Cross-language study of age stereotypes in speech perception

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Perception of indexical properties

- Listeners can identify some of a speaker's social identity by listening to speech.
  - Dialect
  - Ethnicity
  - Gender
  - Sexual orientation
  - Age

Speaker Identification Studies

- Accuracy of speaker identification increases when the listeners are familiar with the speakers (Hollien et al, 1982; Pollack et al, 1954; Van Lancker et al, 1985)
- Accuracy of speaker identification decreases for speakers of foreign language and foreign accented speech (Hollien et al, 1982; Thompson, 1987; Koster et al, 1995; Goldstein et al, 1981).

Perception of a Speaker's Age

- Strong correlation was found between talker's chronological age and perceived age (e.g., Ptacek & Sander,1966; Shipp & Hollien,1969; Ryan & Burk, 1974).
- Listener's age estimation is more accurate for talkers in a familiar language than talkers in a less-familiar language (Nagao, 2006).

Age-related changes in speech characteristics

- Speech characteristics due to physiological change
  - Phrases become shorter in duration.
  - Average fundamental frequency increases for men, and decreases for women.
  - Changes in voice quality (e.g. breathiness).
  - Men tend to undergo earlier and more substantial age-related physiological changes than women.
  - Elderly men tend to speak louder due to presbycusis.

Age-related changes in speech characteristics

- Speech variation due to active sound changes or sociolinguistic factors
  - Change in vowel quality (e.g. Labov, Yaeger, & Steiner, 1973; Labov, 1994).
  - Younger Japanese talkers tend to produce /d/ with more positive VOT than older talkers (Takada, 2004).

Stereotype of vocal age

- Studies of stereotypical speech characteristics for a certain age or certain age groups have not been well-documented.
- Stereotypical speech for age could be different in different cultures.

Effects of age disguise

Aim: To examine the effects of age disguise on age perception.

Assumption: When speakers disguise their age, speakers would project age-related perceptual speech images.

Research Questions

Q1. Do listeners estimate the intended age of speakers in age-disguised voice?

Q2. Is age-disguised voice perceived in the same way for speakers of both familiar and less-familiar languages?

Q3. Do younger talkers disguise their voice age better than the elderly talkers?

Predictions

1. Perceived age for speech in age-disguised voice would be higher/lower than perceived age for speech in normal voice.
2. Perceived age for the age-disguised speech would be different when the listeners listened to a less-familiar foreign language.
3. Perceived age differences between the normal and the age-disguised conditions would be smaller for the elderly talkers than for the younger talkers.

Perception Experiment

Methods

Talkers

- 2 language groups
  - **English talker group**:
    - 30 native speakers of English in Bloomington, IN.
  - **Japanese talker group**:
    - 30 native speakers of Japanese in Kobe, Japan.
- 3 age groups
  - Young (25-30 years)
  - Middle-aged (54-60 years)
  - Elderly (80-86 years)
- Equal number of men and women

Speech material

- Used the letter sequence (“BCC”) as the target phrase.
- The target phrase is pronounced similarly in both English and Japanese.
- Embedded in the carrier sentence written in talker’s native language.

Speech material (cont.)

- The carrier sentence for English speakers:

  The answer was BCC Corporation.

- The carrier sentence for Japanese speakers:

  答えはビーシーシー・コーポレーションだったよ。
  kotae wa biisiisii kooporeeshyon datta yo.
  'The answer was BCC Corporation.'

Speech material: Speaking conditions

- Read the same sentence in 3 conditions.
  - **Normal** condition
    - Read the sentence normally.
    - Recorded prior to the age-disguise conditions.
  - **Maturation** condition
    - “Read as if you are 20 yr older than you are.”
  - **Rejuvenation** condition
    - “Read as if you are 20 yr younger than you are.”

Perception Experiment: Stimuli

- Contained only the target phrase "*BCC*".
- Blocked by the talker's language.
- Each stimulus presented thru a headphone under computer control.
- The following were excluded from the stimuli:
  - Speech by the elderly in matured voice (e.g. pretending to be 105 years old)
  - speech by the young in rejuvenated voice (e.g. pretending to be 5 years old)
- Total number of stimuli: 140

Perception Experiment: Listeners

2 groups of young listeners participated.

