

# The Influence of Gender Typicality on Sibilant Fricative Perception in English and Japanese: *A Review and a Pilot Experiment*

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## Just Remember

- You can't say MCWOP without the "W", standing for "workshop"
- This talk analyses some data that were collected in a pilot study. It raises some interesting questions and motivates prospective studies that we are doing right now.

## Three Topics Coming Together

- 1. Japanese and English anterior sibilant fricatives differ acoustically and articulatorily.
- 2. English listeners' perception of the /s-/ʃ/ contrast is influenced by the gender typicality of the voice to which the fricative is appended.
- 3. Japanese listeners are more sensitive to phonetic variation related to gender than are listeners of a language that is typologically similar to English, Dutch.

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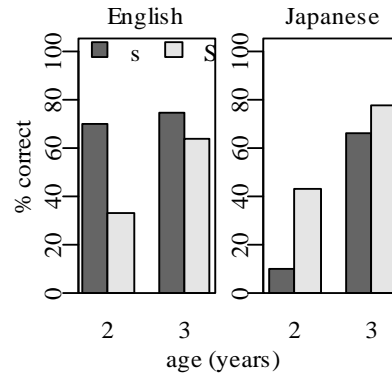
## Topic #1: Sibilant Fricatives in English and Japanese

- Both English and Japanese have alveolar /s/ contrasting with post-alveolar coronal:
  - English: /ʃ/
  - Japanese: /ç/
- In English, these are fully contrastive in all vowel environments.
- In Japanese, these contrast fully before back vowels, and marginally before /e/ (/çe/ occurs in borrowings for *sherry* and *Shakespeare*). They are merged to /ç/ before /i/. The orthography groups {/ça/, /çui/, /çe/, /ço/}, and {/sa/, /çi/, /sui/, /se/, /so/}

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## Topic #1: Sibilant Fricatives in English and Japanese

- How did we get interested in this topic? Acquisition.
- Previous research on the παιδολογος project (PIs: Jan Edwards, Mary Beckman) has shown that the two fricatives are acquired differently in English and in Japanese.
- Edwards and Beckman's findings replicate findings from previous large-scale norming studies.



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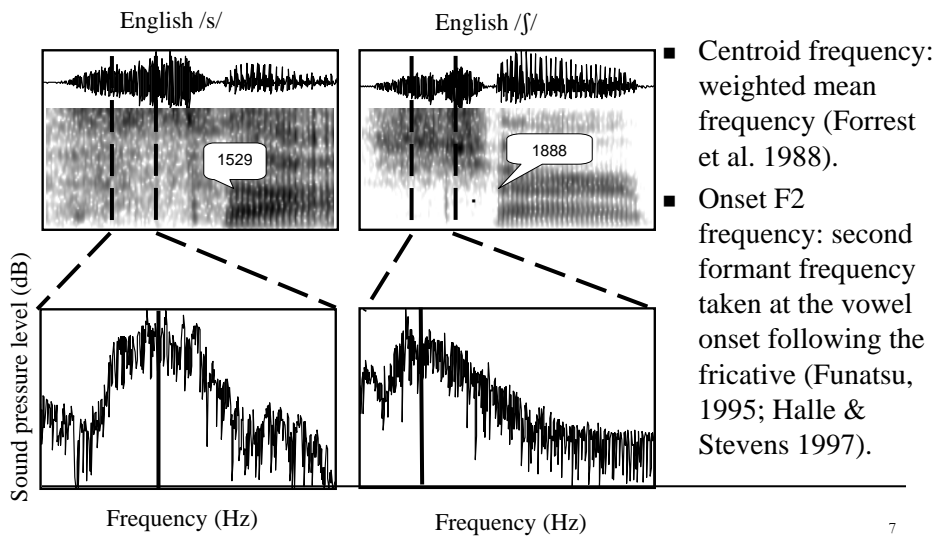
## Topic #1: Sibilant Fricatives in English and Japanese

Initially, Fangfang Li, Mary Beckman, and Jan Edwards, began to examine whether the apparent asymmetry in child acquisition is a consequence of...

