Speech planning in preschoolers' picture naming

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Introduction

Background   In adults, structural, frequency, and probabilistic characteristics of words have been shown to either facilitate or inhibit the planning (early internal organization) of word production [1]. In children however, little is known about their effects on production and its planning, as well as how these may change with increasing language practice.

Research questions   Do 4-year-old German children show the same effect in the investigated factors as the adults?
Does each factor influence the naming process on a lexical or a postlexical stage?

Assumption   Simple naming → lexical & postlexical processes
Delayed naming → only postlexical processes [2]

Predictions   Based on previous findings mainly in adults:

Factor	Direction of the effect	Simple naming	Delayed naming	Reference
Initial segment	/t/ < /k/ < /ʃ/	✓	✓	[3], [4]
	/i/ < /a/ < /u/			
Syllable structure	CV < CCV < V	✓	✓	[1], [5], [6]
Phonotactic probability	high < low	✓	✓	[1]
Neighborhood density	high < low	✓		[1], [2]
Word frequency	high < low	✓		[1], [7]
Syllable frequency	high < low	✓		[1], [8], [9]

Method & Procedure

Participants   6 healthy 4-year-olds & 6 healthy adult controls, all native German speakers

Task   Picture naming in SIMPLE and DELAYED condition:
Target is visually presented, starting prompt visually and auditorily
- simultaneous with picture (SN)
- or delayed (DN)

Adults produced schwa prior to the prompt (avoiding preparation), too demanding for children.

Stimuli   Pictures of 15 disyllabic words (except for Stuhl, "chair"), tense cardinal vowels /i/, /a/, /u/ in stressed first syllable, varying first syllable structure (V, CV, CCV, CCVC):

		/i/	/a/	/u/
V		Igel "hedgehog"	Adler "eagle"	Ute (proper name)
CV	/k/	Kiwi	Kater "tomcat"	Kugel "sphere"
	/t/	Tiger	Tafel "blackboard"	Tube
	/ʃ/	Schienen "rails"	Schale "bowl"	Schule "school"
CCV(C)		Spiegel "mirror"	Stapel "pile"	Stuhl "chair"

