

1. Introduction

- Breathing behavior during pauses provides valuable insight into respiratory functions in speech
- Pauses serve as linguistic markers and are linked to syntactic boundaries [1] [2]
- Lung volume control remains consistent across speech tasks, but fluency-related parameters vary [3] [4]
- Recent research reveal the occurrence of 'partial' inhalations during spontaneous speech [5]
- Focus extends to respiratory behaviors during non-breath pauses, ignored in the literature, and potentially related to cognitive activities [6]

2. Aim of this study

To explore breathing behaviors during breathing and non-breathing pauses, depending on the syntactic structure of utterances and speech tasks → To observe the effects of cognitive-linguistic demands in children

3. Method

Speakers
10 children
(Age = 9.71; sd = 0.772) [6]

Speech tasks
Reading
Spontaneous speech

Acquisition system

- Kinematic data** : Respiratory Inductive Plethysmography (1Tho + 1Abd) [7]
- Acoustic data**

Variation of the thoracic and abdominal perimeter during phonation

Labeling of pauses

- Breathing pauses (BP) → Inhalations
- Non-breathing pauses (NBP) → 'Partial' inhalations

Syntactic analyses

- Major syntactic units (reccion units)
- Minor syntactic units (sequences)
- Non-syntactic pauses

Statistical analyses

Repeated measures ANOVA

- Intra-subject factors : speech tasks and syntactic location
- $p < 0.05$
- When significance was indicated → Bonferroni tests for *post-hoc* comparisons

