

Vocabulary growth and developmental expansion of types of phonological knowledge

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Introduction — (at least) 2 phonological encodings

1. **Episodic memory traces** of very fine-grained parametric representations, are supported by **indexical effects**, such as:
 - Words produced by voices that match perceived gender of concurrent face are repeated more quickly (Strand, 2000).and by **token frequency effects**, such as:
 - Higher-frequency words are shorter and more reduced (e.g. Jurafsky, Bell, & Girand, 2002).
2. **Coarser-grained representations** in terms of variables such as /i/, /k/, [dorsal], V, C, σ , and ω are supported by **type frequency effects**, such as:
 - Words made of high-probability diphones are repeated more slowly, but non-words made of high-probability diphones are repeated more quickly (Vitevich & Luce, 1999).

allomorphic
generalizations

{3sg}+[ked3]_{V[-past]}

[ked3]_N+{PL}

phonological
grammar

..[']dʒɪz]_ω
[é]_{μμ}
F[k_{V[-back]}..]
..ék]_ω
N_[count]

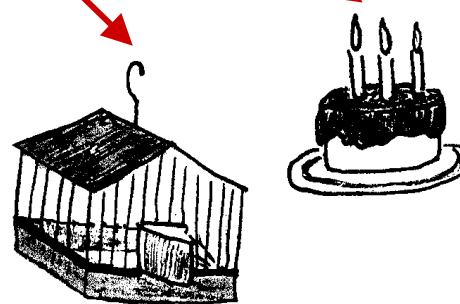
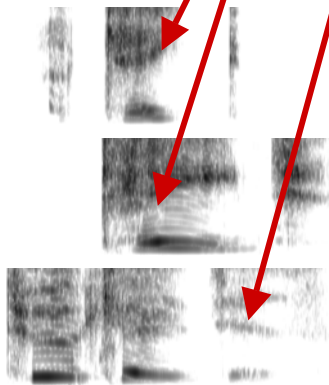
lexemes

{cake}

{cages}

lemmas

parametric
phonetic
representations



real world semantics

The phonology provides a “ladder of abstractions” (Pierrehumbert, 2003), with both finer-grained and coarser-grained encodings of word-forms.

Positing the more abstract encoding in addition to the primary encoding in the parametric phonetic space ...

- is consistent with individual differences in behavior on rating of “word-likeness” of non-words:
 - Non-words made of low-probability phoneme sequences are judged to be less word-like (Frisch, Large, & Pisoni, 2000).
 - Probabilities of stimuli at the threshold point for lowest word-likeness rating by different subjects correlates with the estimated sizes of the individual vocabularies (Frisch, Large, Zawaydeh, & Pisoni, 2001).
- predicts a potential dissociation in the emergence of the two types of representation in phonological development:
 - Munson, Kurtz, & Windsor (submitted) use the Frisch et al. (2000) stimuli in a non-word repetition task to study SLI.
 - Munson, Edwards, & Beckman (in press) use similar stimuli in the same task to study PD.

Specific Language Impairment (SLI)

- A syndrome of delayed or deficit development of general language development in the absence of mental retardation, hearing impairment, or any other neurological or perceptual deficits otherwise known to be associated with language impairment.
- Assessed using tests of mean length of utterance, knowledge of vocabulary knowledge, productive morphology, syntactic processing, etc., such as the *Clinical Evaluation of Language Fundamentals* (CELF-3, Shames, Wiig, & Secord, 1997).
- Children with SLI have difficulty acquiring new words in both structured and implicit word-learning tasks (e.g., Dollaghan, 1997), and they often also have small vocabularies for their chronological age. Therefore, ...
- their phonological generalizations, as assessed on tasks like the one used by Frisch et al. (2000), should be less robust.

Method (Munson, Kurtz, & Windsor, submitted)

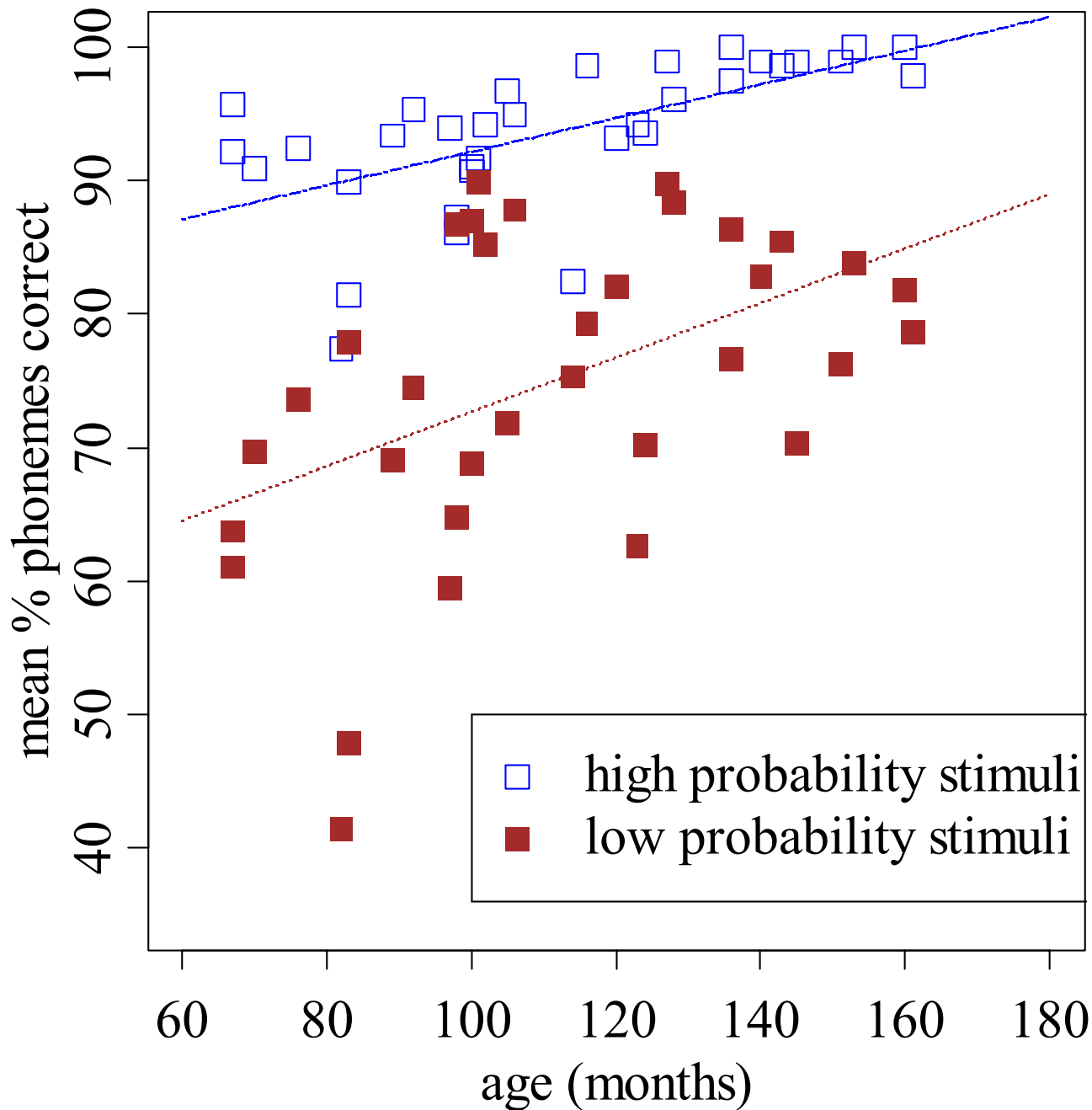
- Non-word repetition task with children using a subset of three- and four-syllable stimuli from Frisch, Large & Pisoni (2000):

<u>high-probability</u>		versus	<u>low-probability</u>	
hesələm	hesəsanət		zuweðus	zufetʃouθɛd
mesəʃem	kisətaləm		gufeged	vufætʃəʒəʃ
...