Measurements   Acoustic reaction times (RTs)
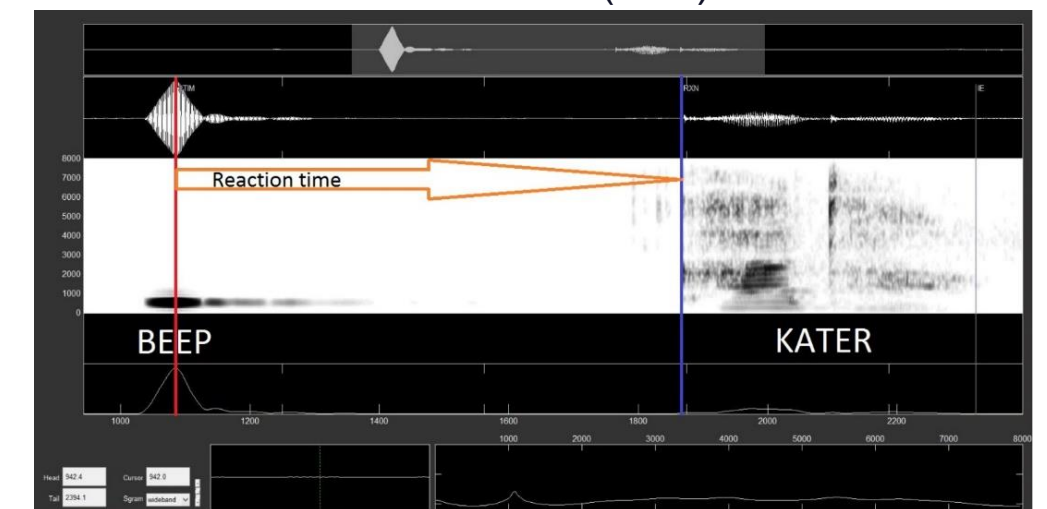
Statistics
- Linear Mixed Models with participant as random factor
  - Fixed effects: Syllable structure (V, CV, CCV, CCVC), Initial segment (/t/, /k/, /ʃ/, /a/, /i/, /u/)
  - Dependent variable: Acoustic RT
- Linear Models: Correlation of averaged RT per stimulus with
  - phonotactic probability,
  - phonological neighborhood density,
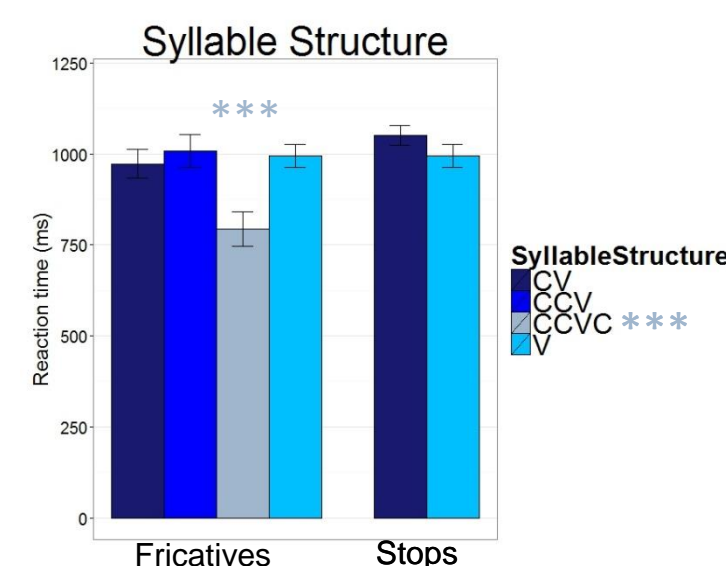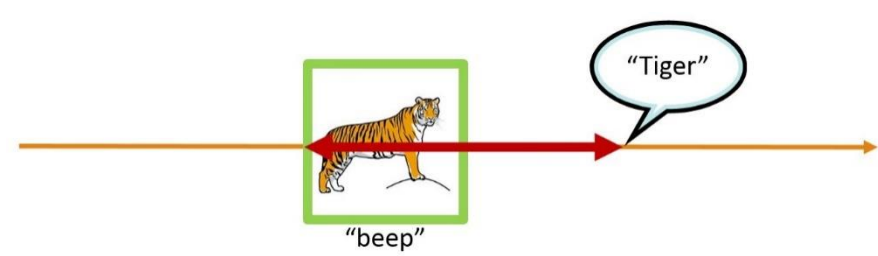 - word frequency,
  - syllable frequency

