

Towards an Integrated Understanding of Speaking Rate in Conversation

Jiahong Yuan, Mark Liberman, Christopher Cieri

University of Pennsylvania

Sept. 18, 2006

Factors that affect speaking rate

- **Demographic factors:**
 - Older speakers have a slower speaking rate (Amerman & Parnell 1992; Verhoeven et al. 2004);
 - Sex, dialect region (Binnenpoorte et al., 2005; Quene, 2005);
 - Nonnative speakers have a slower speaking rate (Riggenbach 1991);
 - **Utterance length and word position:**
 - Inverse relation between segment duration and utterance length (Nakatani et al. 1981);
 - Phrase final lengthening (Oller 1973), boundary adjacent lengthening (Byrd and Saltzman 1998; White 2002);
 - **Situational factors:**
 - Conversation topic;
 - Speaker relationship;
- **We lack a comprehensive understanding of these factors and their functions.**

Study of speaking rate using large speech corpora

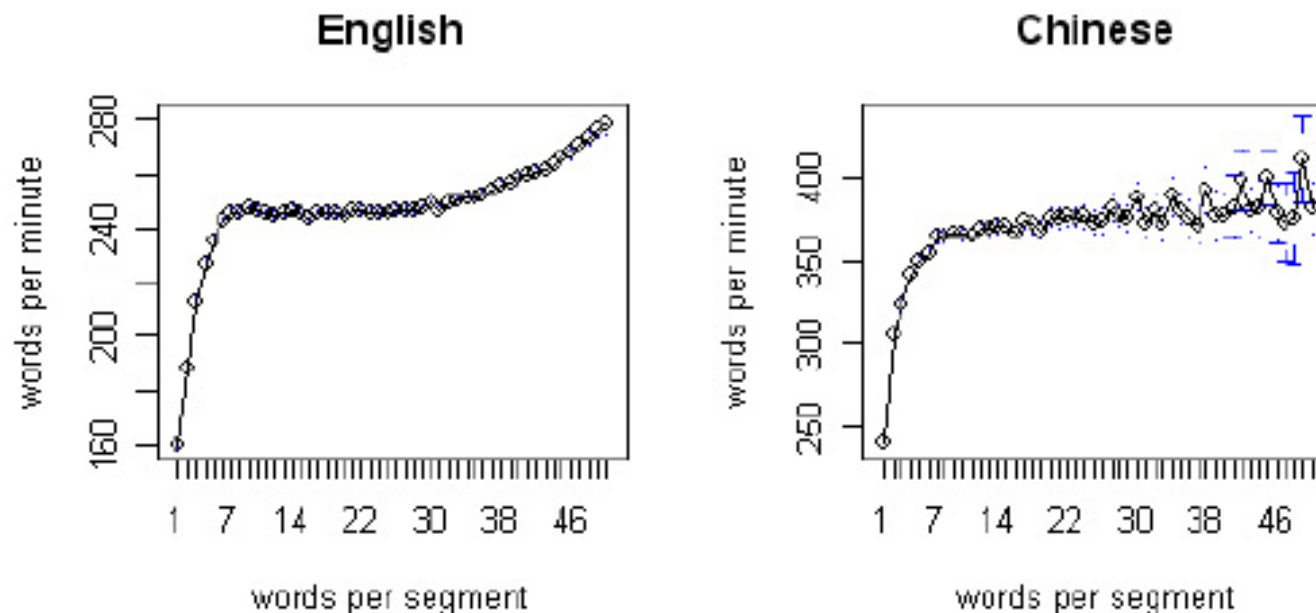
- Large number and variable definition of potentially relevant factors
 - Many different ways to define and analyze rate
 - Speaking rates in Switchboard: 
 - 193 WPM: total words divided by total conversation time;
 - 236 WPM: total words divided by speech time excluding silent pauses;
 - 164 WPM: total words for each speaker divided by the time allotted to that speaker's "turns".
- There's no "standard" way to do all this, ..., based on the goals of your study and the data you're working with, try to keep the practices consistent across the variables of interest to you.