- Participants were 16 children with SLI, aged 8-13 years; a group of chronological age peers with typical development; a group of younger children matched for vocabulary size.
- Presented digitized recordings to the children, who were asked to repeat the “funny made-up words”.
- Productions were labeled at the level of a careful broad phonetic transcription by a trained phonetician.
- Transcriptions used to score each response for the percent of phonemes correctly repeated.

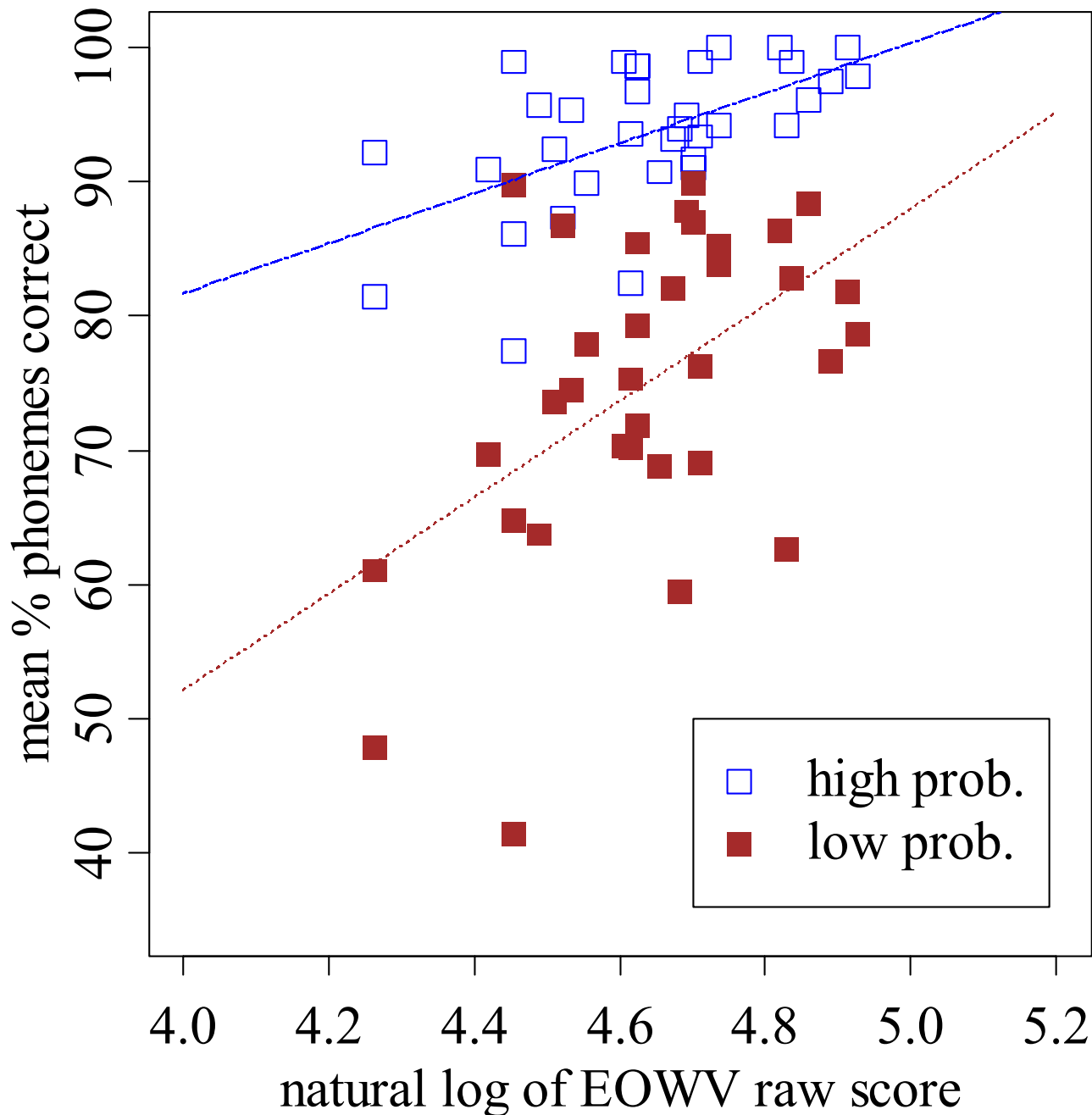
Comparing the two control groups

Overall accuracy and phonotactic probability effect were correlated with age; younger children were both less accurate overall and relatively less accurate on low probability stimuli.



