

# Aging effects on prosodic structuring in French

Anne Hermes, Angéline Bourbon, Cécile Fougeron

Laboratoire de Phonétique et Phonologie (CNRS/UMR7018, U Sorbonne-Nouvelle), France  
 {anne.hermes, angelina.bourbon, cecile.fougeron}@sorbonne-nouvelle.fr

Background

- Physiological changes due to aging can cause changes in prosodic structuring
- With increasing age :
  - Ribcage cannot expand and contract as well and diaphragm becomes weakened [1];
  - Higher lung volume to initiate speech, longer sentences split into smaller units with less breathing at larger units and more breathing at smaller units [2, 3];

Motivation

- Effects of aging on speech breathing with respect to prosodic structuring are relatively sparse
- Cover repair mechanisms and adaptations to the speech system

Research Aim

How are linguistic structures realized on different tiers, when the physical system is challenged?

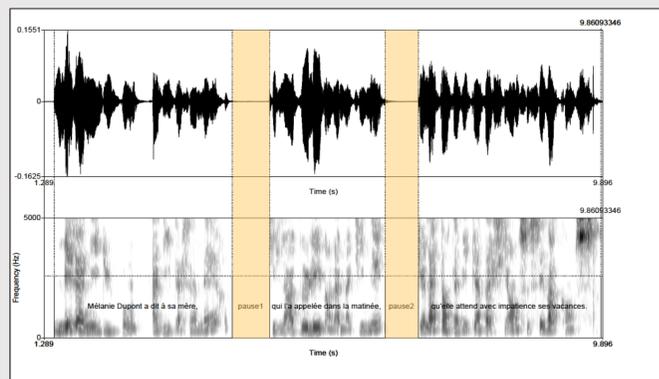
→ Aim to shed light on the effects of aging on prosodic structuring in sentences differing in length and complexity

Speech material

Mélanie Dupont a réservé ses vacances. (Mélanie Dupont booked her holidays.)	short- simple
Mélanie Dupont, qui adore le soleil, a réservé ses vacances. (Mélanie Dupont, who loves the sun, booked her holidays.)	short-complex
Mélanie Dupont a réservé lors d'un froid jour d'hiver ses vacances en Andalousie. (Mélanie Dupont booked her holidays in Andalusia on a cold winter's day.)	long-simple
Mélanie Dupont a dit à sa mère, qui l'a appelée dans la matinée, qu'elle attend avec impatience ses vacances. (Melanie Dupont told her mother, who called her in the morning, she's looking forward to her vacation.)	long-complex

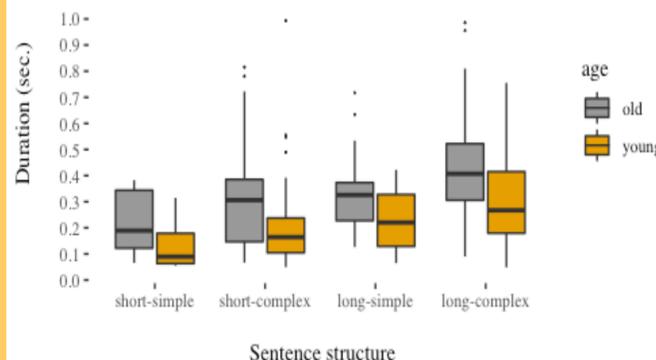
Method

- Subjects:** 27 native French speakers (18 women/9 men)
- 14 'younger' speakers (23-44y) and 13 'older' speakers (68-88y)
- Material:** Read speech of 12 different French sentences (designed on the basis of [4])
- Differing in length (short vs long) and syntactic complexity (simple vs complex) → 12 sentences x 3 repetitions x 27 speakers = 972 tokens
- Annotation:**
- Manually segmented as visual and audible breaks
  - Including inspiratory and physiological phenomena
- Measurements:**
- (A) Pause duration in seconds
  - (B) Articulation rate (syllables/second)
  - (C) Sentence duration (total utterance time including pauses)



