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Learning paths in phonology

Evidence from the CLPF database

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Introduction

- Many phenomena have been investigated in isolation
  - Acquisition of PoA
  - Acquisition of MoA
  - Acquisition of syllable structure
  - etc.
- Variation in development both in time and pathways for each of the phenomena
- But are these connected?

Outline

- Introduction
- Target language: Dutch
    - Syllables, Manner of Articulation, Sonority
- Child language: developmental paths
    - MoA, Clusters, Syllables
- Discussion and Conclusions

Different learning paths: examples

- Consonant clusters

- All children start reducing clusters typically to the least sonorant consonant
    - Example: /blum/ > [bum]

- The next step varies for different children:

- Some children produce the cluster correctly (end state): /blum/ > [blum]

Different learning paths: examples

- But some children have intermediate steps
  - CG: /blum/ > [bjum] (max contrast within onset)
  - [C-Son]$_{PoA}$: /blum/ > /bʊum/
  - L: /blum/ > [lum]
  - CvL: /blum/ > [bəlum]
- All roads lead to Rome

Questions

- Is the pathway chosen dependent on other developments?
- Do children who have PoA harmony within clusters also have more harmony otherwise in their system?
- Do children who chose a maximal contrast in onset clusters also show evidence for maximal contrasts in the development of other parts of the system?
- Do children who have L as an in-between-strategy also show more deletion as a solution for ‘difficult’ sound sequences?
- We have started investigating these questions related to MoA, syllable structure and word prosody, where dependency relations are likely to occur.

MoA, Sonority, syllable structure

- Sonority Sequencing Principle: P > F > N > L > G > V
- Onsets: preferably least sonorous
- Rhymes: preferably most sonorous
- Ideal syllable: CV: Plosive - Vowel
- Syllable contact law:
  - C.C: some sonority distance is preferred (required in many languages) (Cson.Cobst), although Dutch also allows CVC$_{obst}$.C$_{obst}$V (*pasta, klooster*)
  - Word endings: contact law not applicable; extra position for coronal obstruents

Syllables and MoA

Target language

Manner of articulation

- Dutch allows:

- Plosives (P): p b t d k
- Fricatives (F): f v s z χ
- Nasals (N): m n ŋ
- Liquids (L): l r
- Glides (G): j ʋ

Syllables

- Onsets: (s)(C_{obst})(L)
- Rhymes: VV, V(V)C_{son}, V(V)C_{obst}, V(V)$C_{son}C_{obst}$
  - Nucleus: maximally two positions: VV or VC_{son}
  - Coda: one position
  - Rhymes minimally are bipositional (*CV)
- Extrasyllabic position: in word-final position rhymes may be followed by an appendix with (one or two) coronal obstruents

Words

- The majority of words in Dutch consist of one or two syllables
- Most disyllabic words are trochaic

All data come from the CLPF Database

- Data from 12 Dutch children (6 in Groningen, 6 in Leiden)
- Aged between 1;0 and 2;0 at the start of a one-year-period of data collection
- Recordings bi-monthly at the children's homes (30-45 min)

Manner of Articulation

- **Method**:

