ASSESSMENT OF SPEECH PERCEPTION: CROSS-LINGUISTIC CONSIDERATIONS

Lena L. N. Wong, Ph.D., CCC-A, FAAA, FHKSA
University of Hong Kong
THE HINT EXPERIENCE
CURRENTLY IN AT LEAST 20 LANGUAGES

- American English
- Brazilian Portuguese
- Bulgarian
- Canadian French
- Cantonese
- Castilian Spanish
- Japanese

- Korean
- Mainland Mandarin
- Malay
- Norwegian
- South American Spanish
- Taiwan Mandarin
- Turkish
HEARING IN NOISE TEST (HINT)

• Ability to understand sentences in quiet and noise

• 12 lists of 20 sentences each

• In American English

• Sentence reception thresholds (SRTs) are obtained
  
  • In quiet - dB A at which 50% of sentences are repeated

  • In noise - dB S/N at which 50% of sentences are repeated

• Adaptive presentation method
DEVELOPMENT OF THE HINT

- American English HINT
- No standardized Cantonese materials
- 4-7 syllables in English (e.g., The dog is chasing the cat)
- We attempted to identify individual sentences that yield about the same performance-intensity (PI) function slopes
- Results: PI function slopes that ranged from 10-33% per dB change in S/N
EQUALIZATION OF DIFFICULTY

- Outcomes: lengthened the sentences to 10 characters/syllables each by adding adverbial clauses to yield 10% per dB change in S/N
  - Number of syllables varied across languages (Soli & Wong, 2008)
  - Longer sentences may be a problem in elderly listeners with reduced working memory
- Because the sentence yielded 50% intelligibility at different levels, we had to scale so that they yield 50% intelligibility at about the same level.
DEVELOPMENT OF THE TAIWAN MANDARIN HINT

- Created sentences by avoiding vocabulary/lexicons that are not common between the cultures
- The sentences were judged by native speakers for appropriateness and modified to ensure that they suit both cultures
- The sentences were recorded by a news reporter from mainland China with accent acceptable to Taiwanese people
- Sentences were tested to evaluate whether the same scaling factors could be applied and if not, whether there was a consistent difference between cultures
The Taiwanese subjects were annoyed by the accent of our speaker!
APPLICATION OF THE HINT IN DIFFERENT CULTURES

• Vocabulary/lexicon common in each culture

• Controlling the PI function slope at about 10% per dB change in S/N (Soli & Wong, 2008)

• Ensure that the same scaling factors could be applied across cultures

• Speaker with appropriate accent

• South American Spanish
THE HINT IN EVALUATING SECOND LANGUAGE LEARNERS
THE HONG KONG POPULATION

• Immigrants from mainland China
• Bilingual population from overseas (returning Chinese population from Canada, businessmen, South Asian immigrants from Pakistan, India)
• Every child in Hong Kong is learning English as a foreign language
• Normative data collected on monolingual speakers
• How do we distinguish developmental issues and cognitive declines from speech perception problems related to a hearing impairment when a second language is involved?
PERCEPTION OF A SECOND LANGUAGE (L2)

Compared to native speakers, speakers of English as a second language (ESL) (Wu, 2014; Mayo et al., 1997; Takata et al., 1990; Florentine, 1985; Nábělek et al., 1984)

• Difficulties perceiving segmental cues
• More difficulties with L2 particularly in noise and reverberation
• Not as good in top down processing or utilization of linguistic information in speech understanding
BILINGUALS SCORE POORER THAN MONOLINGUALS IN NOISE

• Require more time to access the lexicon
• Phonetic interference from L1 (Mayo et al., 1997; Grosjean, 1989)
• More difficulties with categorical perception of voice onset time (VOT) in L2; experience with VOT modified as early as first year of life (Eilers et al., 1981)

• Simultaneous bilinguals perform as well as monolinguals
**MOST RESEARCH DONE IN USA WITH ENGLISH AS A SECOND LANGUAGE (L2) AND SPANISH AS FIRST LANGUAGE (L1)**

<table>
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<tr>
<th>Characteristics</th>
<th>English as a second language (ESL)</th>
<th>English as a foreign language (EFL)</th>
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<td><strong>Environment</strong></td>
<td>Native English</td>
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<td><strong>English input</strong></td>
<td>Extensive, native</td>
<td>Small amount, accented</td>
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STUDY I: FACTORS AFFECTING EFL PERCEPTION
PARTICIPANTS