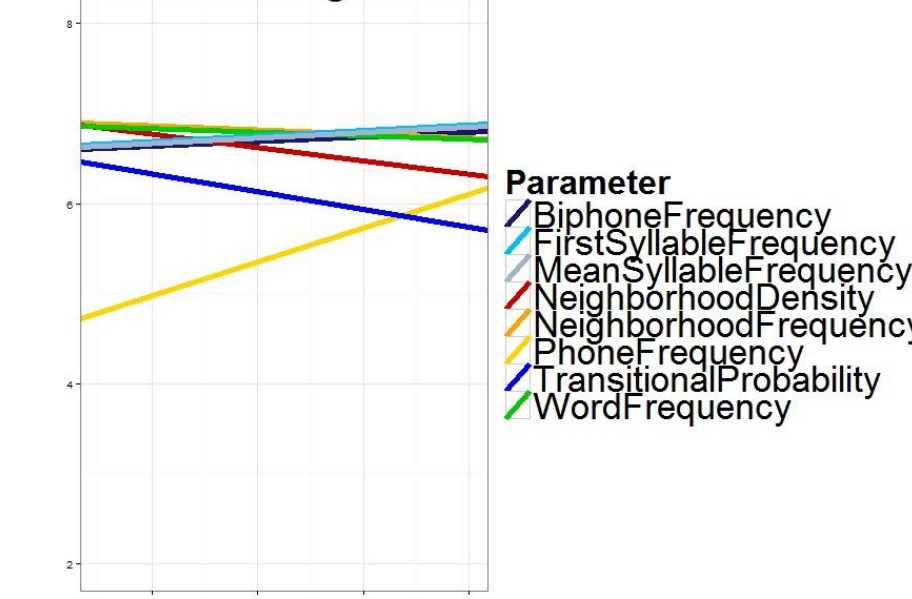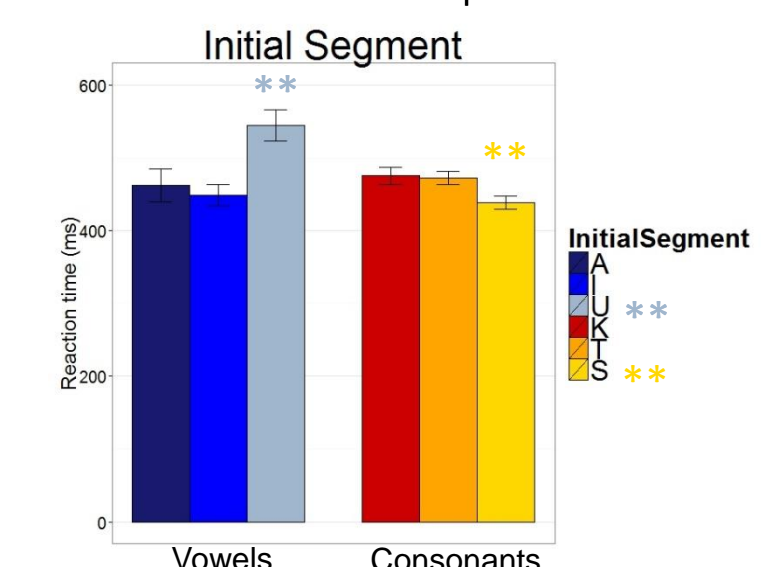## Results