(a) Onsets in isolation

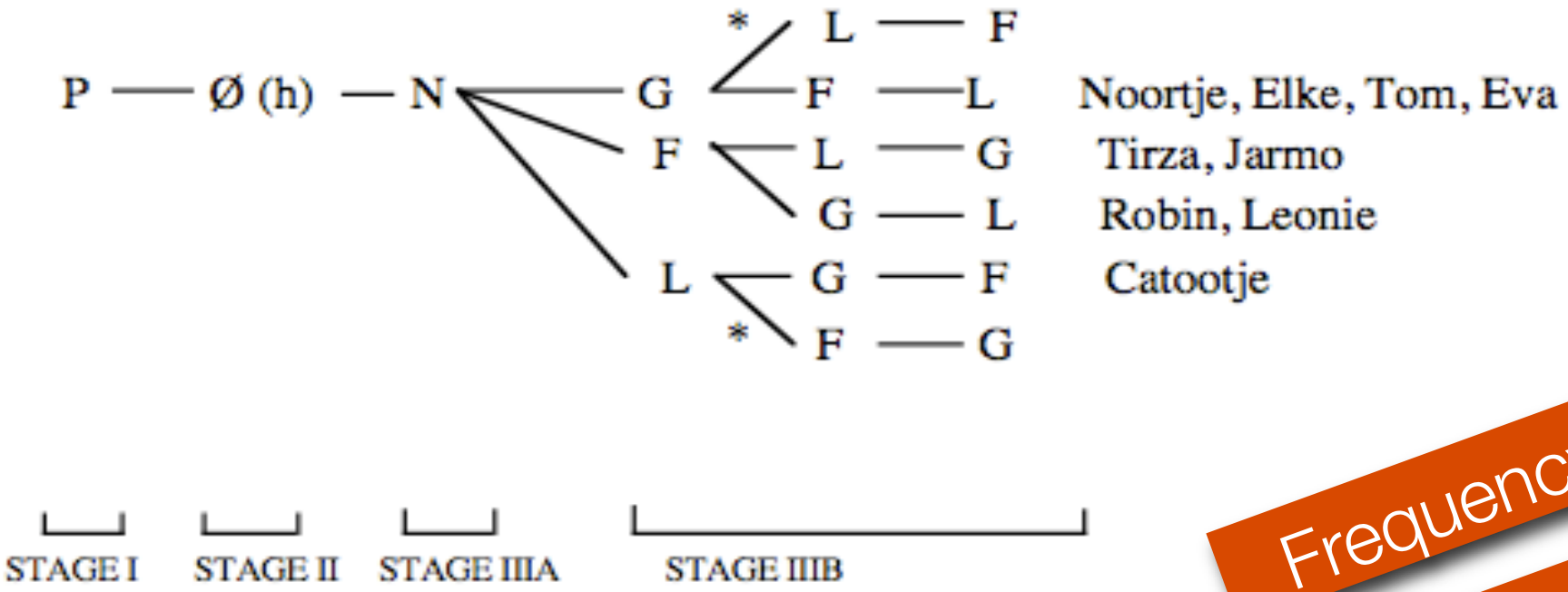
(b) Codas in isolation

(c) Word patterns: Selection of monosyllabic CVC- and trochaic CVCV-nouns resulted in 2122 CVC and 1030 CVCV words

- Every consonant was coded for its MoA: P (stop), F (fricative), N (nasal), L (liquid), G (glide)

- Only the 'youngest' chidren: Elke, Jarmo, Robin, Tom, Eva and Noortje

Developmental paths of word onsets

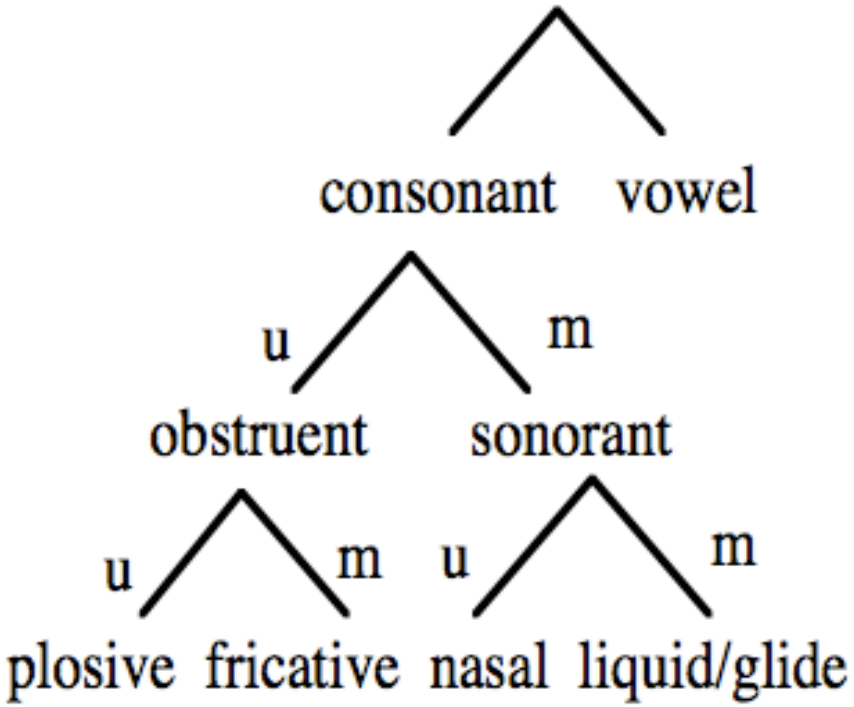


Frequency?