- **English listener group**
  - 24 English native speakers (M = 20.6 years)
  - From the same dialect regions as the talkers.
  - Participated in the experiment in Bloomington, IN.
  - No knowledge on Japanese language
- **Japanese listener group**
  - 24 Japanese native speakers (M = 19.0 years)
  - From the same dialect regions as the talkers.
  - Participated in the experiment in Kobe, Japan.
  - Very limited English proficiency

Perception Experiment: Task

- Listeners listened to each stimulus and estimated the age of speakers using the scale 1 to 100 years old.
- Listeners were not informed about anything about the speakers (age range, sex, native language, etc.).

Perception Experiment: Analysis

- Correlation between perceived age and chronological age.
- $\triangle$age (perceived age differences between the disguised and normal condition)

  = Perceived age in the disguised condition
  – Perceived age in the normal condition
- Each talker's $\triangle$age was computed for each listener.
- Expected $\triangle$age is +/– 20 years.

Perception Experiment

Results

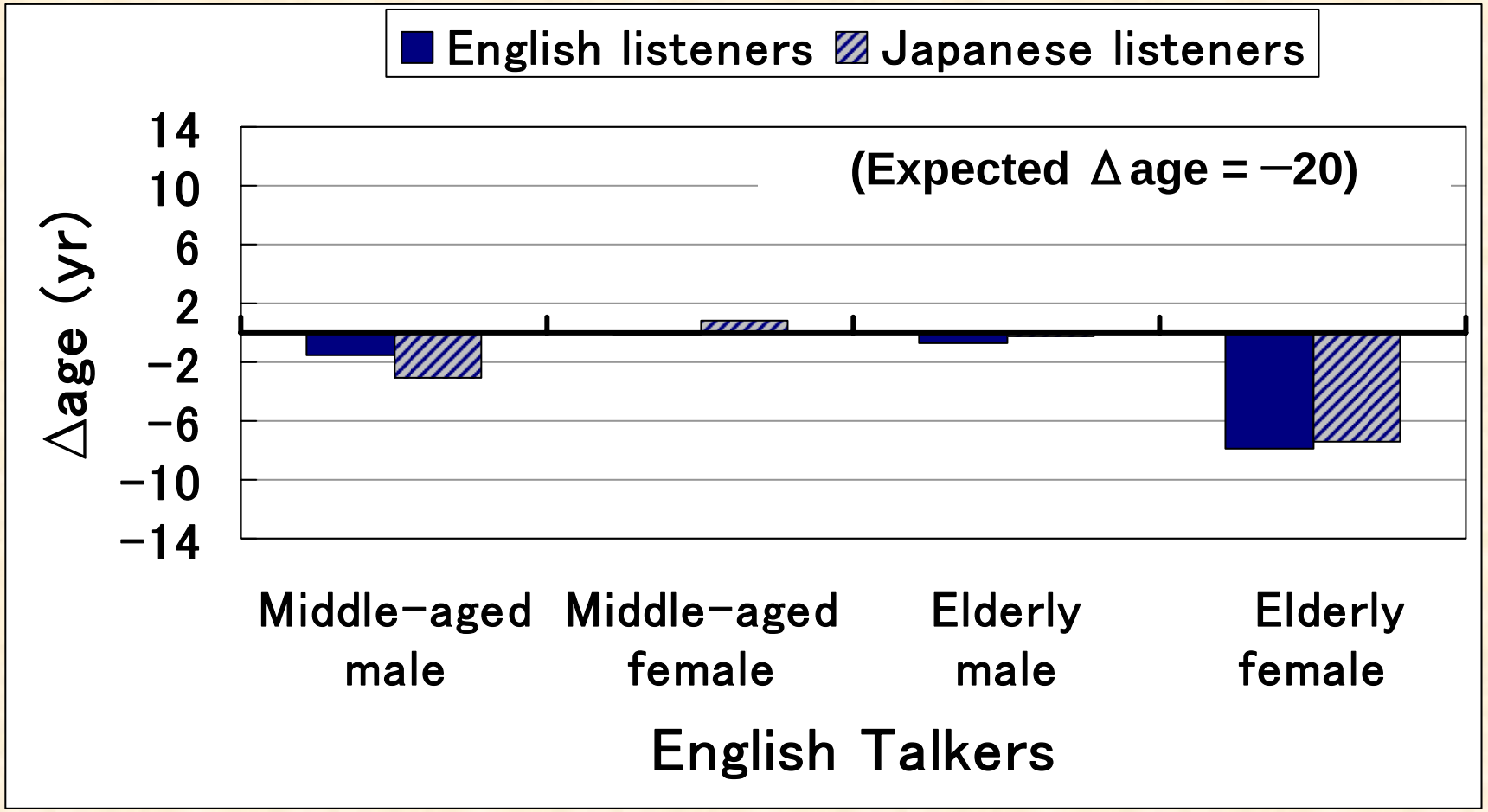
Correlation

- Higher correlations were found when the listeners estimate the age of talkers in the familiar language.