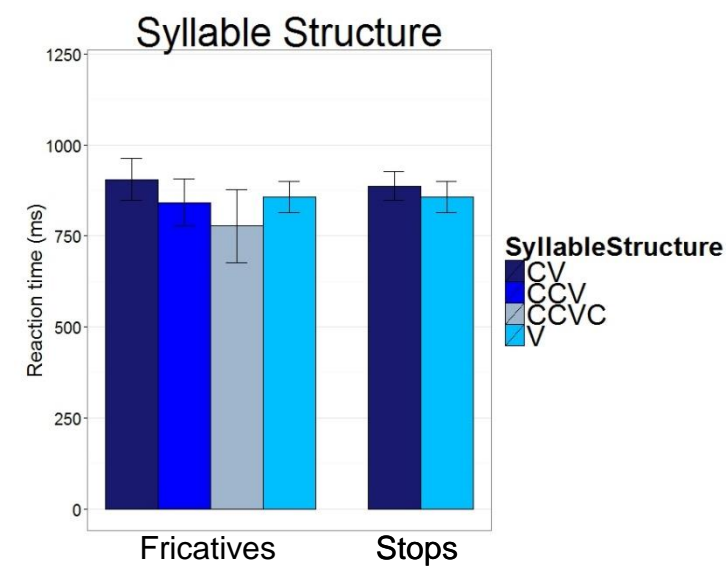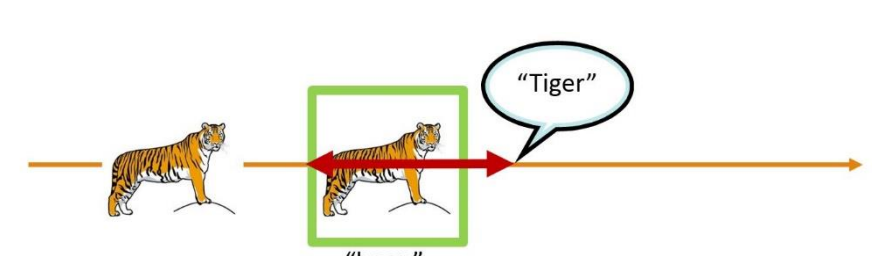| Task	Children	Adults
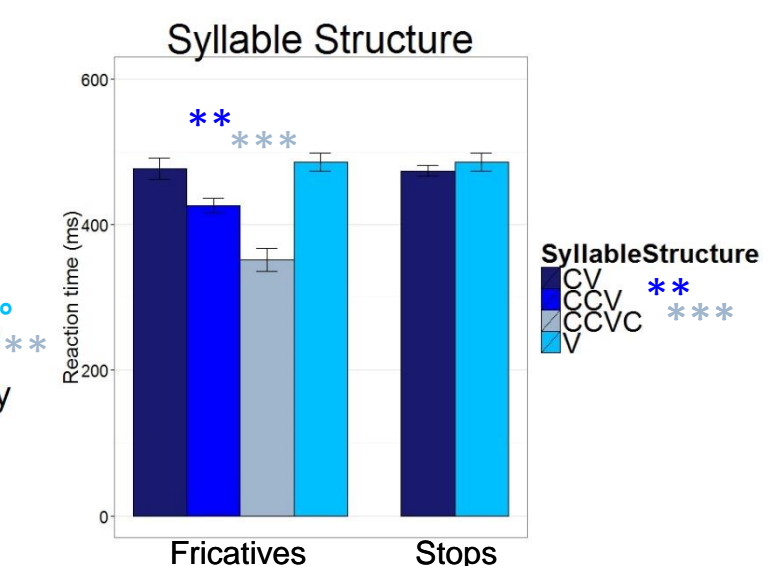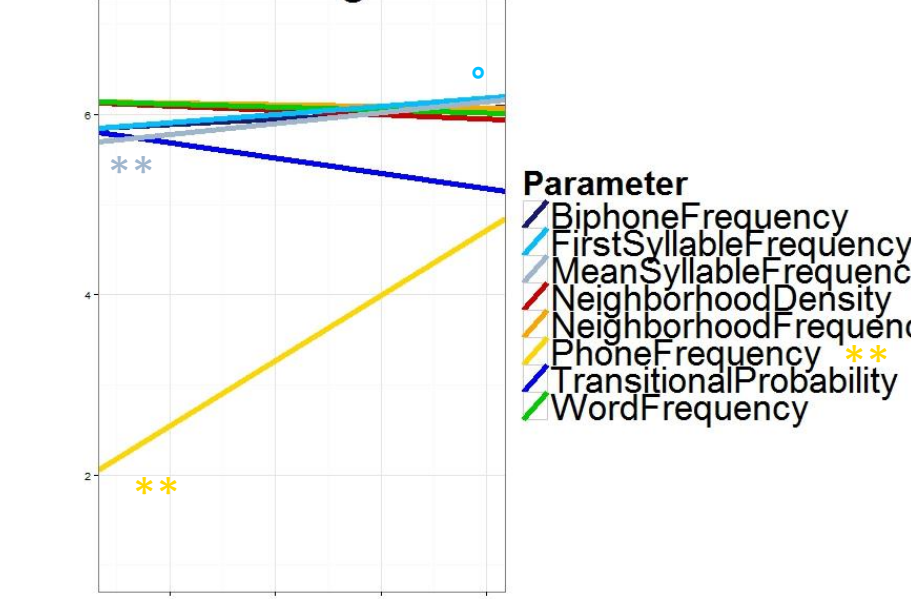
Simple Naming
Lexical & Postlexical Processes