4. Results

1. Inhalations and partial inhalations

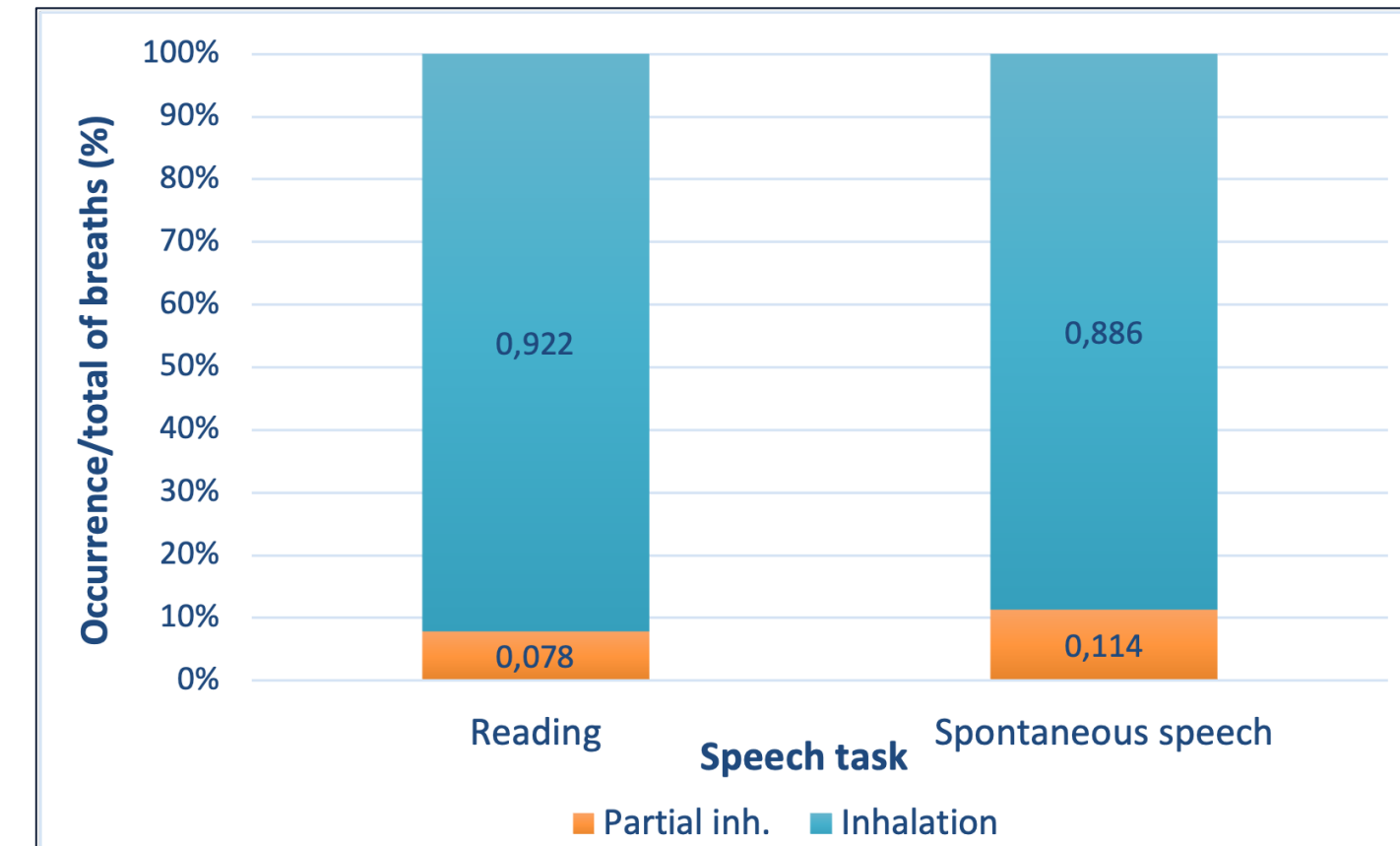


Figure 1. Distribution of inhalations and partial inhalations

- Inhalation > partial inhalation*
- Slight increase of partial inhalation in spontaneous speech