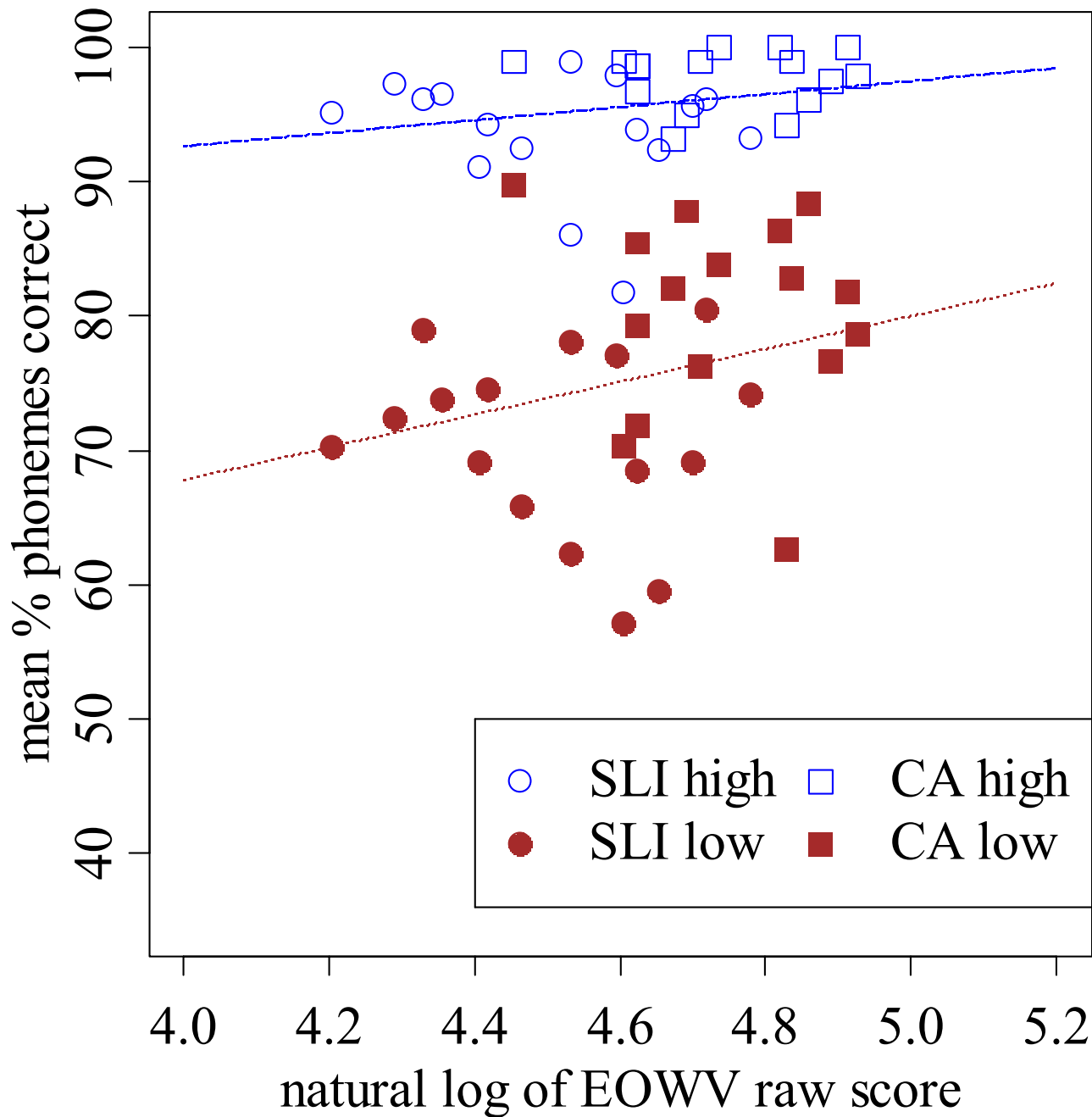
Comparing the two control groups (cont.)

However, age was less predictive than the number of words that the child knows, as measured on standardized tests of expressive vocabulary size (here) and of perceptual vocabulary size.



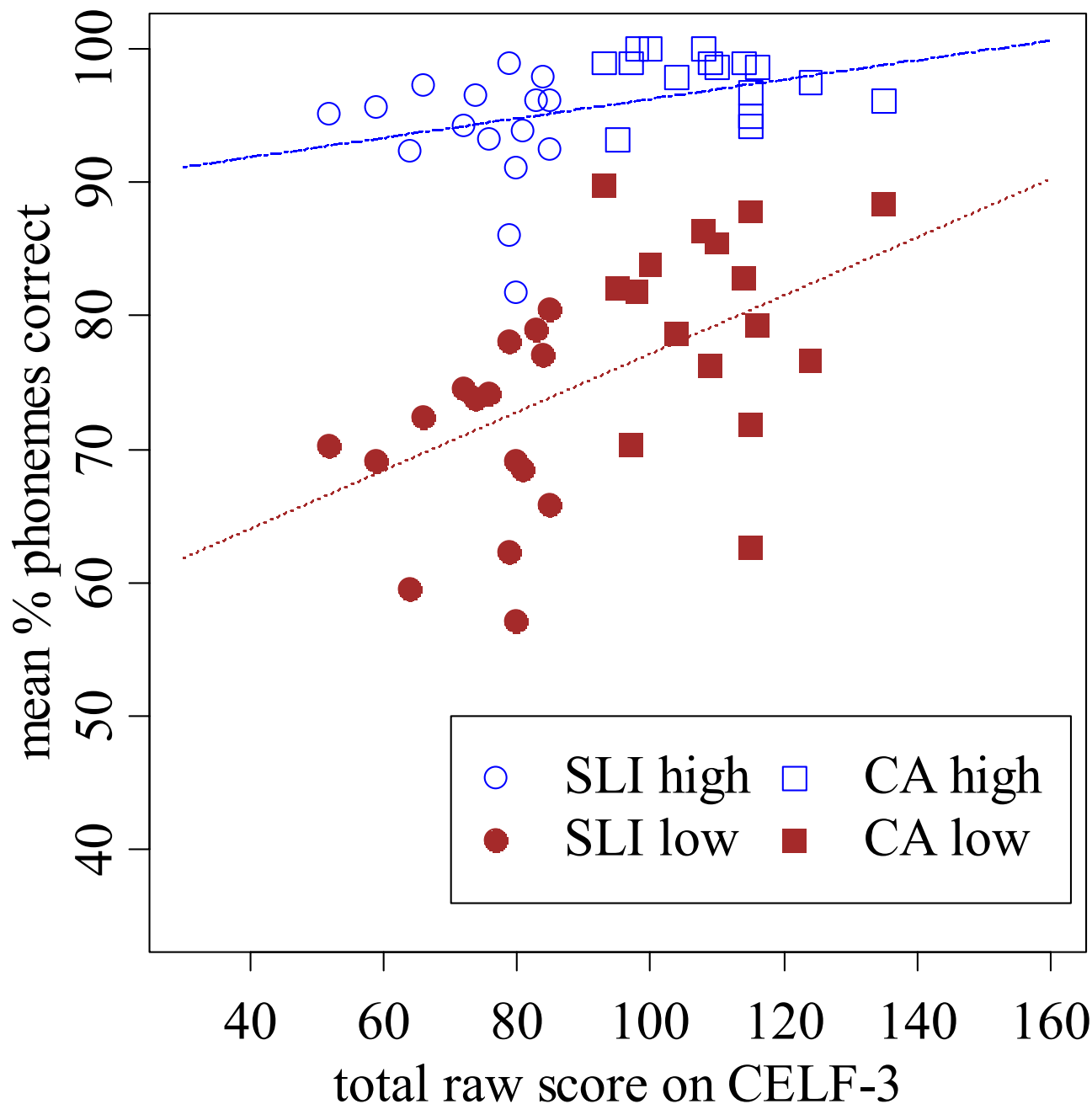
Effect of Specific Language Impairment

When compared with their chronological age peers (CA), the 16 children with SLI (who tend to have smaller vocabularies) showed more of a difference between forms made of high- vs. low-probability sequences.



SLI (cont.)

Overall performance on the CELF-3 test (which measures non-phonological grammatical skills, as well) was an even better predictor of the differences in effect of phonotactic probability between the two groups.



Phonological disorder (PD)

- A syndrome of habitual age-inappropriate mis-articulation in the absence of hearing impairment, cleft palate, or any other gross problems associated with delayed onset of speech.
- Assessed using tests such as the *Goldman-Fristoe Test of Articulation* (GFTA; Goldman & Fristoe, 1986), a picture-naming task that samples each of the consonants of English once in word-initial, medial, and final position.