Sonority?

Based on all word-initial onsets (including CV words)
Essentially only based on stressed syllables

Markedness in onsets (MoA)



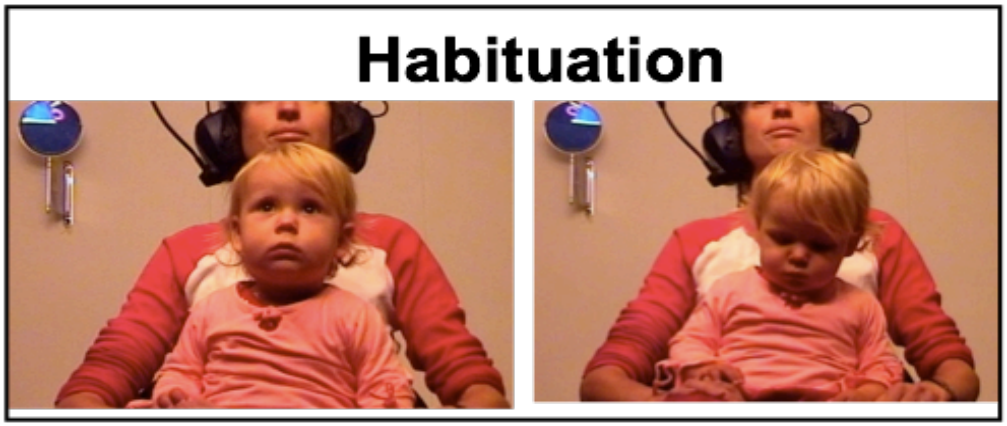
where u = unmarked, m = marked

Least marked stop and least marked sonorant

Perception

- In word learning and word comprehension tasks it seems indeed that plosives are the default (unmarked; unspecified) MoA
- A MP from unmarked stop to marked fricative is not noticed
    - boom ‘tree’ produced as ‘voom’ is not noticed (equal looking times)
- A MP from marked fricative to unmarked stop is noticed
    - vis ‘fish’ produced as ‘bis’ is noticed (shorter looking times to picture)
- Currently we are testing MP from stop to nasal and vice versa.

Perception methods



Markedness in representation (Perception)

- Explanation:
- Only marked features are present in the UR
- All features are perceived (in SR): features must be mapped onto UR
- Mismatch between perceived and stored features excludes the word for recognition.
- Mismatches only possible with marked features. Unmarked features are not present, and hence always lead to a No Mismatch.

Markedness in representation (Production)

- Only marked features are present in the UR
- Children may delete marked features, resulting in less marked productions, but do not often add features (more marked representations)
- Hence, fricatives may be produced as stops, but not vice versa.

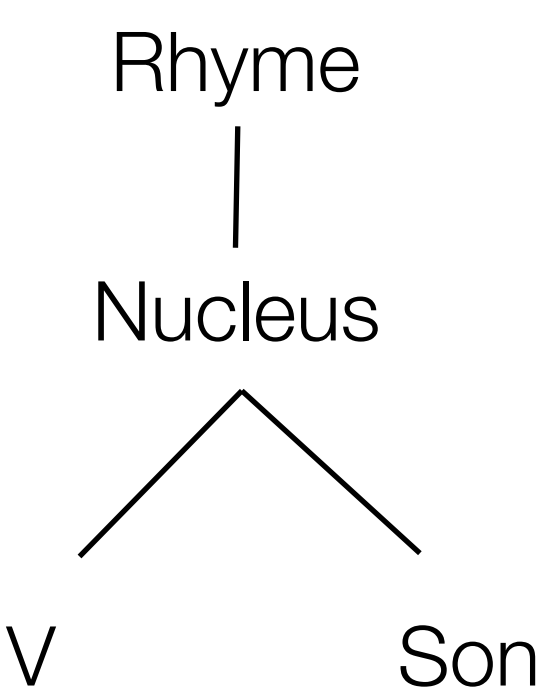
Order of acquisition of Manner of Articulation in word offsets

