
 - Number of target consonants: 26252

- CH
 - Number of CH: 556
 - 214 CH of MoA
 - 342 CH of PoA

RESULTS


Acquisition of natural classes

- For all children in onset of $C_1VC_2(V)$ words (where C_1 and C_2 share the same natural class)
 - MoA
 - Stop and Nasal acquired first
 - Fricative acquired later
 - PoA
 - Labial and Coronal acquired first
 - Dorsal acquired later

CH data overview



- MoA (214 CH)
 - 51% of C_1VC_2V words are harmonized (*less target, more frequent*)
 - 72% are regressive CH
- PoA (342 CH)
 - 35% of C_1VC_2V words are harmonized (*more target, less frequent*)
 - 83% are regressive CH
- Directionality results differ when the natural classes at play are taken into account

Filling CH: MoA

- Filling CH occurs when one CH in the word is in the process of being acquired
 - In our case: Fricative
 - Regressive 
 - Progressive 


		Productions			
		Fri-Fri	Stop-Stop	Nas-Nas	#
Target	Fri-Stop	0%	100%	0%	2
	Fri-Nas	33%	0%	67%	3
	Stop-Fri	6%	94%	0%	31
	Nas-Fri	NA	NA	NA	NA

Filling CH: PoA

- Filling CH occurs when one CH in the word is in the process of being acquired
 - In our case: Dorsal
 - Regressive 
 - Progressive 


		Productions			
		Dor-Dor	Lab-Lab	Cor-Cor	#
Target	Dor-Lab	0%	100%	0%	1
	Dor-Cor	11%	0%	89%	125
	Lab-Dor	0%	100%	0%	3
	Cor-Dor	40%	0%	60%	5

Uniformizing CH: MoA

- Uniformizing CH occurs when two different and already acquired natural classes are present in the word
 - In our case: Nasal and Stop
 - Regressive 

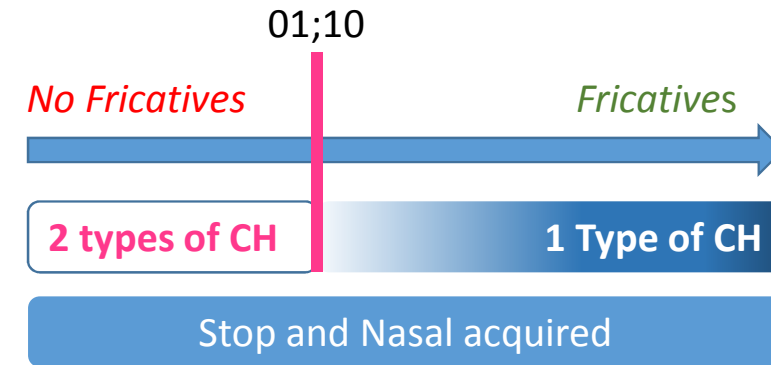
		Productions		
		Nas-Nas	Stop-Stop	#
Target	Nas-Stop	0%	100%	91
	Stop-Nas	97%	3%	37

Uniformizing CH: PoA

- Uniformizing CH occurs when two different and already acquired natural classes are present in the word
 - In our case: Labial and Coronal
 - Regressive 

		Productions		
		Cor-Cor	Lab-Lab	Nb
Target	Cor-Lab	5%	95%	87
	Lab-Cor	72%	28%	46

Results: summary



- Two types of CH occurring at one point in time (*e.g.* 1;06)
 - When one natural class is not acquired, it is replaced by the natural class of the other consonant → Filling CH
 - Directionality determined by the position of the consonant whose natural class is not yet fully acquired
 - Here: Fricative and Dorsal are in the process of being acquired
 - When the natural classes of the two consonants are already acquired, before the child masters the production of a sequence of two different consonants → Uniformizing CH
 - Directionality is regressive like in adult language
 - Here: Stop and Nasal / Labial and Coronal

DISCUSSION

Methodological issues



- Avoid putting apples and oranges together:
 - Limit the number of possible other processes than the one at stake
 - Strict criteria for word inclusion in the study
 - Knowledge of the development of the child's phonological system taking into account prosodic position
- Less data to analyze but emergence of (quite) clear patterns
 - CH of MoA more frequent than CH of PoA
 - Directionality depends on the acquisition or not of the natural classes of the target word → progressive CH are not exceptions

Future directions

- to strengthen the hypothesis
 - Need data from more children
 - Add **CVC words** in the analysis (different prosodic structure)
 - Final consonant development
 - Predictions: find filling and uniformizing CH as well
 - Duplicate the study with another language (English?)
- Compare closely **uniformizing CH** with **adult CH** (regressive or anticipatory CH)

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Thank you for your attention!

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