- 50 normal-hearing listeners 16 to 20 y.o.
- L1 was Cantonese and L2 was English.
- 25 from international schools; 25 from local schools.
- 17 acquired L2 before age 3; 33 later.
- 3 bilingual groups as age of fluent speaking:
  - 9 Early childhood bilingual (EB): < age 6
  - 36 Childhood to Puberty Bilingual (CPB): age 6 to 14
  - 5 After Puberty Bilingual (APB): > age 14.
AGE OF ESL ACQUISITION VS. SRT

Steady-state/English

\[ R^2 = 0.22 \]

\[ r = 0.47 \]
AGE FLUENT L2 SPEAKING ACHIEVED VS. SRT IN ENGLISH

Steady-state/English

![Graph showing the relationship between age of fluent speaking and SRT in English. The correlation coefficient, r, is 0.47.](image)
AGE FLUENT L2 SPEAKING ACHIEVED VS. SRT IN ENGLISH

![Graph showing SRT (dB SNR) for different test conditions and age groups.](image)
SELF-REPORTED PROFICIENCY VS SRT
SCHOOLING EXPERIENCE

![Graph showing SRT (dB SNR) across different conditions and groups.]

- **Test condition**
  - steady-state
  - 4-talker
  - subway
  - café
  - overall

- **Groups**
  - local school ESL
  - international ESL
  - Local Chinese
  - International Chinese

The graph illustrates the SRT (dB SNR) for different conditions and groups, showing variations in performance across the test conditions.
FACTORS RELATED TO BETTER SRT IN EFL

• Early age when ESL/EFL was first learned (Bergman, 1980; Buus, Florentine, Scharf, & Canevet, 1986; Mayo, Florentine, & Buus, 1997; Takata & Nabelek, 1990).

• Early age when EFL was first spoken fluently

• Self-rated language proficiency in speaking, understanding and reading (Marian et al., 2007; van Wijngaarden et al., 2002)

• Greater exposure to native English in education (Flege and Liu’s, 2001; Piske, 2007).

• Self-reported age of acquisition data may not be v accurate.
STUDY II: SPEECH PERCEPTION IN PROFICIENT EFL SPEAKERS
PARTICIPANTS

Mainland Chinese students
- 60 Chinese as L1 EFL learners.
- from the universities in Hong Kong.
- outstanding in academic performance and English proficiency.

Native American English speakers.
- 20 Control group
SENTENCE RECOGNITION IN QUIET BY EFL SPEAKERS
SENTENCE RECOGNITION IN NOISE BY EFL SPEAKERS
The vowel /ʌ/ was best perceived ($p < .01$).

The vowels /æ/ and /ɛ/ were significantly poorly identified than the other vowels ($p < .01$).

Mean percent correct scores of vowels in the front vowel set in the -6 dB S/N condition among the Mandarin speakers (MC) and English speakers (AE).
VOWEL IDENTIFICATION

The vowel /ɔ/ was significantly better perceived than the vowels /ɑ/, /ɔ/ and /u/ (ps < .001);

The vowel /ɔ/ yielded significantly lower scores than the vowels /oʊ/, /ʊ/ and /ʌ/ (ps < .01).

Mean percent correct scores of vowels in the back vowel set in the -6 dB S/N condition among the Mandarin speakers (MC) and English speakers (AE).
SRT AND PROFICIENCY IN LISTENING

$r = -0.53$

$r = -0.26$
SRT AND PROFICIENCY IN SPEAKING

\[ r = -0.40 \]

\[ r = -0.30 \]
SPEECH PERCEPTION IN LATE BUT PROFICIENT BILINGUALS

- Difficulties noted when testing is conducted at threshold.
- Native-like perception is difficult for EFL learners to achieve, but their perceptual ability could still improve with increasing proficiency in English.
- Due to late acquisition and a lack of native English input, Chinese speakers of EFL experience greater difficulty recognizing English even if they are highly proficient.
- Quality and quantity of exposure are important to enhance speech perception by EFL speakers.
WORKING WITH MULTI-LINGUAL SPEAKERS

- Need to profile the language background of our clients when we do research and speech audiometry in clinic.
- Note that even proficient EFL speakers have difficulties in quiet and worse in noise.
- Account for reduction in speech perception ability.
- Listener could serve as his own control for pre- and post-testing.
- Note additional effects of non-native speech perception in a hearing impairment or auditory processing disorder.
IMPLICATIONS ON LANGUAGE USE AT HOME

• Start early
• Exposure matters!
• Simultaneous bilingualism is ideal and probably does not affect L2 perception
  • Is hearing the L2 in the ambient environment adequate?
  • Monolingual norms could be applied
• Early EFL acquisition may still result in poorer speech reception, even if there is good quality/quantity exposure
  • Cautious application of monolingual norms
  • Could targeted training improve speech reception?
THANK YOU