p-values:
*** <0.001
** <0.01
* <0.05
° <0.1
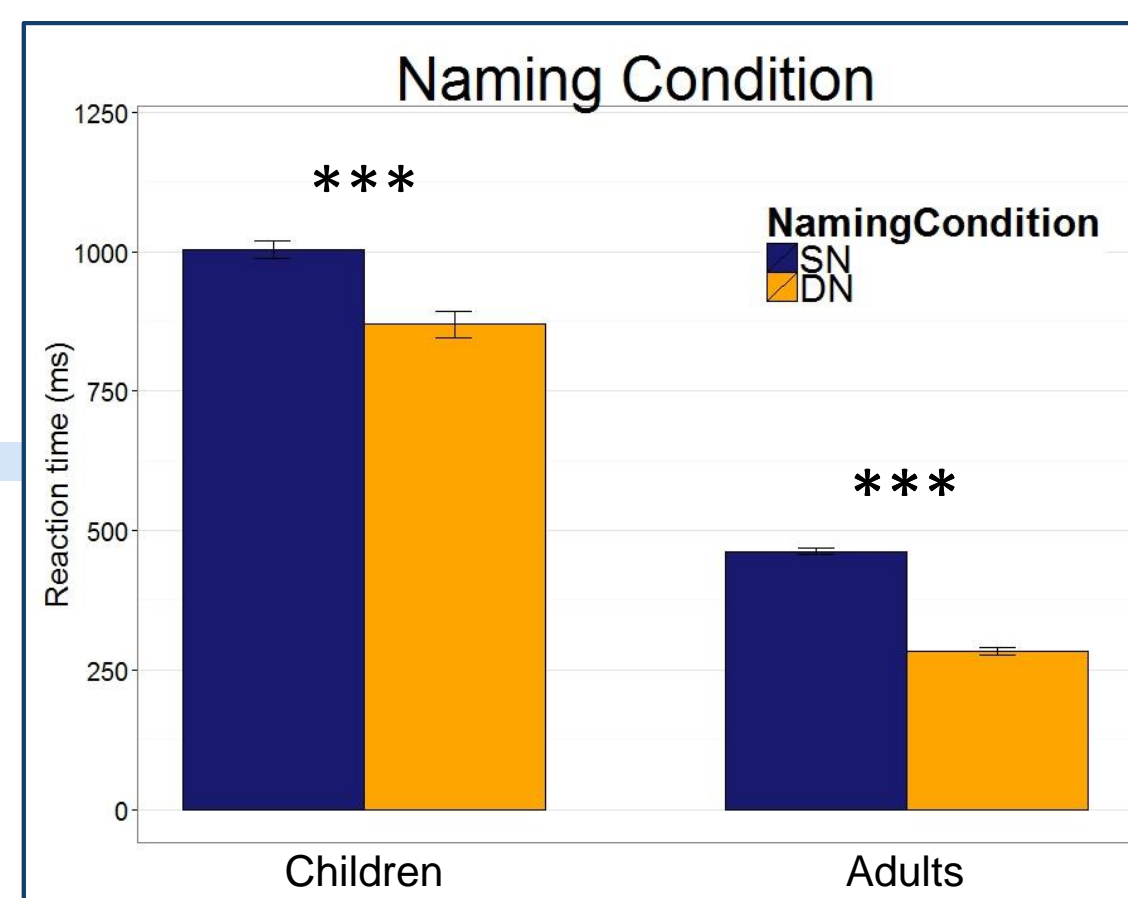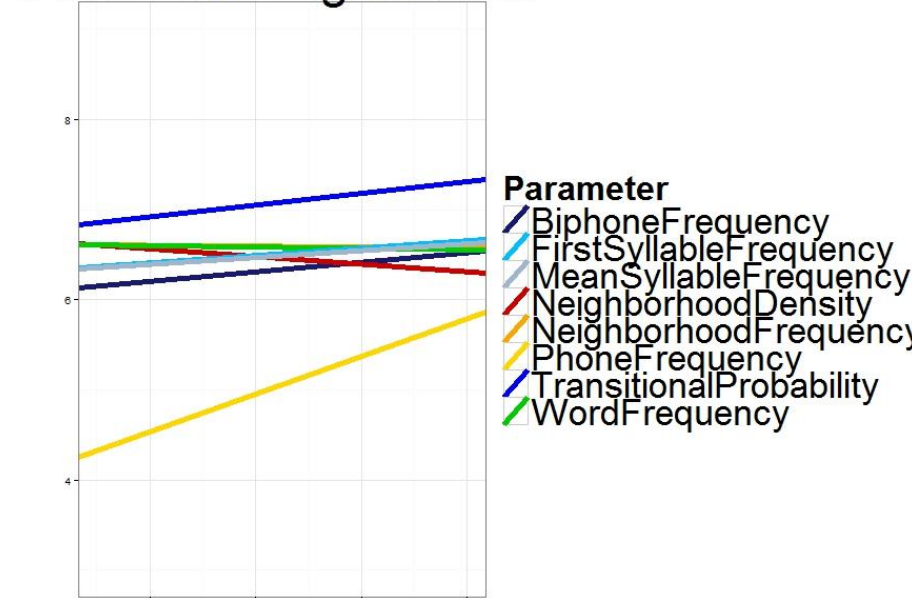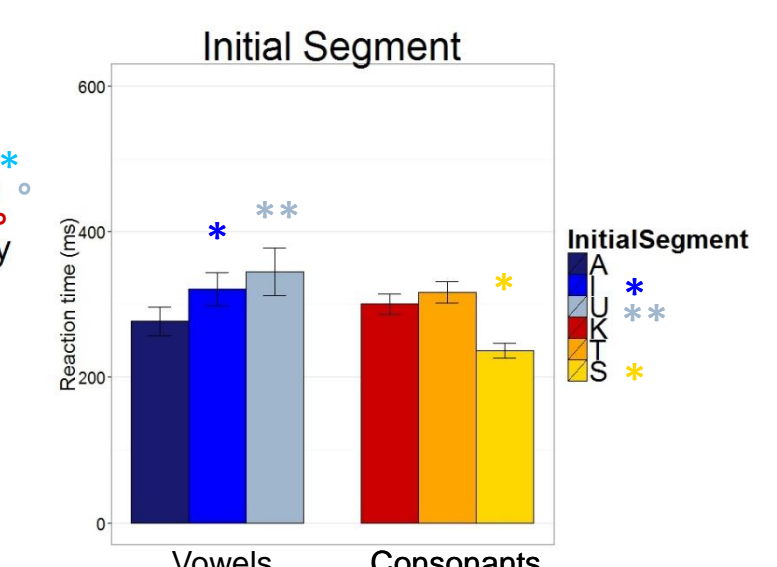