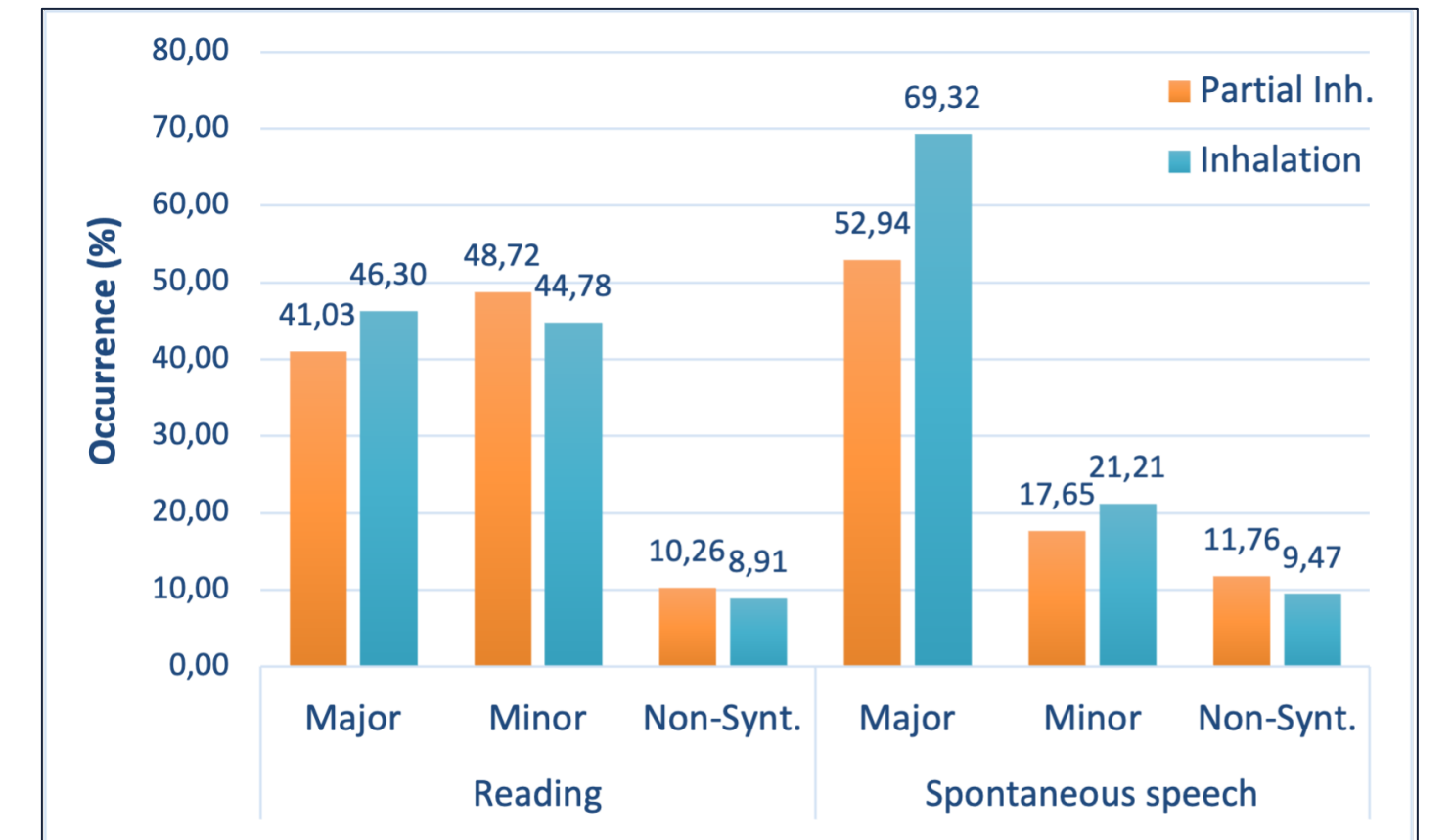


Figure 2. Syntactic distribution of inhalations and partial inhalations

- Majority of inhalations and partial inhalations → grammatical
- Reading : partial inhalations were slightly more frequent between 2 minor units