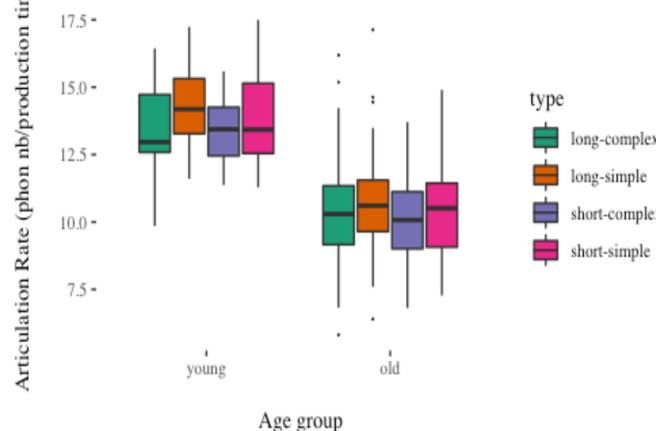
Results

(A) Pause duration



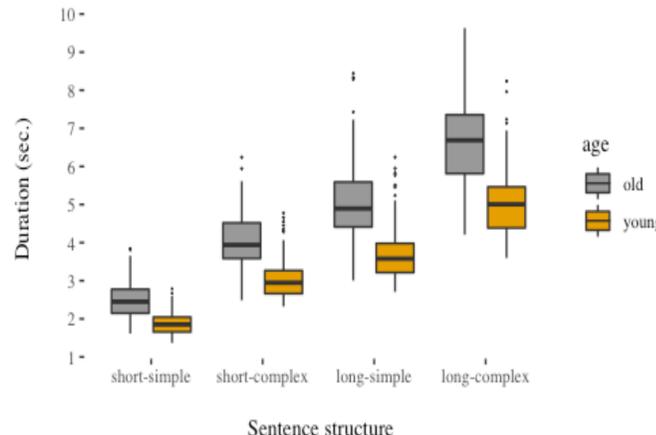
- Longest pause durations in both groups for long-complex
- Longer pause durations in all conditions for older than younger speakers

(B) Articulation rate



- Speakers with the slowest articulation rate produced the longest pauses :
- Slower articulation rate for older than younger speakers

(B) Sentence duration



- The longer and complex a sentence, the longer its duration
- Age-effect even more visible

Conclusion

- Both length and complexity affect durational patterns in younger and older speakers
- Age entailed an additional increase in duration (of e.g. whole sentences, and even pauses):
  - Possible explanations: (1) a mechanism to make sure to reach the targets properly [5]. (2) A slower speech rate for e.g. long-complex sentences can be explained by increased cognitive demands [6]
  - Link to breathing will be of main interest in future studies

This study shows that :

- ① All age groups produce phrasal breaks at expected syntactic boundaries
- ② Older speakers produced much longer pausal breaks, slower articulation rates and longer sentence durations than the younger ones

REFERENCES

[1] Kahane, J. C. (1981). Anatomic and physiologic changes in the aging peripheral speech mechanism. *Aging, Communication Process and Disorders*, 21-45.  
 [2] Hoit, J. D., & Hixon, T. J. (1987). Age and speech breathing. *Journal of Speech, Language, and Hearing Research*, 30(3), 351-366.  
 [3] Huber, J. E. (2008). Effects of utterance length and vocal loudness on speech breathing in older adults. *Respiratory physiology & neurobiology*, 164(3), 323-330.  
 [4] Fuchs, S., Petrone, C., Krivokapić, J., & Hoole, P. (2013). Acoustic and respiratory evidence for utterance planning in German. *Journal of Phonetics*, 41(1), 29-47.  
 [5] Hermes, A., Mertens, J., & Mücke, D. (2018, September). Age-related Effects on Sensorimotor Control of Speech Production. In *Interspeech* (pp. 1526-1530).  
 [6] Swets, B., Jacovina, M. E., & Gerrig, R. J. (2013). Effects of conversational pressures on speech planning. *Discourse Processes*, 50(1), 23-51.

**ACKNOWLEDGEMENT :** This work was partially supported by the Swiss FNS Grant CRSII5\_17371/1 as well as by the French ANR Grant ANR-10-LABX-0083.