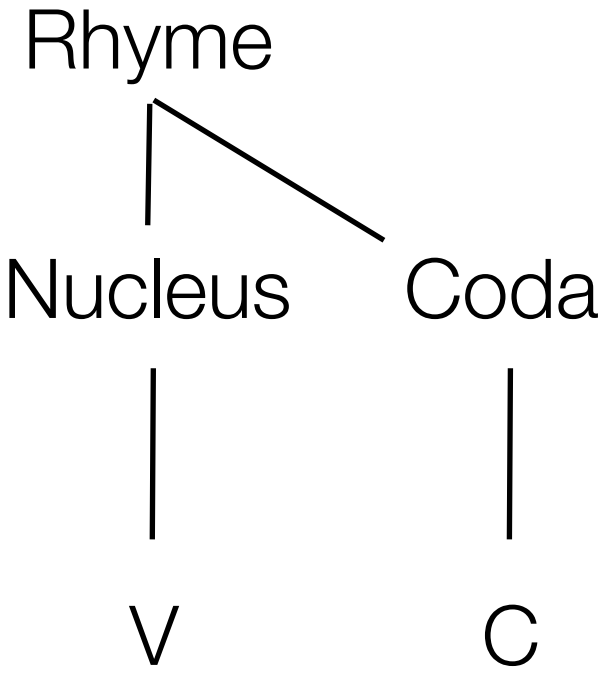
- Final position: all children start with a (default) obstruent
- For some children this is the stop, but many prefer a fricative in word final position.
  - Those children show the typical error pattern: plosives produced as fricatives. They all usually produce plosives as well, but PVF is more frequent
  - Example: Elke's first recording session
    - 15 target plosives realized as fricatives (7), plosives (5), deleted (3)
    - 9 target fricatives: all realized as fricatives

Why obstruents? Against typology?

- All children first have obstruents, and only later nasals
- Universality? Many languages have restrictions as to what can occur in postvocalic position. Usually, if a language allows obstruents, it also allows sonorants, but not vice versa.
- Why obstruents acquired early for Dutch?
  - Very frequent in CVC words.
  - Difference between consonants in branching nucleus (always sonorants), and consonants in codas (can be both)
  - Codas are acquired first
  - Branching nuclei are acquired later (with VL contrasts)

Rhyme structure





CVC Word patterns

- Predominantly PVF words in the early stages for PVF targets and PVP targets. Markedness? No MoA contrast yet: obstruents are plosive in onsets and fricatives in codas (complementary distribution; allophones): OVO

- At this stage unfaithful manners are observed: target nasals and liquids may be produced as obstruents. Later unfaithfulness becomes rare

- Some children have a subsequent stage in which the two C's of the word have the same MoA: one MoA per word for Consonants

  - Example: Elke's second stage: FVF > NVN > PVP

- Subsequently, different MoA features appear in her words: PV**F** and PV**P**: Faithful productions of both stops and fricatives.

- Some children introduce MoA contrast first in initial position; others in final position (Noortje en Robin)

Some children start introducing contrasts in offsets

- Initial position remains fixed; final position varies

Noortje and Robin

C1=C2	C2=stop	C2=fricative	C2=nasal
C1=stop	PVP	PVF	PVN
C1=fricative	FVP	FVF	FVN
C1=nasal	NVP	NVF	NVN

Some children start introducing contrasts in onsets

- Final position remains fixed; initial position varies

C1=C2	C2=stop	C2=fricative	C2=nasal
C1=stop	PVP	PVF	PVN
C1=fricative	FVP	FVF	FVN
C1=nasal	NVP	NVF	NVN

Order of acquisition of MoA

- Most children acquire MoA contrast in initial position before they acquire the contrast in final position

- Noortje and Robin introduce the contrast in final position.

Onset Clusters

- Two types

- Clusters obeying the sonority sequencing hierarchy (Obstruent - Sonorant)

- Clusters disobeying the sonority sequencing hierarchy (s-Obstruent)

Onset clusters (1): Obstruent - Sonorant

- Dutch allows the following onset clusters:

c1 / c2	p	b	t	d	k	f	v	s	z	x
m								x		
n					x			x		
l	x	x			x	x	x	x		x
r	x	x	x	x	x	x	x			x
ʊ			x	x	x				x	
j										