2. Duration of inhalation and breath pauses

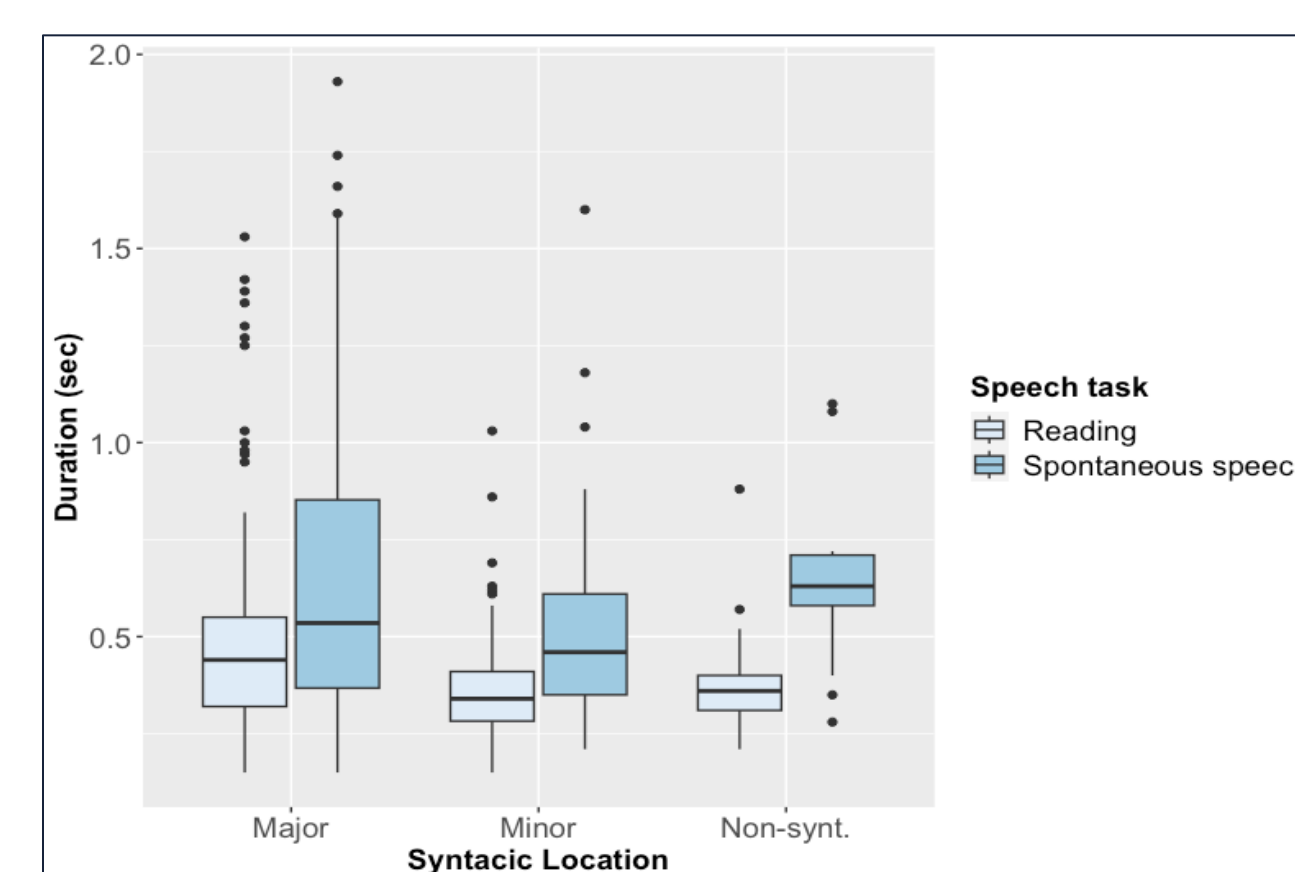


Figure 3. Distribution of duration values of inhalation

- Duration of inhalation in reading < spontaneous speech*
- Spontaneous speech, duration of non-syntactic inhalations > others*
- The duration of breath pauses followed similar patterns*
- Ratio of inhalation duration to the total duration of pause in reading > spontaneous speech