Corpora used in the study

Corpora	Sides	Segments
1. English Fisher I (WordWave part)	10,150	943,044
2. English Switchboard	4,876	248,479
3. English CallHome	200	27,542
4. Chinese Fisher I (HKUST)	1,746	189,568
5. Chinese Callhome/CallFriend	284	47,004

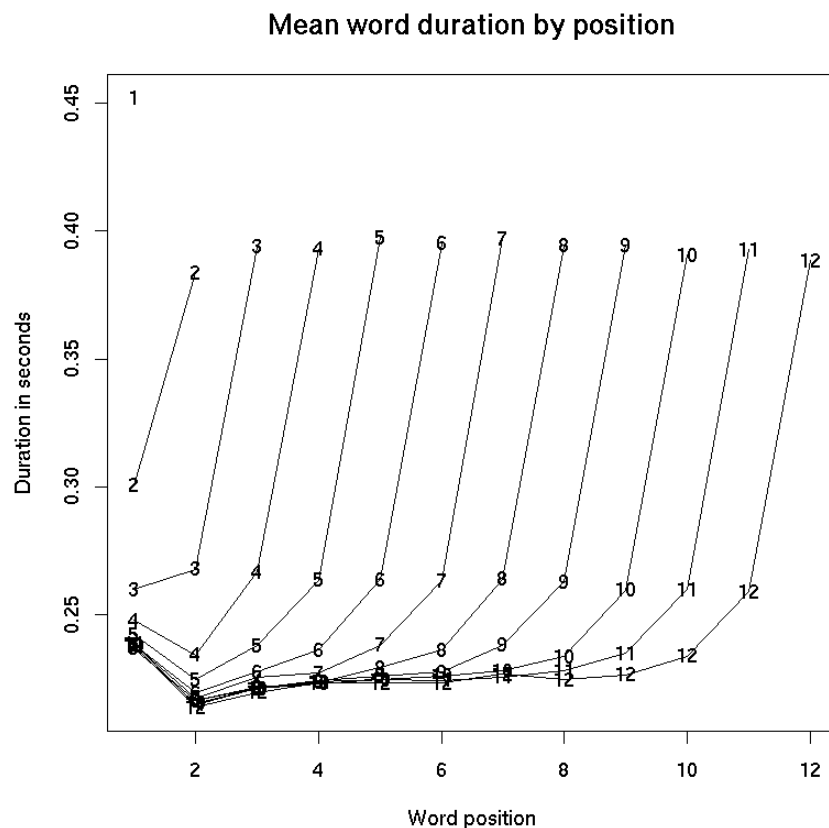
- ✓ Effect of segment length and word position: 2; 5 (word aligned)
- ✓ Effect of speaker relationship: 1 vs. 3; 4 vs. 5
- ✓ Effect of conversation topics: 1; 4
- ✓ Effect of age and sex: 1; 4
- ✓ Effect of native languages: 1; 4

Effect of segment length



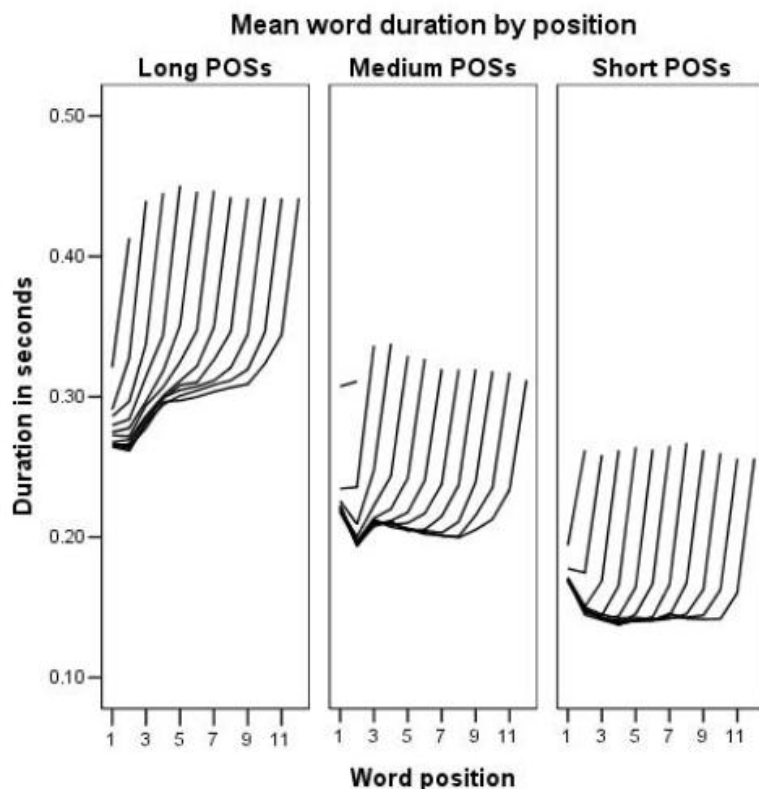
- ❑ Abrupt rise for the segments containing from one to seven words;
- ❑ Stays level for the segments having eight to about 30 words;
- ❑ And then, especially in English, the speaking rate rises again, but with a more gradual slope.