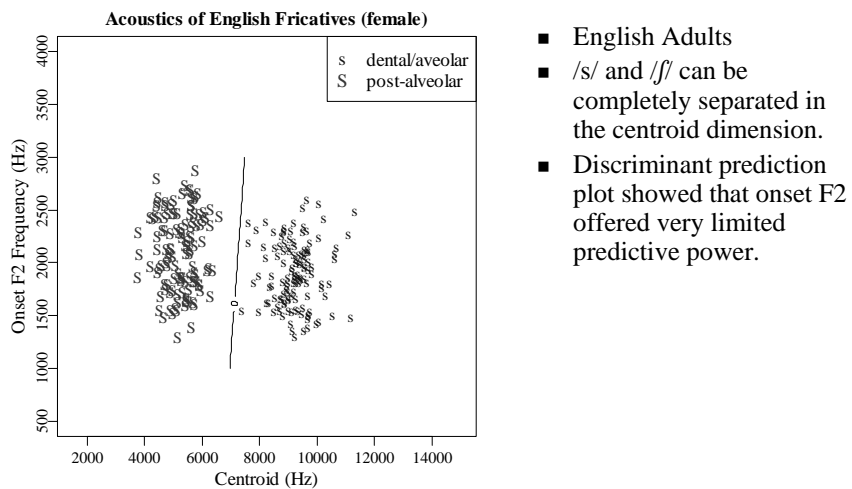
- Fine differences between languages in production of the contrast;
- Differences in the perceptual criteria that listeners in the two languages use to perceive /s/ and its postalveolar counterpart;
- Or differences in both.

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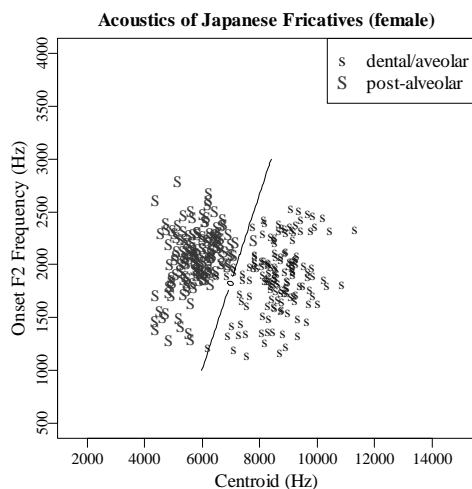
Topic #1: Sibilant Fricatives in English and Japanese  
(Li, Beckman, & Edwards, in press, *Journal of Phonetics*)



Topic #1: Sibilant Fricatives in English and Japanese



## Topic #1: Sibilant Fricatives in English and Japanese



- Japanese Adults
- /s/ and /ʃ/ cannot be completely separated in the centroid dimension.
- Discriminant prediction plot showed that onset F2 offered more predictive power than the English /s-ʃ/ pair.

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## Topic #1: Sibilant Fricatives in English and Japanese (Munson, Li, et al. 2008 LSA; Li, Munson et al. in prep)

- In our ongoing work, Fangfang, Kiyoko, and I have asked...
  - What are the cross-linguistic differences in perceiving the two fricatives in the two languages?
  - To what extent is the apparent cross-linguistic asymmetry in acquisition due to differences in perceptual norms?
- Prediction:
  - Given the production differences, we would expect that adult native speakers of English and Japanese would parse the multidimensional acoustic space differently.
- Subjects:
  - 19 English-listeners from Minneapolis, MN, US.
  - 20 Japanese-listeners from Tokyo, Japan.

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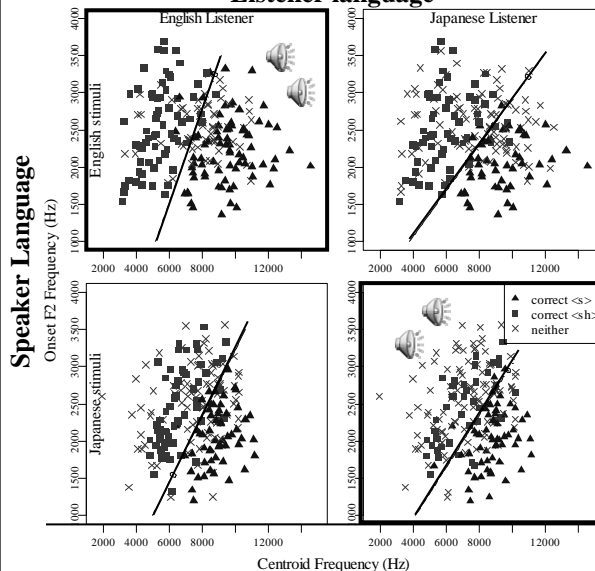
## Topic #1: Sibilant Fricatives in English and Japanese