Example misarticulations from Isermann (2001)

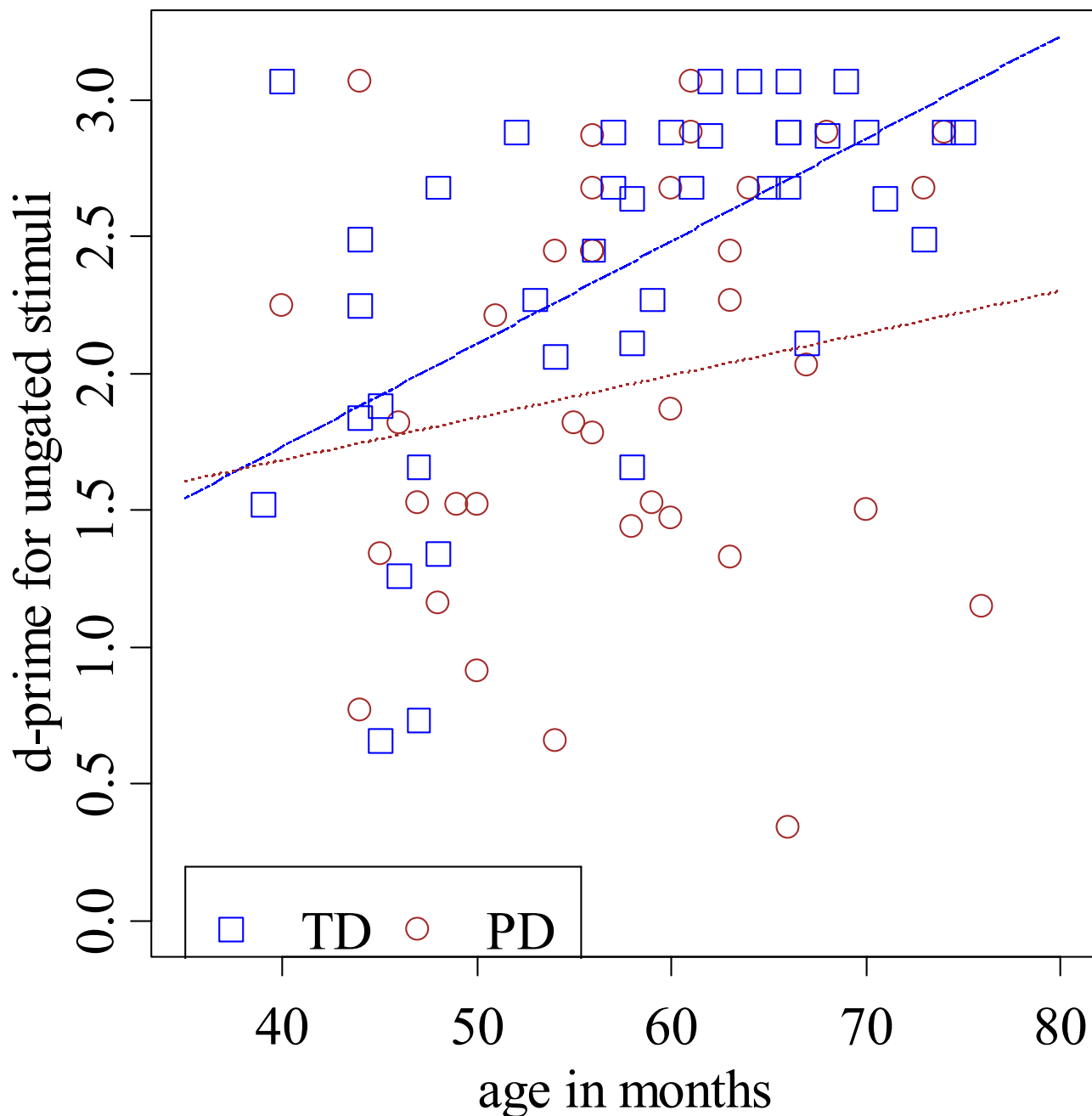
error type	target form	error	ID	sex	(yr; mo)
“stopping”	<i>socks</i> /saks/	[dat ^h]	p137	M	4;4
	<i>sheep</i> /ʃip/	[ti]	p112	F	5;4
	<i>cheeze</i> /tʃiz/	[ki]	p103	F	5;9
“fronting”	<i>cake</i> /keɪk/	[teɪk]	p106	F	5;7
	<i>brush</i> /brʌʃ/	[bwʌs]	p106		
	<i>shoe</i> /ʃu/	[su]	p124	M	4;11

Comparing younger speakers to children with PD

- Substitution errors produced by many children with PD are like younger children with TD in showing non-perceptible but measurable distinctions (“covert contrast”) from target productions of the substituted sound:
 - e.g., Macken & Barton (1980) and Scobbie et al. (2000) for voicing errors; Baum & McNutt (1990) for “fronting” of /s/ to [θ]; Gibbon (1990) and White (2001) for “velar fronting”
- Speech perception by many children with PD is like perception by younger children with TD in being less robust in difficult listening conditions, such as gated presentation (Walley, 1988).
 - Edwards, Fox, & Rogers (2002) compared 40 children with PD, aged 3 to 6 years, and TD age peers on forced-choice identification of *cap* vs. *cat* and *tap* vs. *tack* in three gates (1) digitized whole word, (2) final stop burst removed, (3) /æ/ truncated to have no F2 transition into stop.