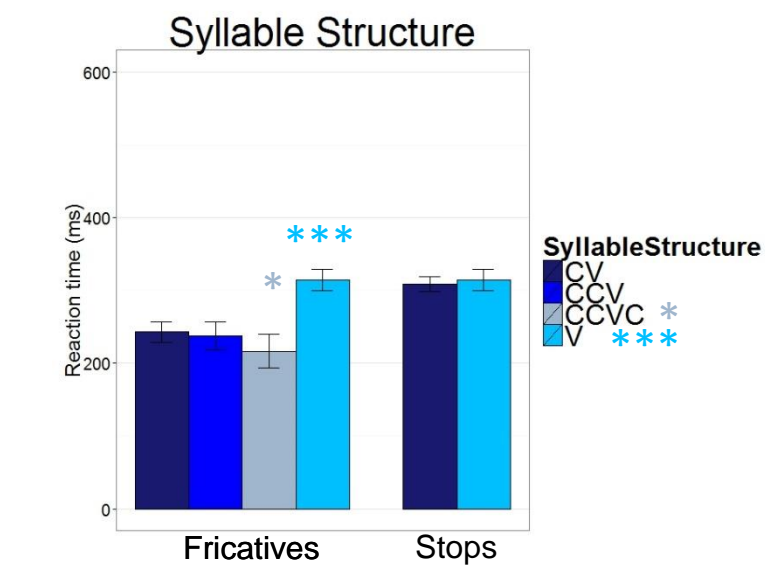
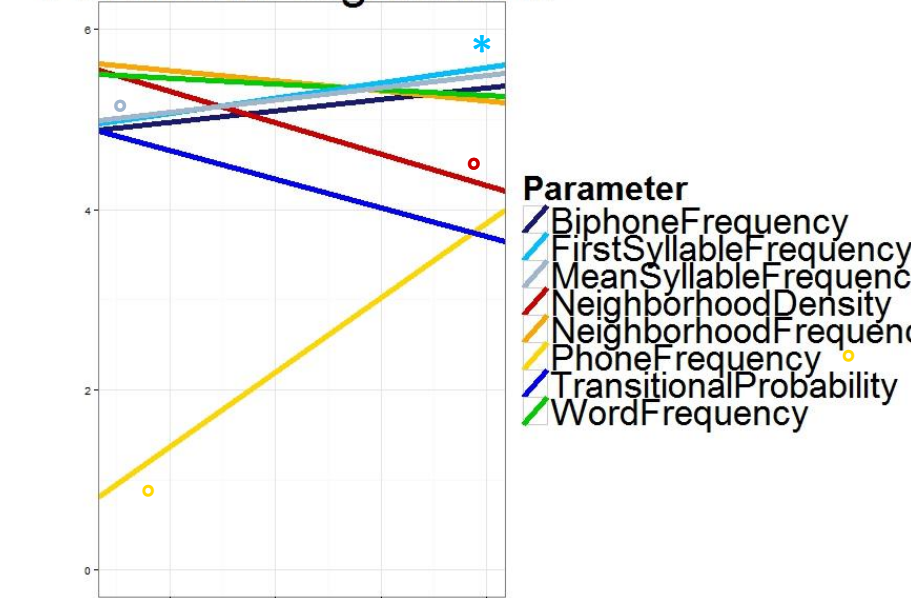### Delayed Naming
Only Postlexical Processes