Effect of word position in a segment



□ The second word is a little shorter than the first; the words have similar durations until the third to the last word; the second to the last word is longer than the previous ones, and the last word is the longest.

Effect of word position: by POS



Short: [DT, IN, PDT, PRP, TO, WP, WRB]

Medium: [CC, CD, EX, FW, MD, RBR, RP, VB, VBD, VBP, VBZ, WDT, WP\$]

Long: [JJ, JJR, JJS, RB, RBS, UH, VBG, VBN, NN, NNP, NNS, NNPS]

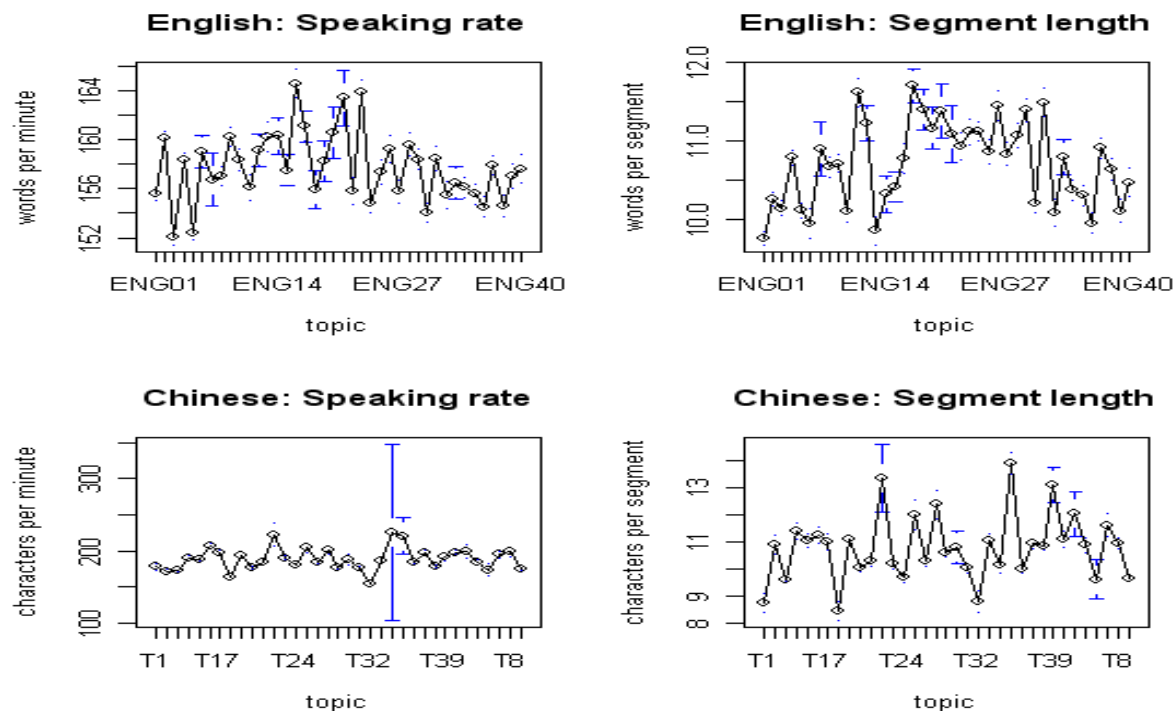
❑ Different POS categories show the same pattern of word duration vs. position.

Effect of speaker relationship

Corpora	Speaking rate	Segment length
English CH (intimates)	214±6.73 wpm	7.84±0.95 words
English Fisher (strangers)	193±0.71 wpm	10.00±0.02 words
Chinese CH/CF (intimates)	247±10.2 cpm	9.76±0.83 chars
Chinese Fisher (strangers)	228±2.85 cpm	10.42±0.04 chars