- Stimuli:
  - Initial CV in words produced by English- and Japanese-acquiring children (from the παιδολογος project database.)
  - Words selected by excluding stopping errors and other fricative substitution errors with /f/ or /θ/.
- Task:
  - Each listener hears two blocks of the same 400 tokens.
  - They were asked whether each token began with an <s> sound in one block and an <sh> in the other block.
  - They need to answer by pressing “Yes” or “No” button.
  - Naïve listeners didn’t know they were listening to multiple languages.

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## Topic #1: Sibilant Fricatives in English and Japanese

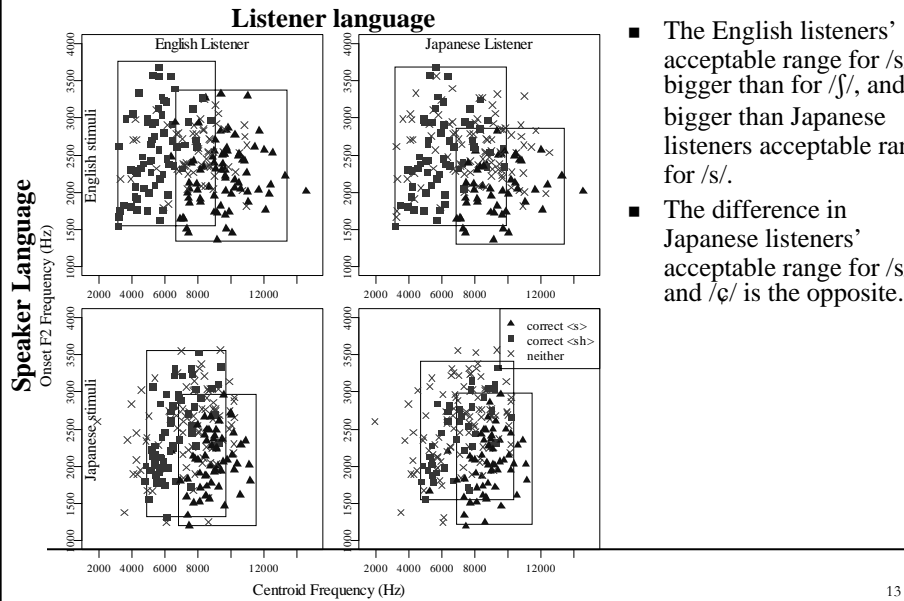
### Listener language



- English: centroid is weighted more than onset F2 frequency.
- Japanese: centroid and onset F2 frequency are nearly equally important.
- The perception of a target fricative in a particular language is constrained by the competing fricatives which share the same space.

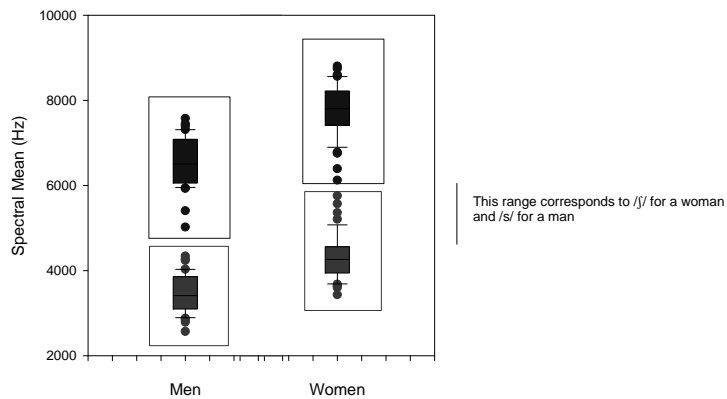
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## Topic #1: Sibilant Fricatives in English and Japanese