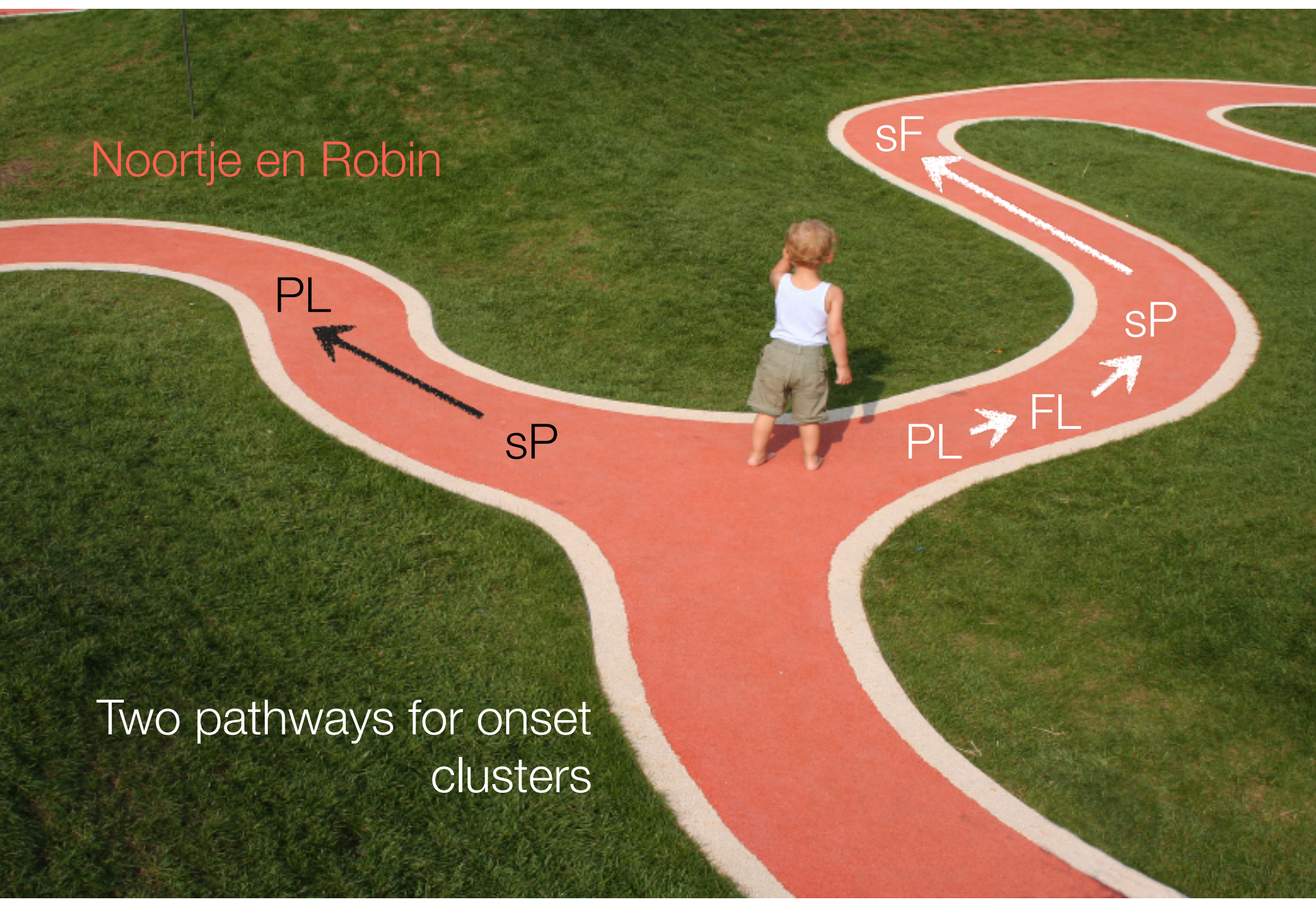
Onset clusters (2): /s/+obstruent

- Dutch allows the following combinations

c1 \ c2		s
p	(r/l)	x
t	(r)	x
k		
f		
s		
χ	(r)	x

Generalizations

- /s/ plus voiceless stop
- If stop can be followed by a sonorant, this can be combined with /s/
- /k/ is replaced by /χ/ (historical change)
- /sχl/ is not allowed