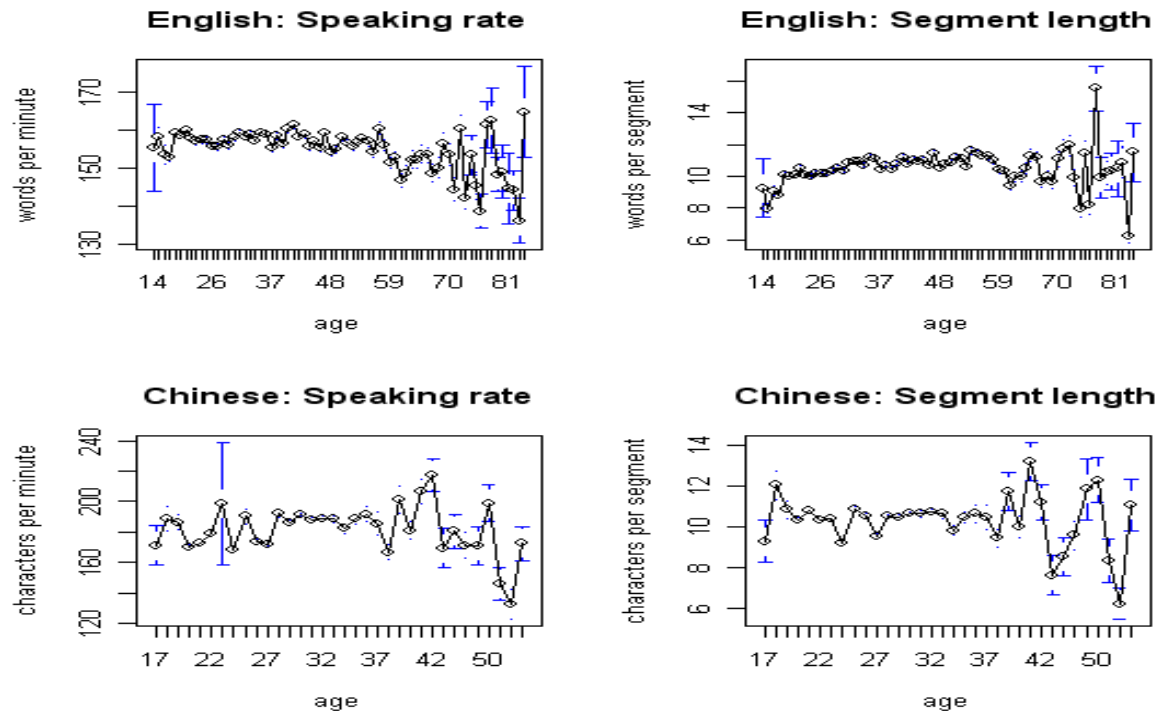
❑ People tend to use longer segments (in terms of word or character count) but slower speaking rates when talking with strangers than when talking with friends or family members (intimates).

Effect of conversation topics



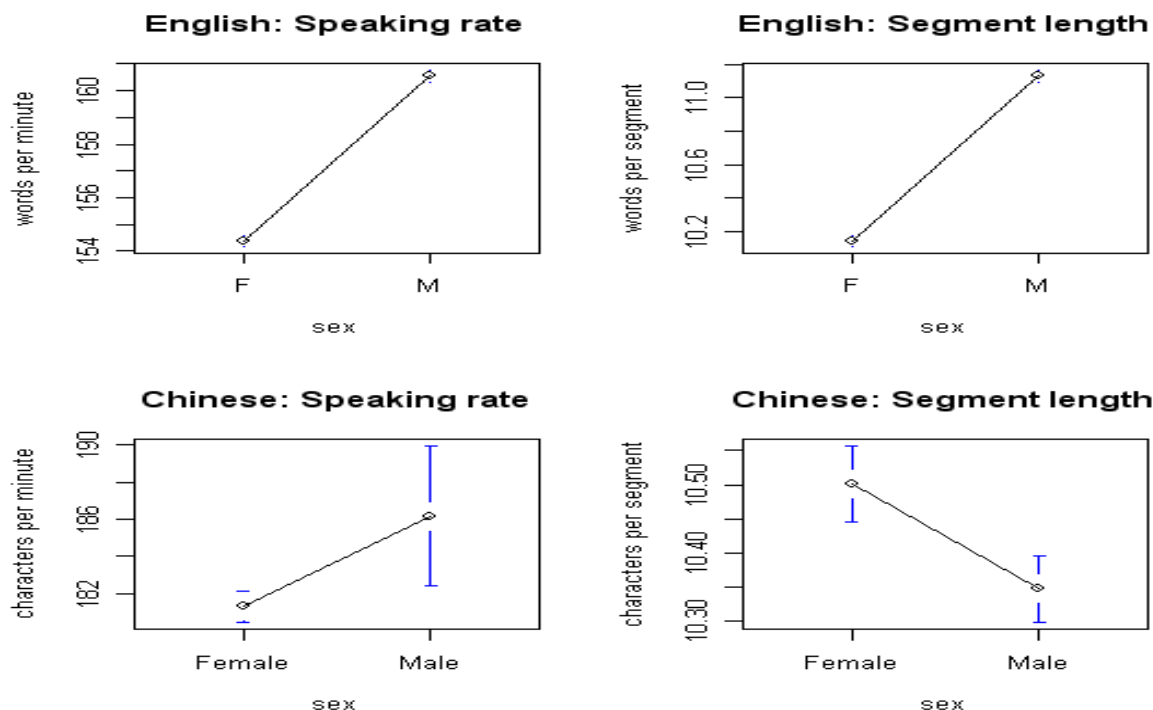
- ❑ Conversation topics significantly affect both speaking rate and segment length (English: 152 – 170 WPM, 9 - 11 WPS).
- ❑ Some conversation topics tend to have both longer speaker turns and slower speaking rates.