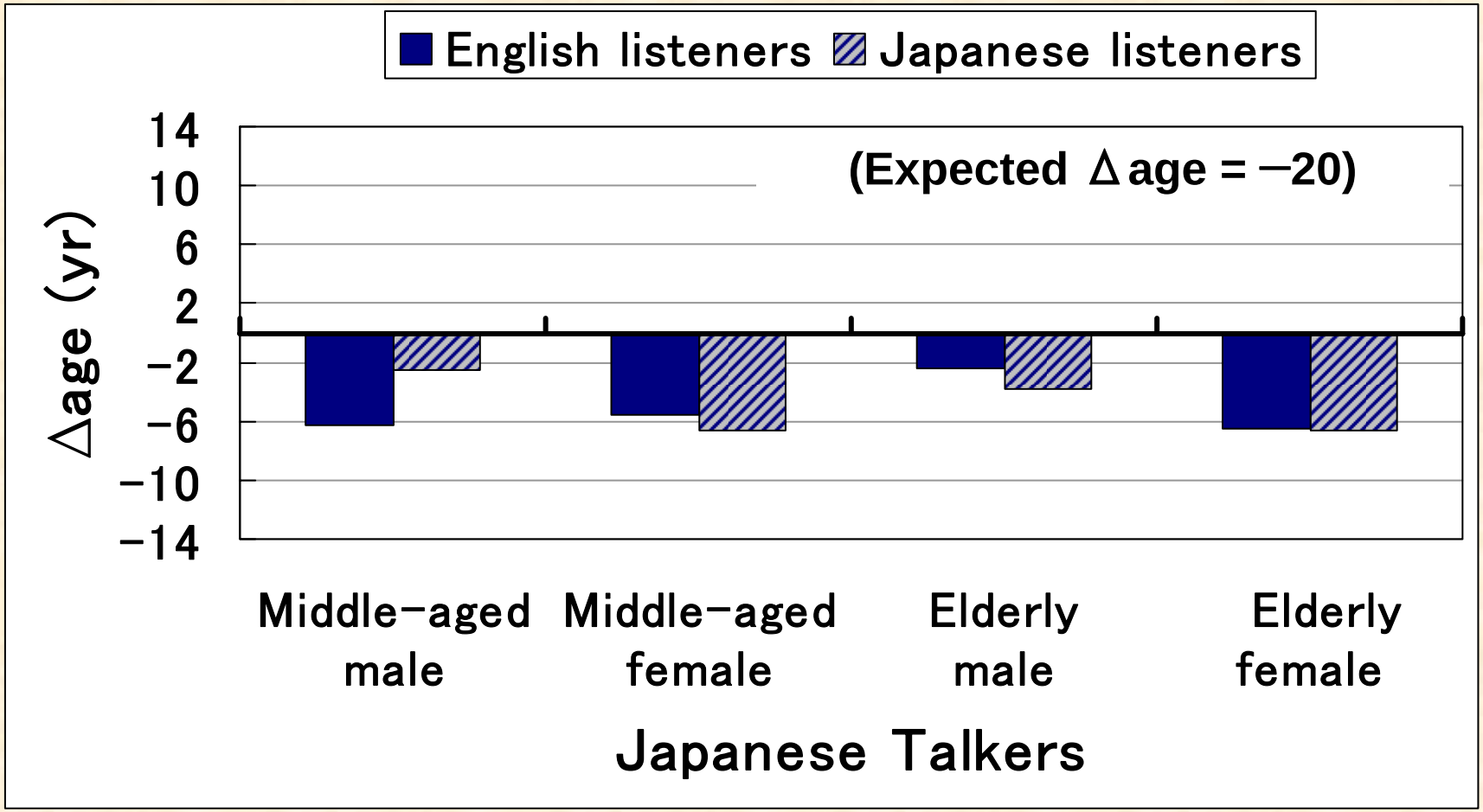
Table. The r-values between perceived age and chronological age.

