Sources of variation of articulation rate in native and non-native speech: comparisons of French and German

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Introduction

- Speech tempo, especially articulation rate (AR), considered as a good predictor for:
  - second language (L2) proficiency,
  - intelligibility and comprehension [1],
  - perceived foreign accent [1].

- Main sources of variation (Fig. 1)
  - on average native speech (L1) faster than L2 speech
  - AR of learners correlates with level of L2 proficiency
  - some languages are "faster" in syllables per second than others
  - individual speakers differ in their tempo [2]
  - AR of learners converges towards L1 speech with additional auditory input by L1 speech

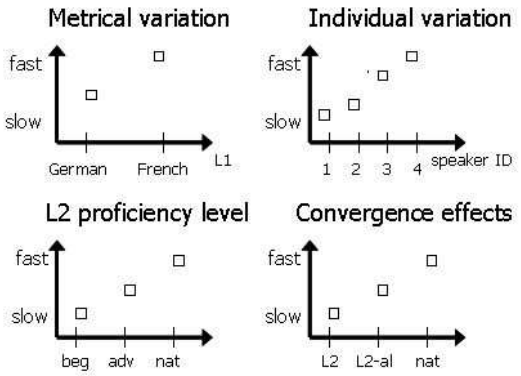

Fig. 1 Sources of variation of AR with expected patterns (beg=L2 beginners, adv=advanced L2 learners, nat=native speakers, L2-al=L2 speech after listening).

Research questions

- Most informative *rate metrics* (for cross-linguistic comparisons)?
- *L2 proficiency*: beginners slower than advanced learners, native speakers faster than advanced learners?
- *Individual rate habits* in L1 visible in L2? [2]
- Any *convergence* of AR when learners get more extensive exposure to L1 speech?

Method

- Material: German-French learner corpus
  - 7 native speakers of German (G), 7 native speakers of French (F)
  - 5 beginners (BEG), 2 advanced (ADV) speakers (per language)
  - each subject produced read speech in L1 *and* in L2
  - 2 conditions selected:
    - READ = sentences read aloud
    - REPEAT = like READ but after listening to an L1 model speaker (only for L2 speech)

- Analysis:
  - start and end of articulation phases and pauses (if present)
  - AR = net rate excluding pauses calculated for:
    - phones per second (phon/s)
    - phonological syllables per second (syll/s)
    - words per minute (wds/min)

Results (Fig. 2)

- Rate metrics
  - comparing L1 speech: G and F substantially differ for syll/s, not so much for phon/s and wds/min
  - for 4 speakers: G read L2 "faster" in syll/s than in their L1
  - distinction between L1 and L2 for each group best for phon/s
- L1 and L2 proficiency
  - fastest L2 speakers belong to ADV, slowest L2 speakers to BEG
  - selected BEG also very fast (speakers 5 and 12)
- Individuality
  - difference in L1 speech between 4 phon/s (GG) and 5 phon/s (FF)
  - difference in L2 speech between 5 phon/s (GF) and 3 phon/s (FG)
  - AR in L1 does not predict AR in L2, e.g.:
    - slow in L1 but fast in L2 (speaker 13)
    - fast in L1 but slow in L2 (speaker 1)
- Convergence
  - all French speakers faster in REPEAT compared to READ
  - 3 German speakers slower in REPEAT (slow French model speaker)

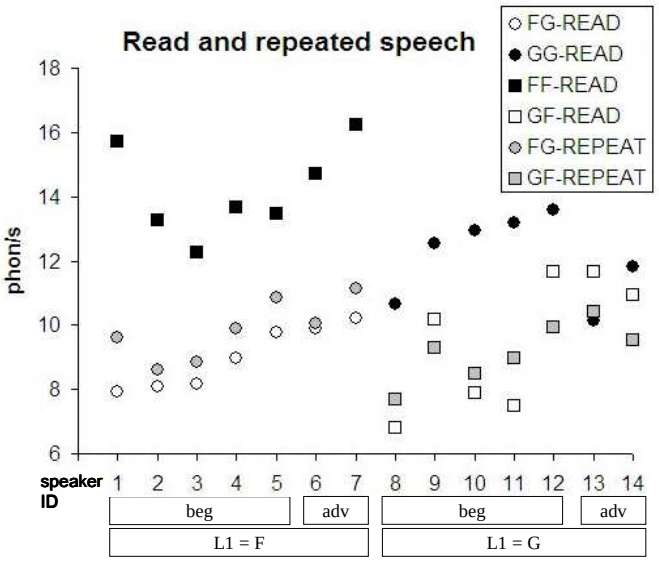

Fig. 2 *AR in phon/s of READ and REPEAT for all groups.*

Discussion and conclusion

- Interpretation limited by rather low number of subjects
- Best AR metric here phon/s, however, F and G still differ in phon/s
- No clear-cut distinction between BEG and ADV
- L1 rate habits only partially reflected in L2
- L2 speakers converge to L1 speakers in the REPEAT condition
  - better temporal control of L2 speech by additional auditory input
  - most beneficial for BEG
  - applicable in computer-assisted pronunciation training

Selected references

[1] M. Munro & T. Derwing 2001. Modelling perceptions of the comprehensibility and accentedness of L2 speech: The role of speaking rate. *Studies in Second Language Acquisition* 23, pp. 451-468.

[2] N.H. De Jong et al. 2013. Second language fluency: speaking style or proficiency? Correcting measures of second language fluency for first language behavior. *Applied Psycholinguistics* 34, 21 pp.