

A Longitudinal Comparison of Speech Rate of Spontaneous Utterances vs Repeated Utterances in Preschool Children

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Introduction

- Most researchers have concluded that the rate of speech increases gradually from young childhood to adulthood
 - However, a detailed understanding of the longitudinal trajectory of speech rate development is lacking from even a brief review of existing data.
 - This shortcoming has recently taken on clinical relevance for fluency disorders (e.g. Chon et al., 2012; Tumanova et al., 2011; Kloth et al., 1995) because aberrations in speech rate are noted in early developmental stuttering
- Achieving adult-like speech rate is actually a developmental accomplishment, but there is essentially no published data from typical children at the critical times when speech and grammar are developing to understand how motor development and language development shape speech rate.
- This study is the first to evaluate longitudinal speech rate development between 24 and 36 months when grammar emerges.
- We will test whether speech rate increases across this critical language development period and whether spontaneous utterances differ in rate compared to repeated sentences.

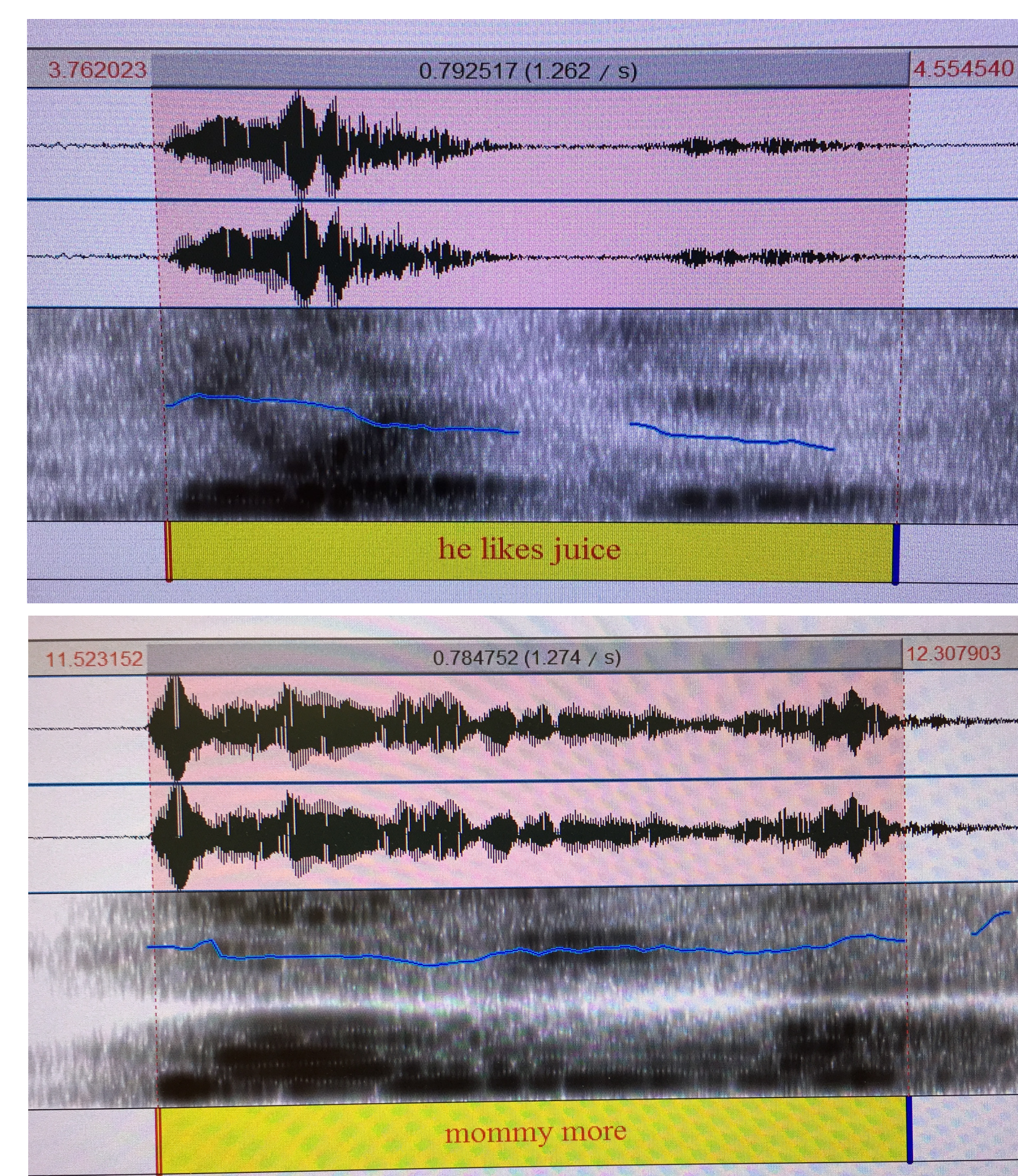
Aim

- From previous research it has been shown that speech rate for true sentences increases from 24 to 36 months.
- We predicted spontaneous utterances would be produced more slowly than repeated utterances, given that grammatical encoding is only beginning to develop in the age range of 2-3 years
- We tested this prediction using a longitudinal design in which speech rate (syllables/second) at 24 months and 36 months of novel grammatical productions was compared with repeated utterances
- This question has theoretical implications for whether active encoding of new syntax forms is produced more slowly than utterances stored in short-term working memory.



Method

- Children's productions of ten original utterances and ten repeated sentences were extracted from a one-hour videotaped observation period.
 - The data came from an existing database of spontaneous speech recordings at both time points.
- The 5 children identified for the study had typical vocabulary development and communication skills for their age.
- The children in this study were selected based on their MLU (mean length of utterance) values. We excluded children in the 14th percentile and lower, and children in the 86th percentile and higher. We checked them for ability to create syntactic structures (ADS).
 - We included utterances that contained at least two open class words. All children produced a minimum of ten spontaneous utterances and ten repeated utterances during each session.
 - Only perceptually fluent utterances were included in the study while any utterances with disfluencies or pauses longer than 250 msec were excluded.
 - The utterances were extracted as wav files and processed with a noise reduction algorithm.
- The mean speech rate of each utterance was calculated as the number of syllables divided by duration to give syllables / second.
- Paired-sample t-test were used to test the effect of TIME (24 vs. 36 months) and TASK (Original vs. Repetition)



Examples of spectrograms of the children's utterances created using the software PRAAT.