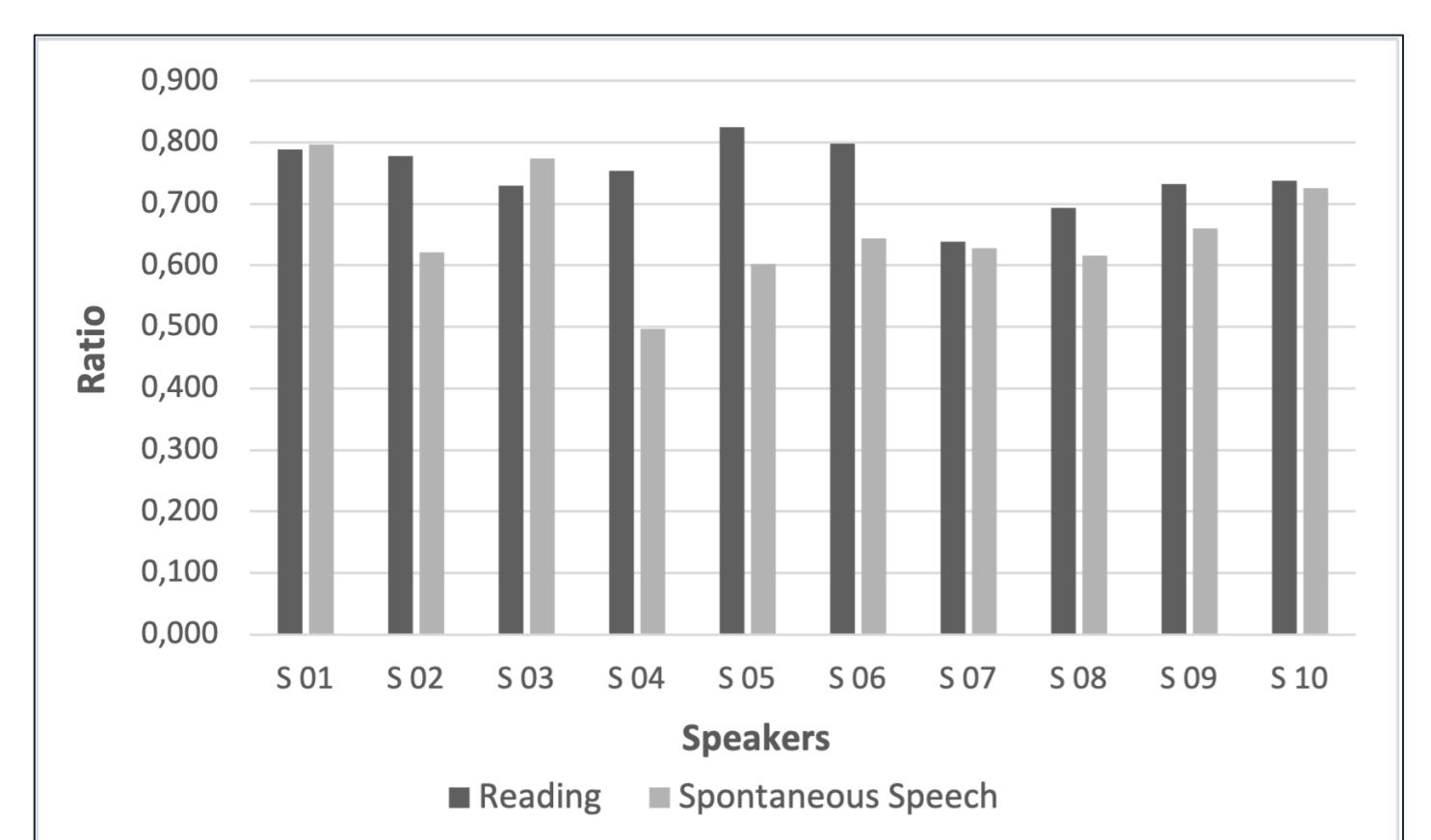


Figure 4. Ratio of the duration of inhalation to the total duration of the pause