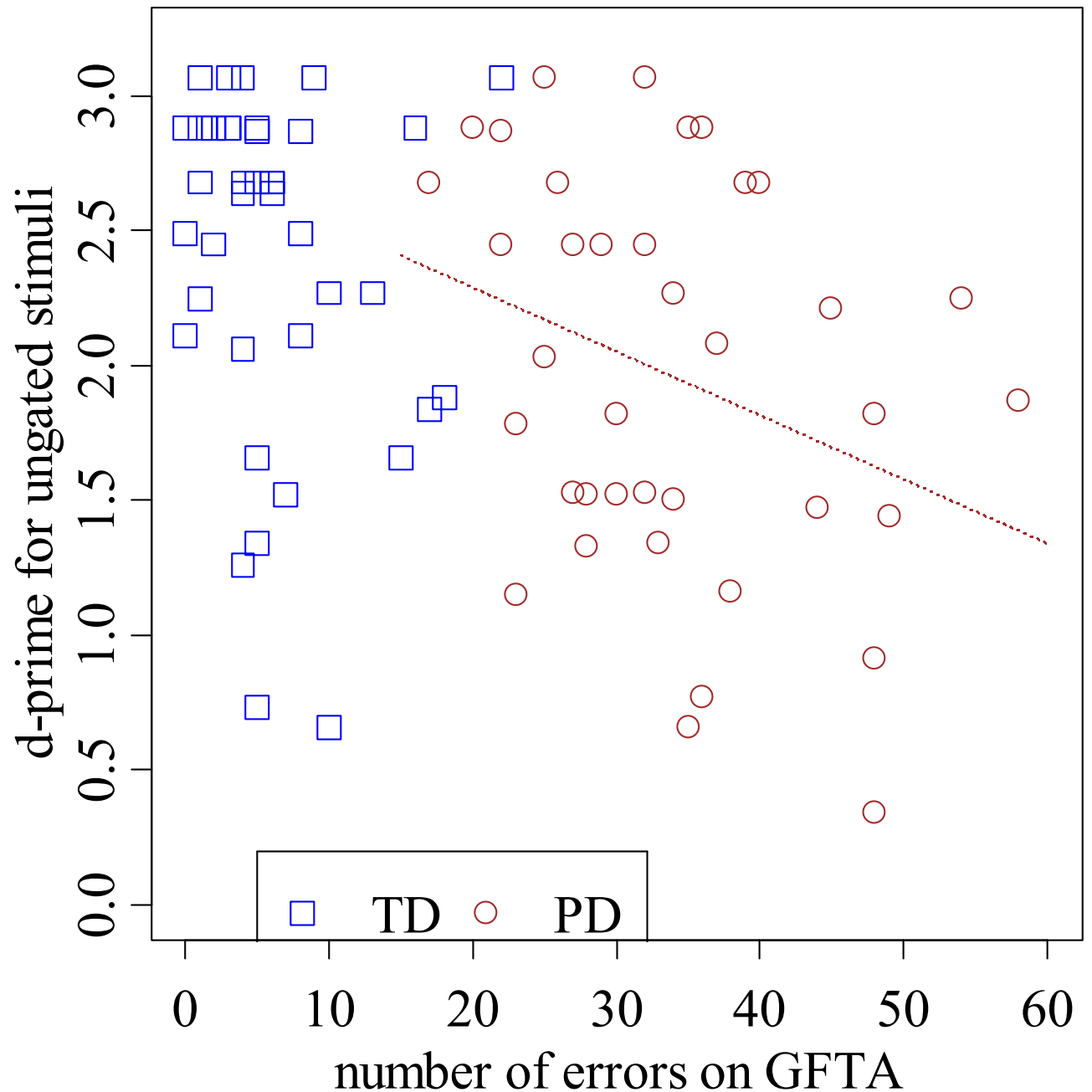
Development of parametric representations

Younger children with TD were less accurate than older children with TD at identifying the final stop even in the whole-word condition; children with PD were less accurate than age peers with TD.



Perceptual deficits in PD

Within the PD group, severity of PD (as measured by number of errors on GFTA), rather than age, was a significant predictor of perceptual accuracy.

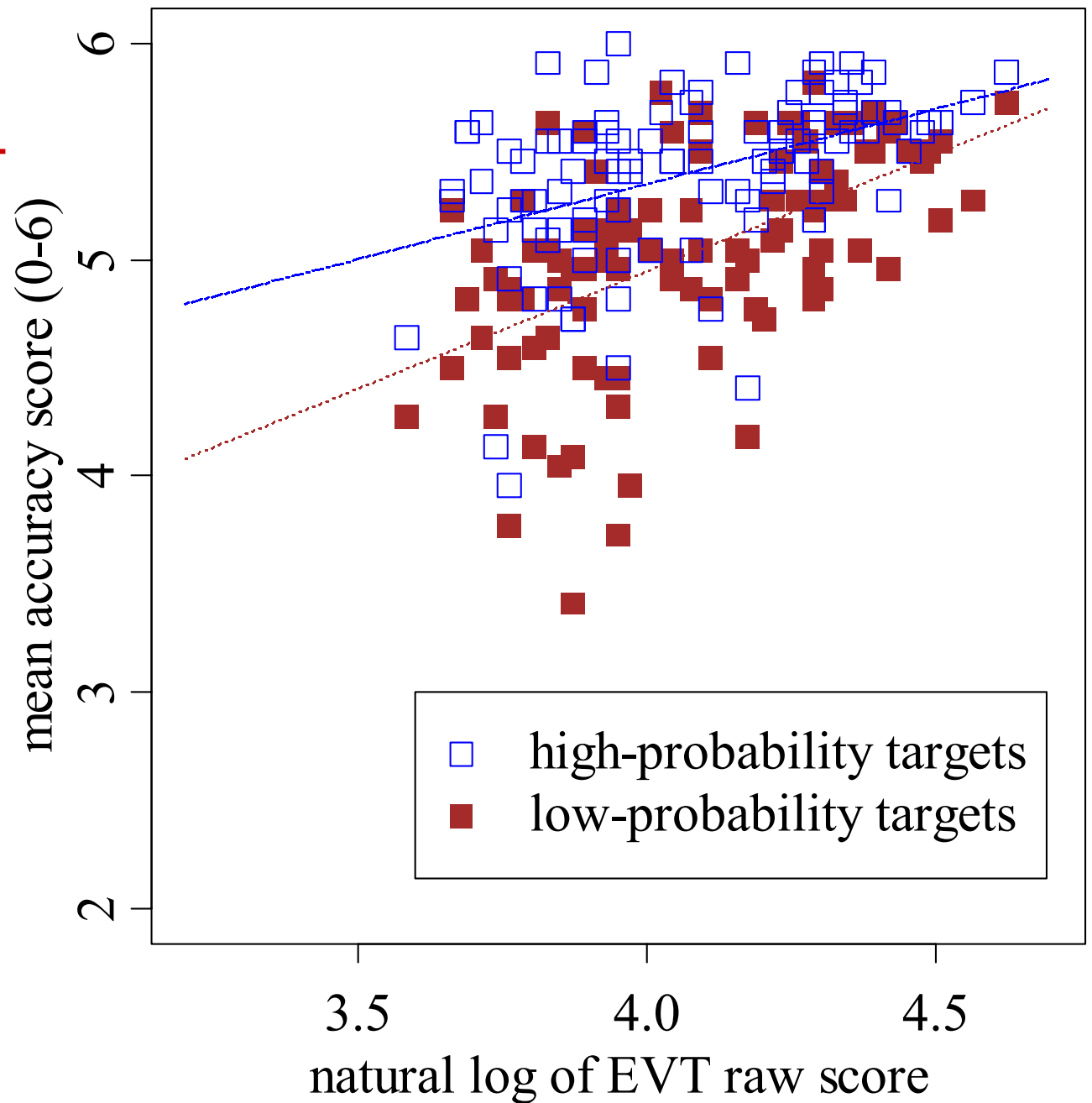


Method (Edwards et al., 2004; Munson et al., in press)

- In order to use non-word repetition with even younger children, devised pairs of two- and three-syllable stimuli where:
 - one member of each pair contained a high frequency target sequence: e.g., /æɡ/ in /bedæɡ/; /mæ/ in /mæbɛp/
 - other member of each pair contained a low frequency target sequence: e.g., /uɡ/ in /donuɡ/; /moɪ/ in /moɪpəd/
- Presented digitized recordings to the 40 children with PD and to 104 children with TD aged 3 to 8 (including 40 age peers).
- Productions were labeled at the level of a careful broad phonetic transcription by a trained phonetician.
- Transcriptions of targets used to score each phoneme on a three-point scale:
 - consonants: 1 point each for correct place, voice, manner
 - vowels: 1 point each for front/back, height, tense/laxmaking a total of 6 possible points per target sequence.