Discussion & Conclusion

General findings
- Longer RTs in children than adults
- Longer RTs in SN than DN
- More variability in children than adults

Syllable Structure
- No effect for stops → issue of measuring acoustic data only
- Effect of CCVC with caution → only 1 item
- CV < V effect present only in adults' DN → masked by lexical/memory effects in SN?

Initial Segments
- Caution for vowels: only 1 item each
- /i/, /a/ < /u/ (Ute!) stable for adults, trend in children's SN disappears in DN
  - Lexical/memory effect for kids
  - Postlexical process for adults
- /ʃ/ < stops → issue of measuring acoustic data only

Lexical / phonological parameters
- Parameters measured post-hoc → no even distribution!
- Most stable predictor: Positional phone frequency → surprising: low < high

- Syllable frequency highly correlated → surprising: low < high
- Effects get weaker in DN
- No significant effect in children → too high variability? Task too demanding? Different organization of speech? Parameter values not appropriate (adult data bases)?

Conclusion   This first pilot study shows differences between speech planning in 4-year old children and adults. High variability suggests instable representations and an effect of limited practice. However, more precise deductions would need a larger participant cohort, the focus on one or two controlled parameters, and articulatory measures.

Factor	Simple Naming			Delayed Naming		
	Expected	Found in Children (p<0.05)	Found in Adults (p<0.05)	Expected	Found in Children (p<0.05)	Found in Adults (p<0.05)
Syllable structure	CV = CCV < V	X	CCV < CV	CV = CCV < V	X	CV = CCV < V
Initial segment	/t/ < /k/ < /ʃ/	/ʃ/ < /t/, /k/	/ʃ/ < /t/, /k/	/t/ < /k/ < /ʃ/	X	/ʃ/ < /t/, /k/
	/i/ < /a/ < /u/	X	/i/, /a/ < /u/	/i/ < /a/ < /u/		/a/ < /i/ < /u/
Phonotactic probability	high < low	X	(low < high)	high < low	X	X
Neighborhood density	high < low	X	X	X	X	X
Word frequency	high < low	X	X	X	X	X
Syllable frequency	high < low	X	low < high	X	X	(low < high)

References & Acknowledgements

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