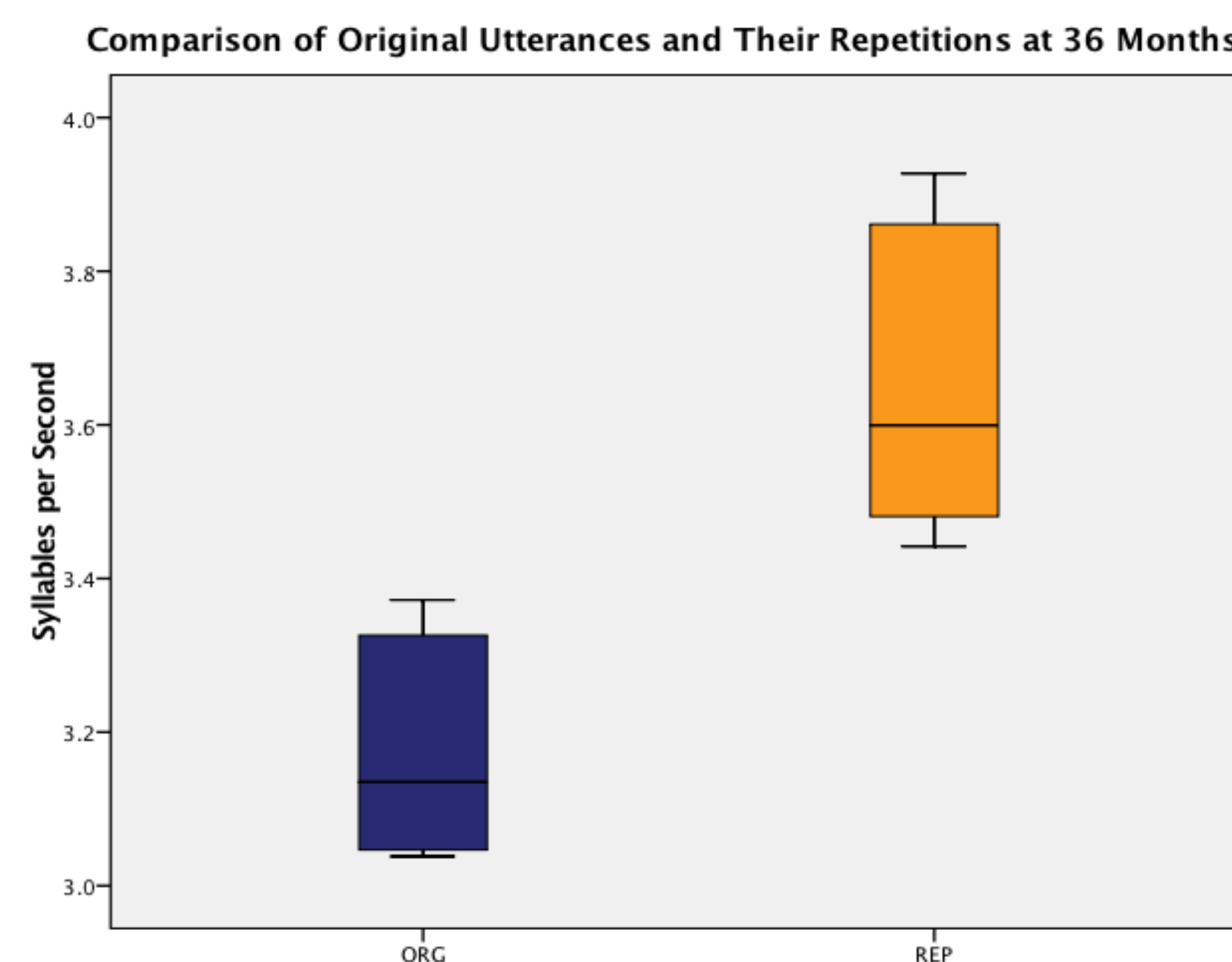
Results

Speech Rate of Spontaneous vs. Repeated Utterances

24 Months



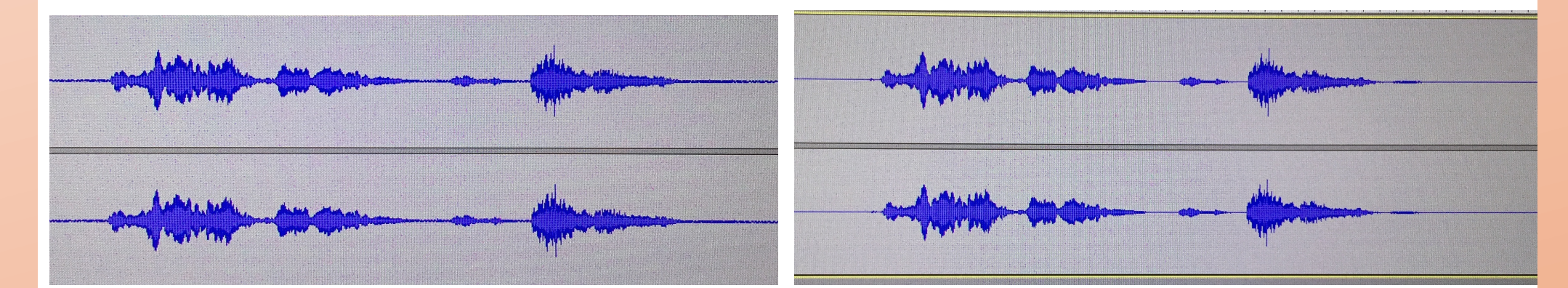
36 Months



A paired-sample t-test comparing the mean speech rate (syllables per second) of spontaneous utterances vs repetition revealed a significant increase at 24 months ($t(4) = 3.1, p = 0.02$) and 36 months ($t(4) = 3.81, p = 0.018$).

The paired t-test of spontaneous utterances between 24 and 36 months indicated a significant increase in speech rate ($t(4) = 2.78, p = 0.05$).

The paired t-test comparing speech rate of repetitions between 24 and 36 months also indicated a significant rate increase ($t(4) = 5.8, p = 0.004$).



Audacity recordings before noise reduction (left) and after noise reduction (right).

Discussion

In our previous study (Tendera et al., 2015), we found that speech rate increased significantly between 24 and 36 months.

The current study partially replicates those findings

Spontaneous utterances require grammatical encoding while repeated utterances can be held in short-term memory (or produced through direct activation)

A higher rate for repeated utterances supports our hypothesis that grammatical encoding takes longer to generate and convert into a phonetic code than direct activation

Similar changes in rate for both classes of utterances may indicate that speech rate shows a general increase over this time period, but is sensitive to linguistic task. In general, this study provides some support for an interaction between motor maturation and linguistic development

Acknowledgments

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