3. Analyses of non-breathing pauses

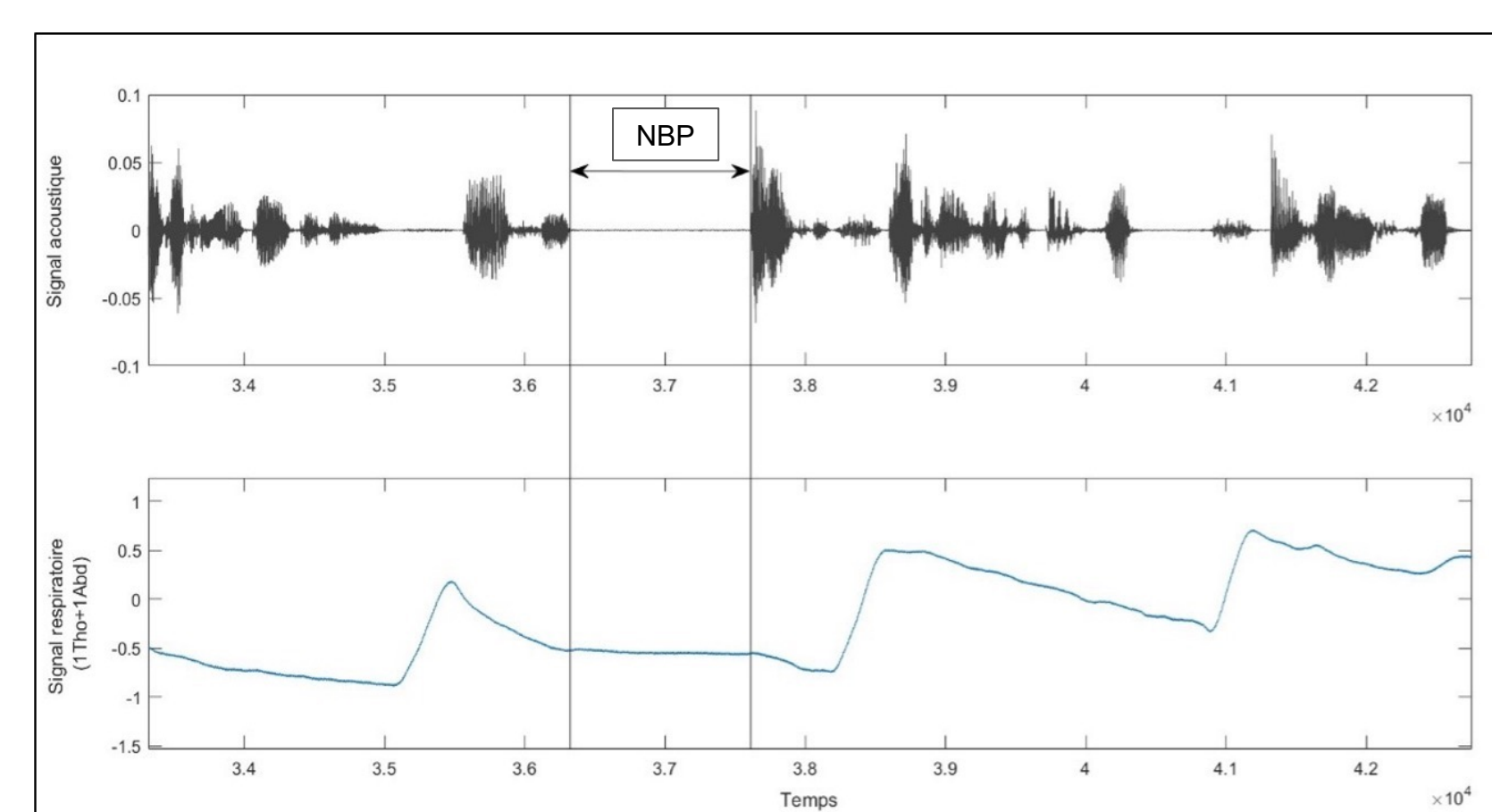


Figure 5. Illustration of non-breathing pause with rib cage blocking (NBP-B)