Noortje en Robin
sF
PL
sP
sP
PL
FL
Two pathways for onset clusters

Some data (Robin): Obstruent-Sonorant

- plukken ‘pick’
  - [pykə] (1;10.20)
    - [pœkə] (2;03.21)
- slapen ‘sleep’
  - [patə] (1;7.26)
  - [sapə] (2;04.28)
- brood ‘bread’
  - [pot] (1;08.09)
  - [bot] (2;03.21)

Some data (Robin): /s/-Obstruent

- schoen ‘shoe’
  - [pum] (1;7.12)
  - [sɔnə] (1;10.06)
- stoel ‘chair’
  - [tu] (1;08.09)
  - [stu] (2;03.21)
- speeltuin ‘playground’
  - [pitœyn] (1;11.06)
  - [speltœyn] (2;03.21)

Complex offsets

- Two types
  - Sonorant-Obstruent
    - hand, eend, etc.
  - Obstruent-Obstruent
    - kast, dicht, etc.

Offset clusters

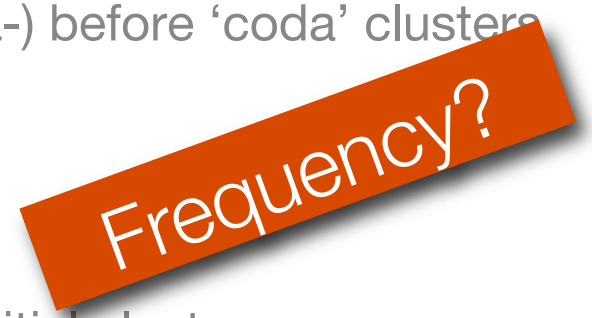
- Two possible acquisition orders:
- - NC > - CC
    - Robin, Noortje, Catootje, Tirza and Eva
- - CC > - NC
    - Leonie, Tom, Jarmo and Elke
- Here, there seems to be a lot of variation. Why?

Rhymes

- Some children allow all sonorants to occur in nucleus: for example Jarmo.
    - Compensatory lengthening: If liquid is deleted, the vowel is often lengthened or diphthongized
    - Sonorants are acquired late, and are dependent on vowel length acquisition
- But some children do not, such as Robin: nasals seem part of coda (not nucleus). Robin acquires nasals early in coda position
- Also word medial N.C clusters are acquired early by Robin
- These children seem to end up with different syllable structures

Coda clusters

- Robin and Noortje acquire ‘coda’ clusters earlier than onset clusters
  - -NC > -CC > sC-
- Leonie, Tom, Jarmo and Elke acquire onset clusters (CL-) before ‘coda’ clusters
  - CL- > -CC > -NC
- Catootje, Tirza and Eva also have final clusters before initial clusters
  - -NC > -CC > CL- > sC-



Correlations?

- Is it the case that children who introduce MoA in initial position have initial clusters before final clusters?
- And do children who introduce contrast in final position have final clusters first?
- Preliminary analysis suggests this, but exact analysis depends on
  - whether you take all child's production into account (including unfaithful productions)
  - focus on first faithful realizations

Noortje and Robin

- Add MoA contrast in word-final position first
- Have final clusters before initial clusters

They also:

- Have N-Obstruent before Obstruent-obstruent clusters in final position
- Have s-Obstruent clusters before Obstruent-Liquid-clusters
- What do these facts have in common? Are they related?

???

Beyond CV

- Noortje and Robin seem to build on a stable, more or less fixed CV pattern to which new structure is added
- CV + C, where MoA contrast are introduced in the final C
    - Giving rise to a onset-nucleus-coda syllable
- When final clusters are introduced, the peripheral consonant is in the appendix
- After the final appendix has been acquired, this seems to trigger the developement of word initial s + CV cluster: where the appendix is at the word beginning

Discussion

- In general, the following generalization holds: if a child has sC- clusters then s/he also has final consonant clusters
- What do sC-clusters and final consonant clusters have in common?
    - extrasyllabic position: knowledge of extrasyllabic position enhances the acquisition of sC-clusters
    - sC- and CL- acquisition not related
    - CL- acquisition not related to final cluster acquisition
- Correlation with morphology? Too few cases in database
- Correlation with initial unstressed syllables? Not clear

Many questions:

- How can we exploit longitudinal databases/Phonbank to find correlations among different phenomena?
- How many data/children do we need to discover possible learning paths?
- Or do we use the database to build hypotheses and test them experimentally?

Thank you!