	Listener language		*p-two tailed*
Talker language	English	Japanese	
English	.64	.51	< .01
Japanese	.59	.79	< .01

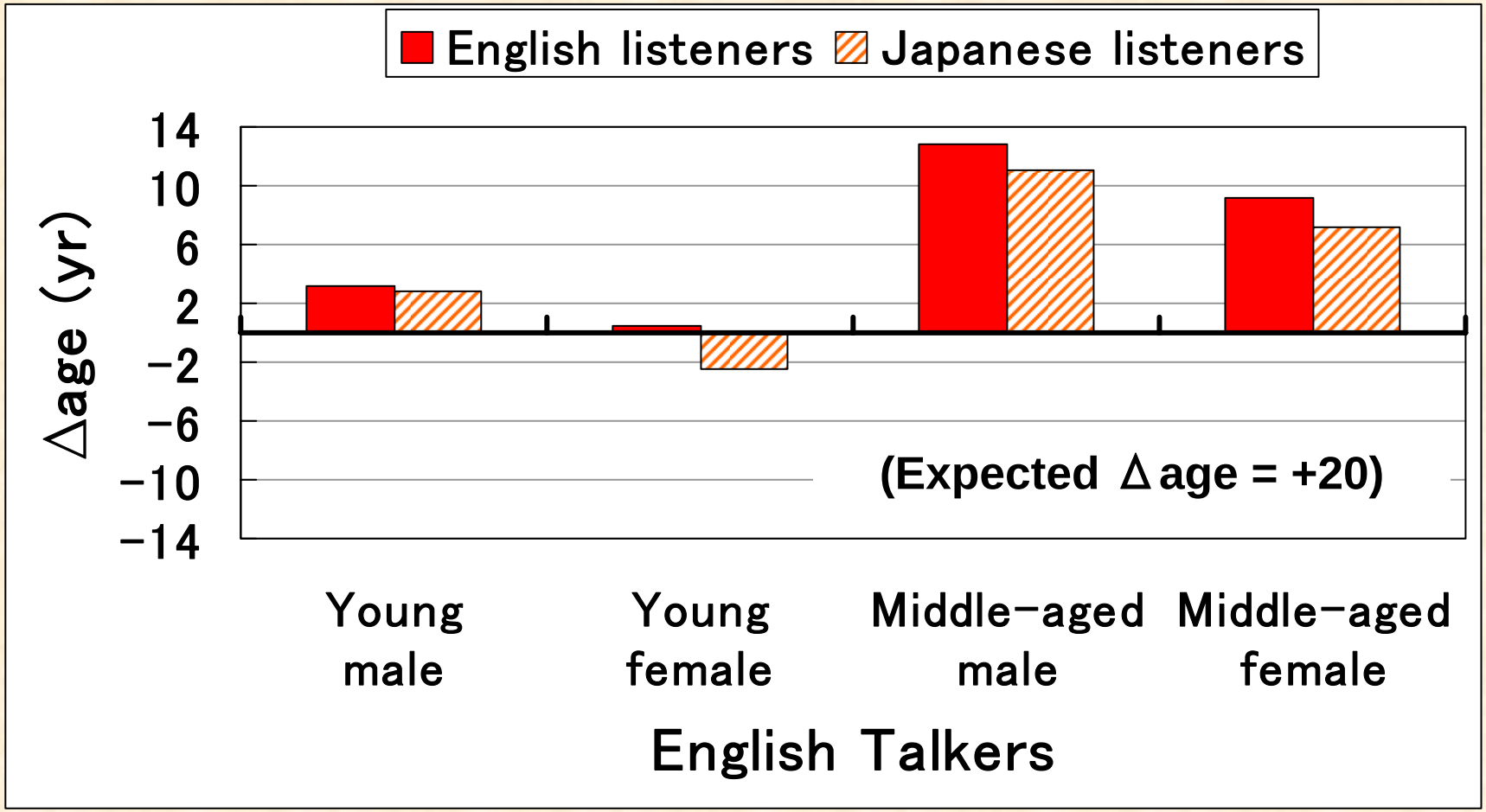
Δage for English talkers between Rejuvenation & Normal conditions