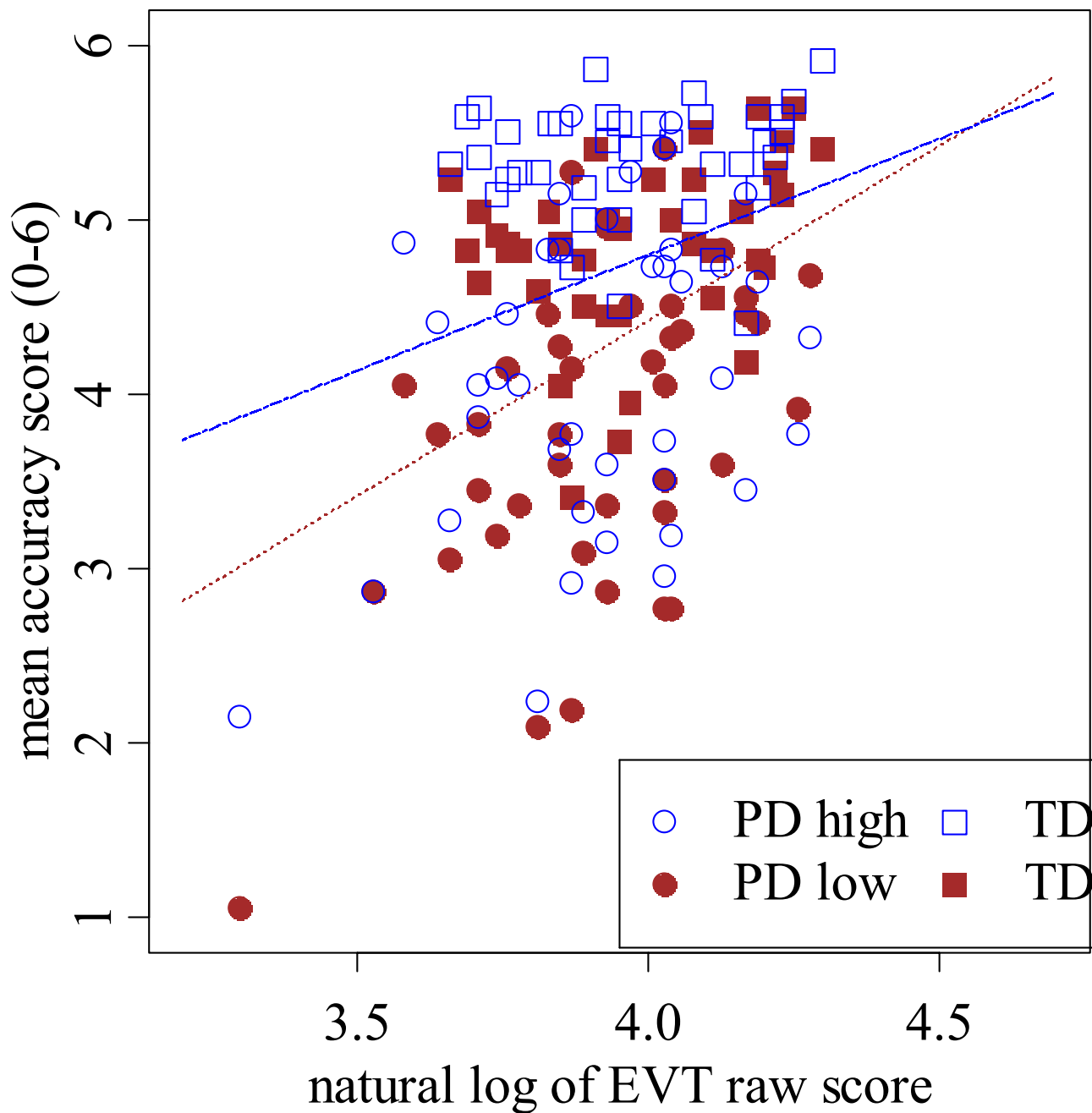
Edwards et al.
(2004)

Overall accuracy and phonotactic probability effect were related to size of expressive vocabulary in the 104 children with TD aged 3-8 years; children who know fewer words were relatively less accurate on low probability targets.



Munson et al. (in press)

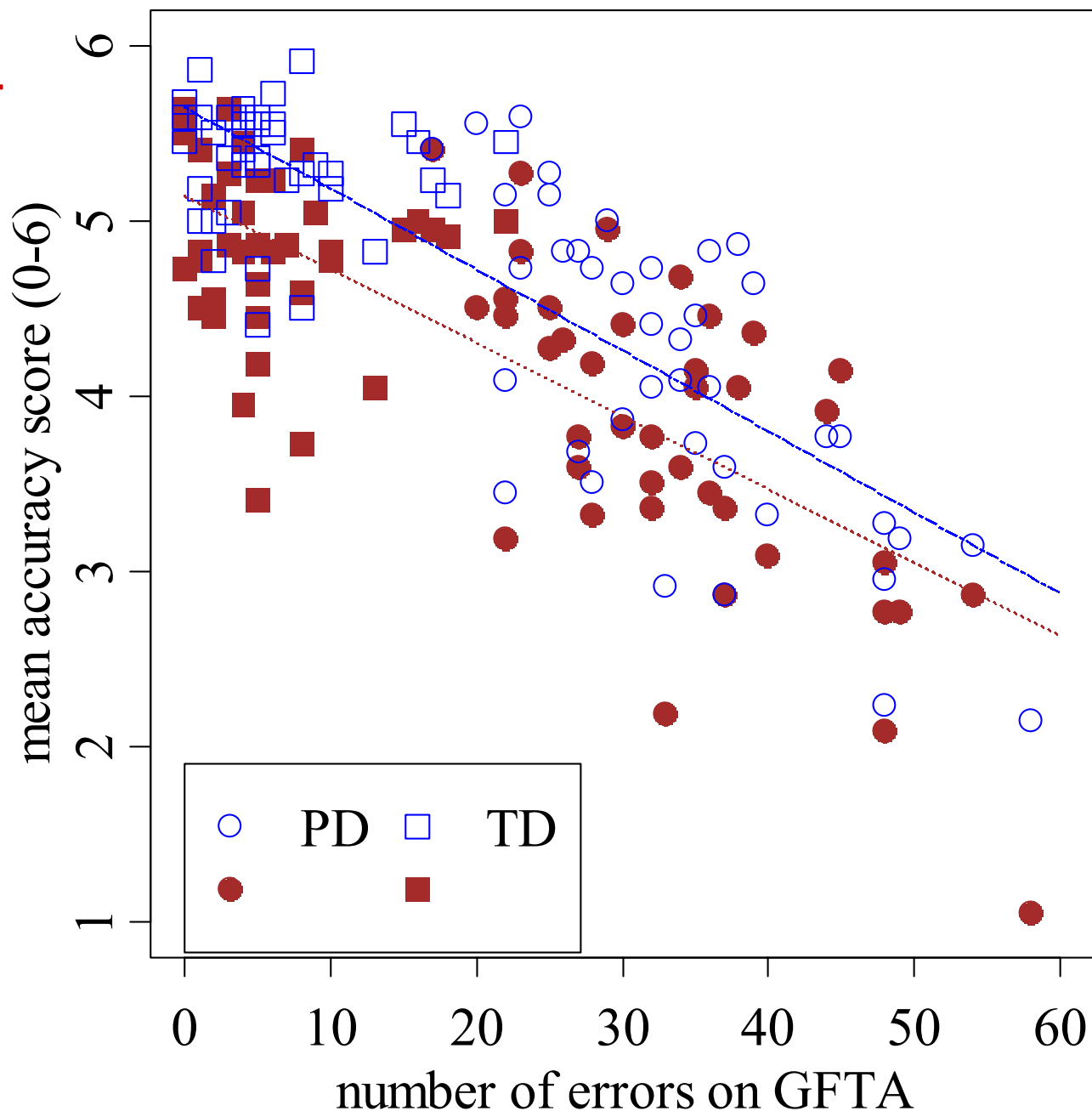
Although there was more scatter because PD children were less accurate overall, the relationship of vocabulary size and phonotactic probability effect was replicated in the group of children with PD and their age matches.



