

Life-span changes in spoken French: a study on 400 speakers from 20 to 90 years old

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Our knowledge of life-span changes in the speech of adults is quite sparse. Documented in a variety of studies and age-group comparisons, age-related changes have been found in voice quality parameters (Ramig & Ringel, 1983; Russell et al., 1995; Ferrand, 2002; Xue & Hao, 2003), pitch (with an increased in mean f0 for older males but not older females, Harnsberger et al., 2008), and in some instances, formant frequencies and VOT (Xue & Hao, 2003; Torre & Barlow, 2009, but see Fletcher et al. 2015). Overall, the more robust (and documented) age-related differences in speech production concern speech rate (mainly, articulation rate), with older speakers speaking more slowly than younger adults (Verhoeven et al., 2004; Jacewicz et al., 2009; Quené, 2008, Staiger et al. 2017).

A better understanding of the evolution of speech throughout adulthood is critical for clinical research where data have to be age-standardized. It is also crucial for our general understanding of the complexity of the speech production system since age-related changes can as well originate from structural changes at the peripheral level (anatomical and physiological changes in the speech apparatus affecting pulmonary function, laryngeal structure and/or vocal tract length), or from neurological changes affecting speech motor control or cognitive functions (e.g. Linville, 2001; Torre & Barlow, 2009; Seidler et al. 2010, Bilodeau-Mercure et al. 2016).

The current study aims at further documenting life-span changes over adulthood over a large range of ages, and over multiple speech dimensions for the same speakers. This is done through an on-going investigation of a recently collected cross-sectional speech database. The ‘monpAGE’ database is an outcome of the MonPaGe project whose general goal is the development of a speech screening protocol directed for French-speaking patients presenting signs of speech motor disorders. For the validation of the protocol, a set of reference values have been collected from 400 French-speaking adults, half male and half female, encompassing five age groups with 80 speakers per groups: [18-39], [40-49], [50-59], [60-75], [75+]. Speakers have been recorded in Paris, Geneva, Mons and Montreal in order to cover several regional varieties. These cross-sectional data thus form one of the largest French database available for observing normal changes in the speech of adults as a function of gender and age.

A variety of linguistic material produced in different speech conditions is included for each speaker in order to assess multiple speech dimensions. Tasks include repetition; reading; automated production of the days of the week; diadochokinetic tasks (DDK, fast and precise repetitions of alternating speech movements); semi-spontaneous production in a picture description task. The speech material is aimed at assessing articulatory precision, coarticulation, expressive and linguistic prosody, speech and articulation rate, voice quality, maximum phonation time. Phonetico-phonological complexity factors (structural patterning, length, planning demands) are also manipulated.

The analysis of this large database is currently in progress and more data will be presented at the congress. To date, the analysis of a subset of 100 speakers covering 6 age groups [18-29], [30-39], [40-49], [50-59], [60-75], [75+]) has provided interesting results concerning age-related changes in coarticulatory patterns as well as in the temporal organization of speech as a function of speech task.

No effect of age (age_group) is found in maximum phonation time suggesting preserved pneumo-phonatory control over time despite potential reduction in pulmonary function. In contrast, a significant effect of age is observed in speech rate in tasks requiring the

articulation of sound sequences, with a consistent drop in articulation rate for the last two age groups. Interestingly, this effect of age is found both in the sentence reading task and in the DDK task. In this maximum performance task, no interaction is found between age and the complexity of the sequence to be repeated (CVCV... or CCVCCV...). This uniform decrease in articulation rate thus suggests a general decline in the rate of articulatory movement independent of the motoric and cognitive complexity of the task (as found in German by Staiger et al., 2016).

Regarding coarticulation, anticipatory effects have been measured in local and non-local environments. Local V-to-C coarticulation is tested on the spectral characteristics of /s/ according to the rounding of the following V₂ (/tesi/ vs. /tesy/) and non-local V-to-V coarticulation is tested on the spectral properties of V₁/a/ according to the height of V₂/a,i/ (in VCV /maba/-/mabi/, and VCCV /laspa/-/laspi/). Coarticulation is found in all age groups as evidenced by an effect of V₂ type on the F2 of /a/ or center of gravity of /s/, but the size of the effect tends to vary with age. Further results will be presented at the conference based on the full dataset (including more speakers per age group), as well as complementary measures documenting other speech dimensions (articulatory precision of vowels and consonants, voice quality, prosody, pausing...).

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