Effect of age



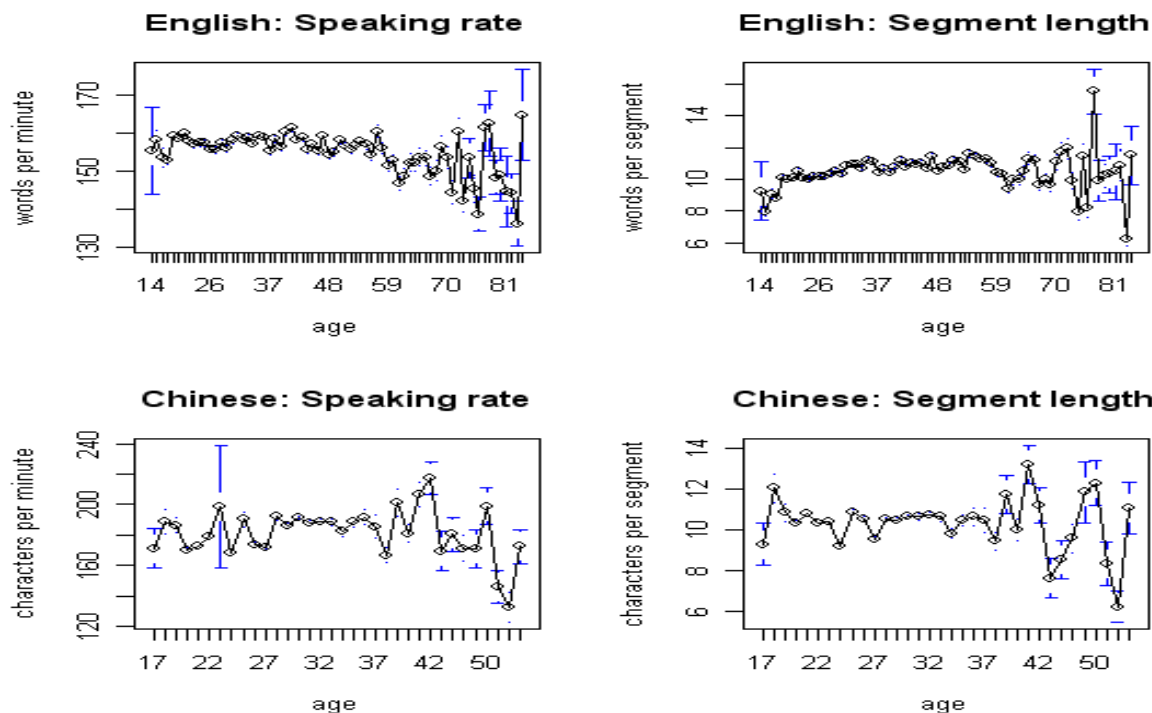
❑ Older people tend to have a slower speaking rate, and they produce significantly more variation in the length of their turns than younger speakers do.

Effect of sex



- ❑ Males tend to speak faster than females, the difference between them is only about 4 to 5 words or characters per minute (2%).
- ❑ Opposite patterns of segment-length difference between male and female in Chinese and English.

Effect of native languages



- ❑ When speaking in English, the Japanese speakers have a slower speaking rate than the others.
- ❑ The speaking rate in L2 is L1 dependent.

Conclusion

- Speaking rate is highly dependent on segment length and word position in a segment;
- The other factors that significantly affect speaking rate include conversation topics, relationship between the speakers, the native language of the speaker, and age;
- Compared to the other factors, speaker sex has a smaller effect on speaking rate, although males tend to speak a little faster than females.
- We regard this work as a first step towards a comprehensive analysis. Because our research is based on published corpora, we look forward to future investigations that will supplement or revise our results.

Thank You!

http://ldc.upenn.edu/myl/llog/icslp06_final.pdf