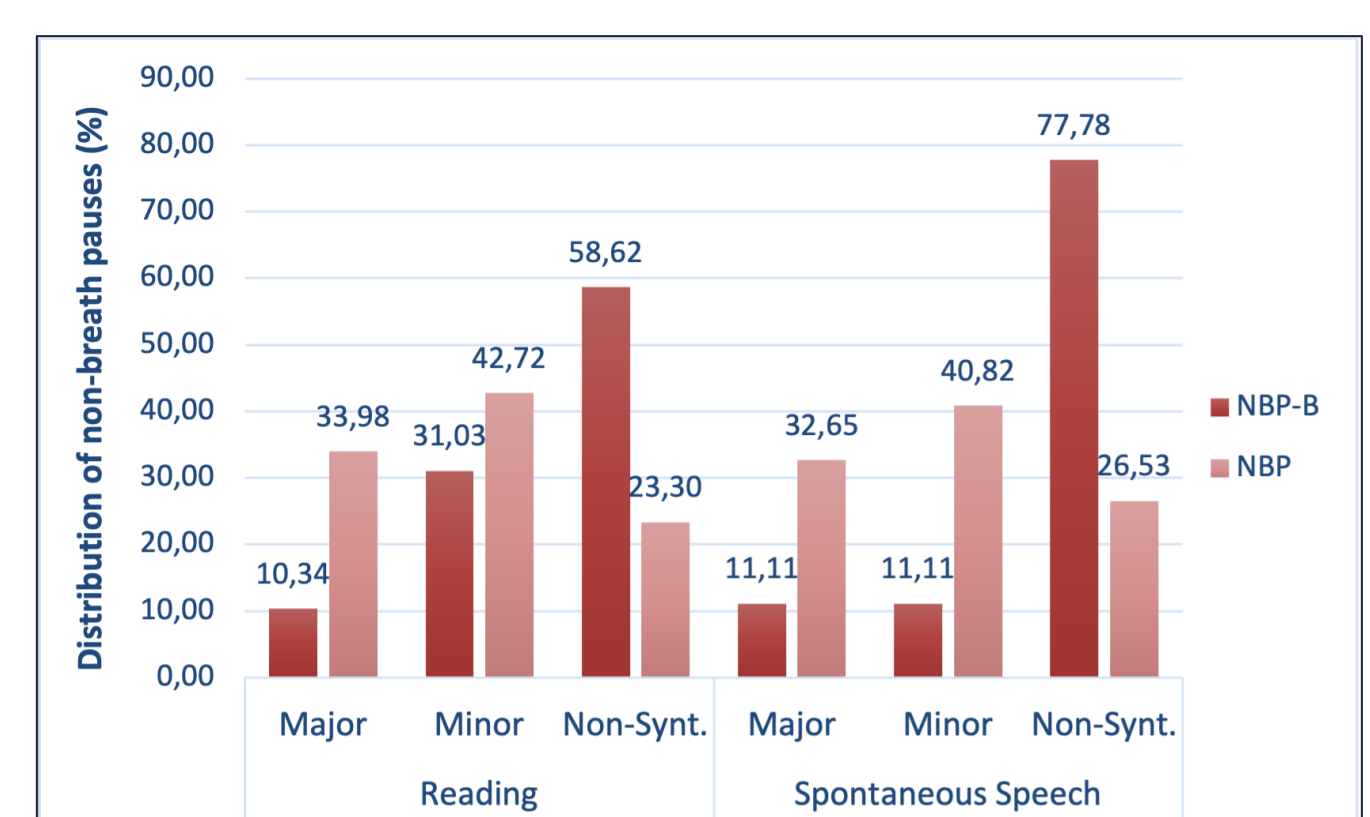


Figure 6. Distribution of NBP and NBP-B

- NBP-B account for 20.67% of NBP
- NBP-B are mainly non-syntactic

5. Discussion

The presence of 'partial' inhalation [5] in reading and spontaneous speech

- Predominantly occurred at syntactic boundaries → are incorporated into respiratory patterns
- The study of this inhalations is important in order to understand the respiratory strategies implemented by speakers

Cognitive-linguistic demands has an effect on the breathing control

- The durations of inhalations were longer in spontaneous speech
- In spontaneous speech, non-syntactic breaths and pauses were longer
- The pause was not solely dedicated to inhale

Cognitive-linguistic demands influence also the expiratory movement control during non-breathing pauses

- Some non-breathing patterns pauses characterized by the cessation of rib cage
- This pauses were mainly non-syntactic
- Chest blocking → a good indicator of elevated cognitive activities ?

To approach breathing not as a biphasic phenomena, but as a process that can involve intermediate phased characterized by a momentary pause in rib cage compression

6. Conclusion

- This study highlights **certain respiratory events integrated** into children's breathing patterns
- It also highlights the importance **in considering new approaches** in the investigation of speech breathing
- Considering the influence of cognitive-linguistic demands on the respiratory control, these breathing behaviors **could also be observed in adults**

References

- [1] A. L. Winkworth, P. J. Davis, R. D. Adams, and E. Ellis, "Breathing patterns during spontaneous speech," *JSLHR*, vol. 38(1), 1995. [2] E. Godde, G. Bailly, and M.-L. Bosse, "Pausing and breathing while reading aloud: development from 2nd to 7th grade," *Reading and Writing*, vol. 35(3), 2021. [3] H. L. Mitchell, J. D. Hoit, and P. J. Watson, "Cognitive-linguistic demands and speech breathing," *JSHR*, vol. 39(1), 1996. [4] Y.-T. Wang, J. R. Green, I. S. Nip, R. D. Kent, and J. F. Kent, "Breath Group Analysis for Reading and Spontaneous Speech in Healthy Adults," *Folia Phoniatrica et Logopaedica*, vol. 62(6), 2010. [5] H. Weston, "Proposal for a novel analysis of the organization of breath pauses, silent pauses and speech intervals in spontaneous speech," in *Proc. 1st International Seminar on the Foundation of Speech - Breathing, Pausing and Voice*, Sønderborg, 2019. [6] D. Charuau, *Étude de la corrélation entre l'organisation temporelle des patterns respiratoires et la production de la parole chez les enfants porteurs de fentes labio-palatines*. Doctoral thesis, 2022. [7] C. A. Boliek, T. J. Hixon, P. J. Watson, and P. B. Jones, "Refinement of Speech Breathing in Healthy 4-to-6-Year-Old Children," *JSLHR*, vol. 52(4), 2009.