PD vs. SLI

However, while overall accuracy was related to severity of disorder, the phonotactic probability effect was not related.

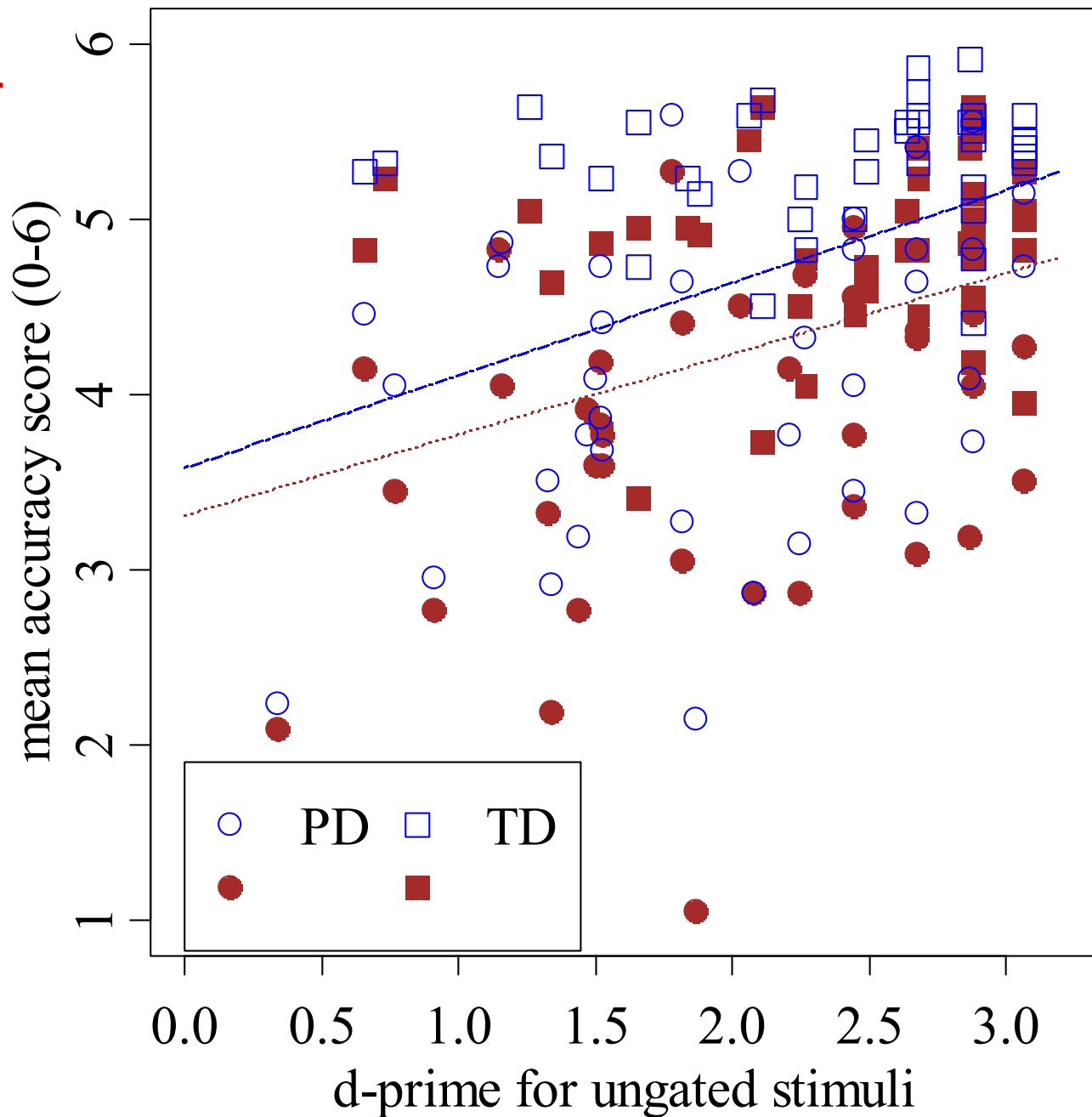
Unlike SLI, PD is not usually associated with word-learning difficulties or smaller vocabularies.