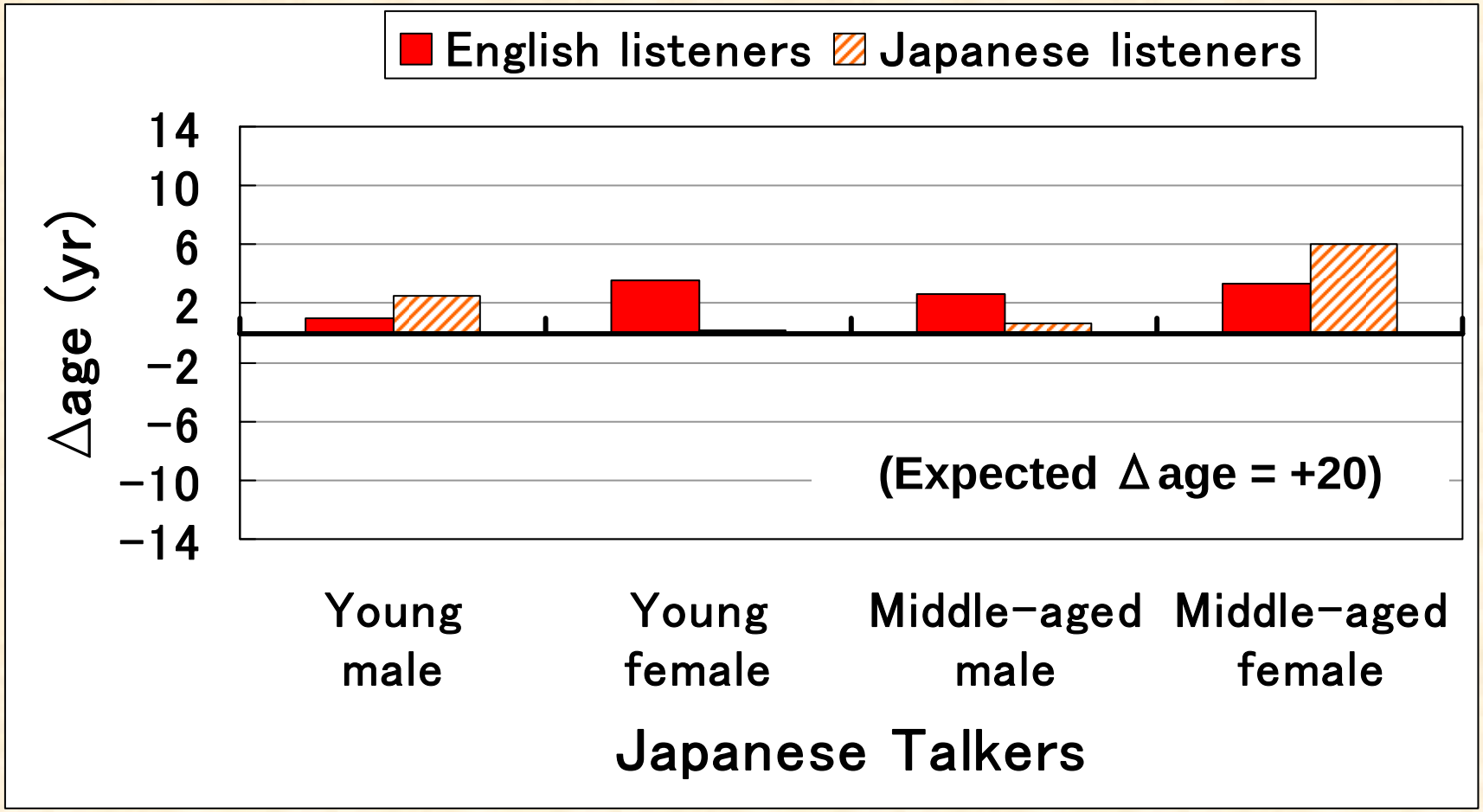
Δage for Japanese talkers between Rejuvenation & Normal conditions



Δage for English talkers between Maturation & Normal conditions



Δage for Japanese talkers between Maturation & Normal conditions



Summary

- Better age estimation was found when listeners listened to a familiar language.
- The age of talkers in their age-disguised voice was perceived younger or older than their actual age in line with the talkers' intended direction of age shift.
- However, the effect of age-disguise was small.

Summary (cont.)

- Age-disguise influenced listeners' age estimation similarly for both English and Japanese listeners.
- The elderly talkers showed similar or larger effects on the perceived age for their disguised speech than the younger talkers.

Effects of Listeners or Talkers?

- Why were the effects of age-disguise small?
  - Talker's age-disguise was not good.
  - Talkers manipulated some speech characteristics, which did not match actual age-related speech characteristics.
  - Listeners were extremely good at identifying the age of talkers.
  - Unnaturalness in the age-disguised speech.

Conclusion

- In both Japan and the United States, the stereotypical speech images for younger or older talkers seem to be similar among the young listeners.
- However, speech stereotypes may be perceived similarly based on different acoustic characteristics in different linguistic communities.

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