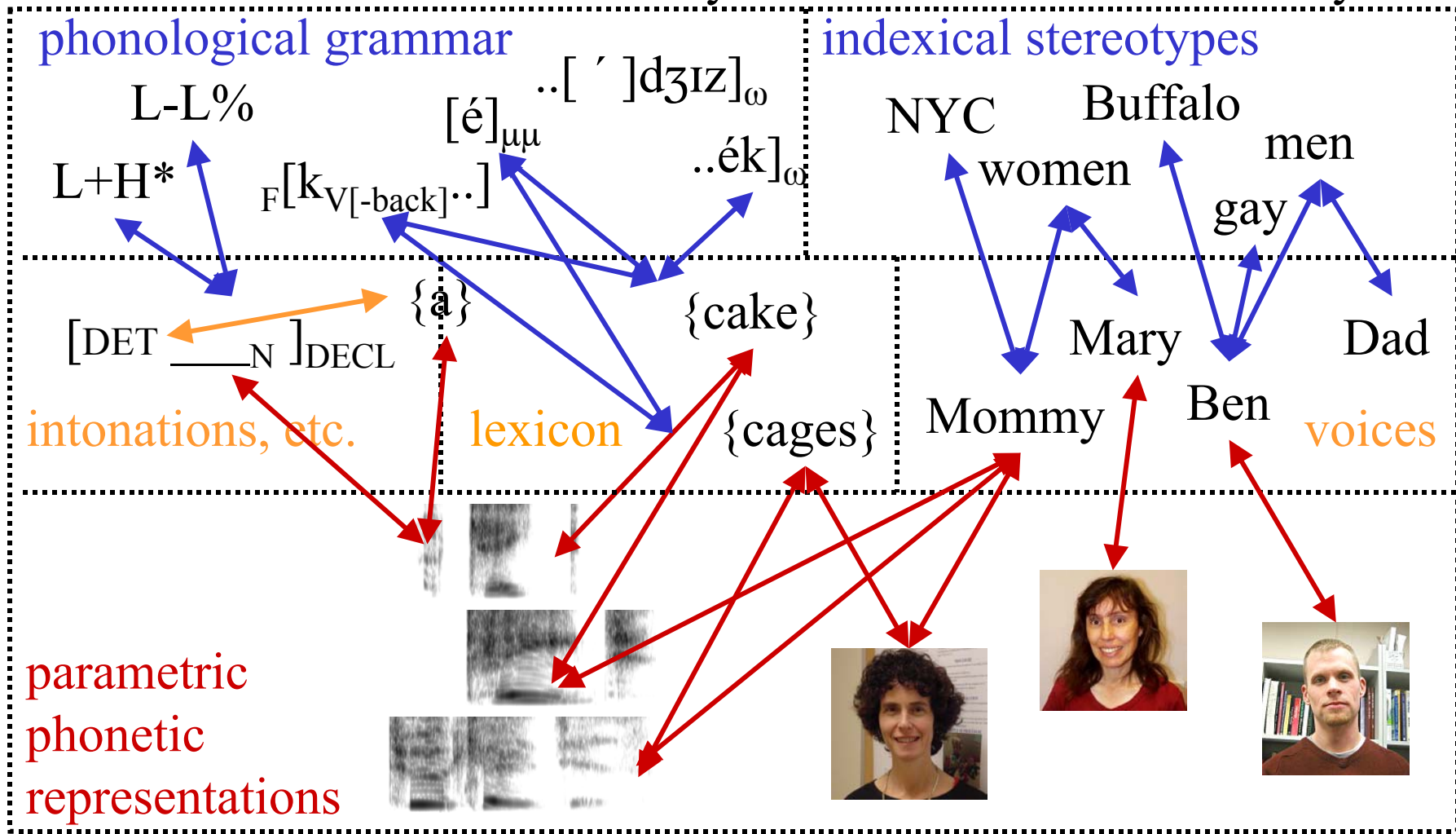
PD vs. SLI (cont.)

Overall accuracy was related to differences in auditory word recognition, but the phonotactic probability effect was not.

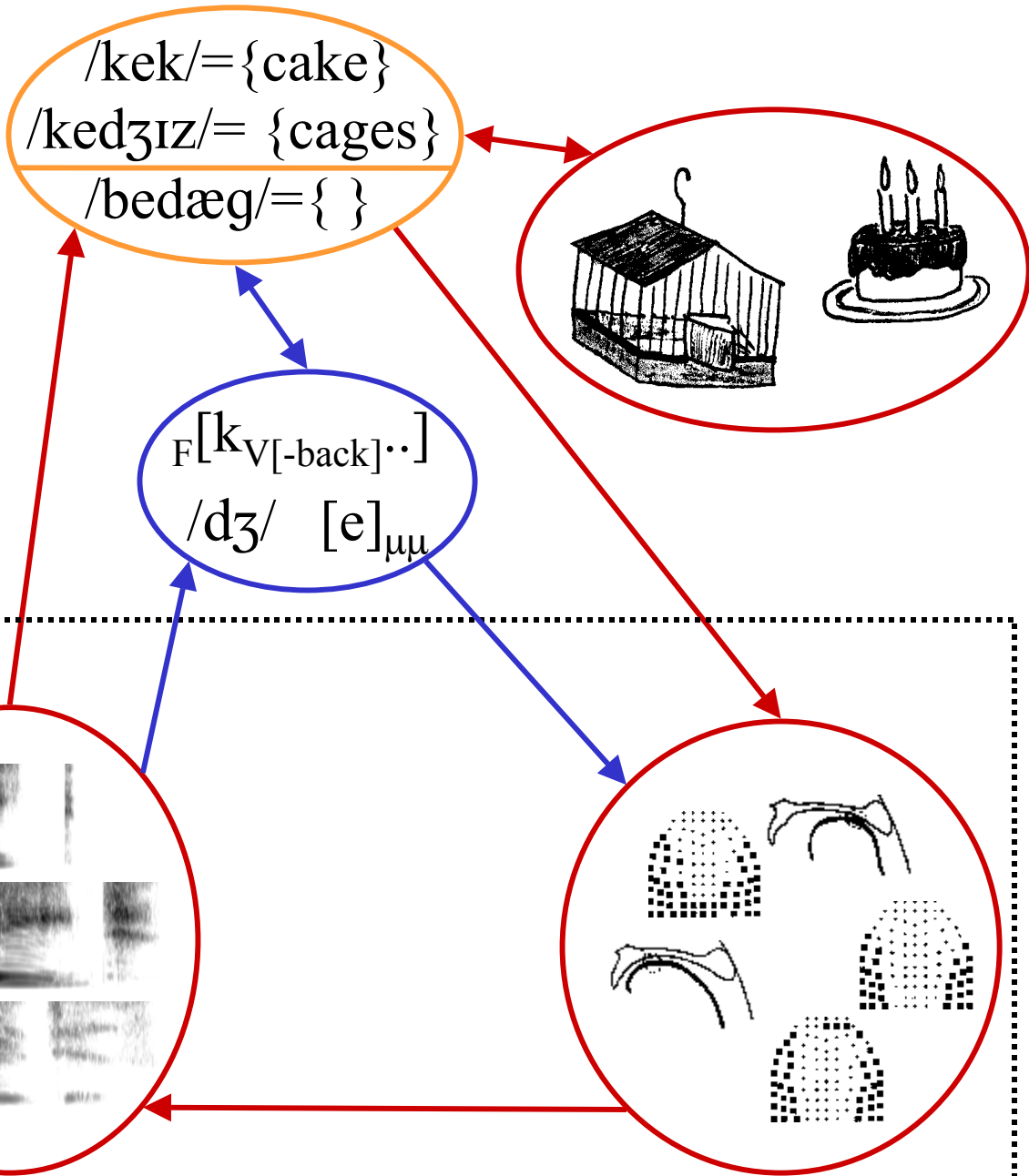
At least some misarticulations in PD may be associated with deficits in the auditory phonetic representations.



Fisher & Church (2001): “representations must be abstract enough to encompass variability due to voice, intonation, and linguistic context [but] also include enough phonetically relevant detail ... to permit the child to learn about the various systematic sources of variability.”



Beckman & Pierrehumbert (2003): Non-linearities in the mappings among articulation and acoustics encourage symbolic abstraction in the same way that *arbitraire du signe* does.



parametric representations of others' and one's own productions