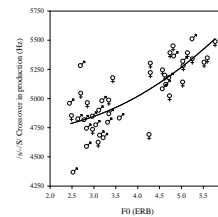
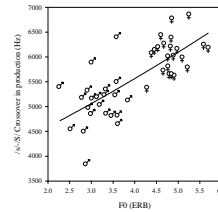
## Topic #2: Gender Normalization for Sibilant Fricatives

- Men and women produce sibilant fricatives with different spectral ranges. /s/ is in blue; /ʃ/ is in red. These data are from Munson, McDonald, DeBoe, and White (2006, *Journal of Phonetics*).



## Topic #2: Gender Normalization for Sibilant Fricatives

- Munson, Jefferson, and McDonald (2006, JASA):
- The midpoint between actual /s/ and /ʃ/ productions varies continuously as a function of another acoustic parameter that differs between men and women, F0.
- When a continuum of sibilant fricative is paired with male and female voices, listeners give different crossover points. The relationship with F0 is about what you would expect from the production data
- There is considerable variation in crossover point within biological sexes.



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## Topic #2: Gender Normalization for Sibilant Fricatives

- This can occur even when the gender of the talker is merely implied (Strand & Johnson, 1996; Munson, 2009 LSA).
- Crucially, this has been studied exclusively in English. Does this effect occur in Japanese? Is the size of the effect the same?
- Why would it be different? Next slide, please...

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### Topic #3: The sociophonetics of gender in Japanese

- Do different languages parse phonetic variation related to gender equivalently?
- Van Bezooijen: Japanese listeners' perception of attributes about talkers is more strongly influenced by the F0s of their voices than Dutch speakers are.
  - Japanese listeners rate Japanese women with higher pitches and Japanese men with lower pitches more positively than low-pitched female voices/high-pitched male voices.
  - Pitch doesn't have as strong an influence on evaluations of Dutch talkers by Dutch speakers in the Netherlands.

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### Research Questions: This Study

- 1. A Basic Question: Do Japanese and English listeners assign the labels /s/ and {/ʃ/, /ç/} to different ranges of frication noise?
- 2. Are there differences across languages in the extent to which listeners' fricative identifications more affected by sex typicality of the talker's voice?









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## Methods

- A seven-step /s/-/ʃ/ continua were created by pairing an /s/-/ʃ/ continuum (created by mixing naturally produced /s/ and /ʃ/ endpoints at various amplitude ratios). The four least /ʃ/-like tokens were used in this experiment
- These were paired with 32 low vowel productions by English-speaking men, the gender typicality of whose voices had been measured and reported previously in a series of papers
  - Munson, McDonald, DeBoe, & White (2006); Munson, Jefferson, & McDonald (2006); Munson (2007)
  - It is notable that these judgments were made by English listeners, a question we return to later.

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## Example Stimuli

	More Prototypical	Less Prototypical
Step 1		
Step 2		
Step 3		
Step 4		

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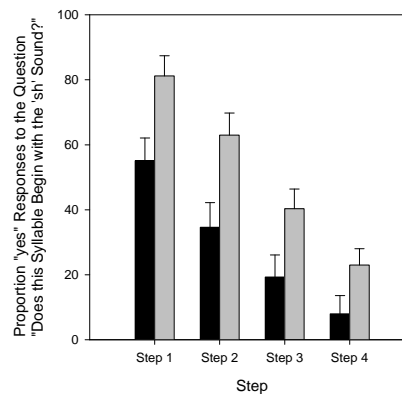
## Methods

- These were included in the “Did this syllable begin with a ‘sh’ sound?” block of the Li, Munson et al. experiment, ostensibly as filler items.
- Participants’ responses and response times were logged

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## Result: Question 1

- Are Japanese listeners’ spectral ranges for /ç/ different from the English listeners’ ranges for /ʃ/?
- Yes.
- This was significant in an ANOVA.
- $F[1,34] = 9, p = 0.005,$   
 $\eta^2_{\text{partial}} = 0.21$



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## Results: Question 2

- There was a three-way interaction between step, talker sex typicality and listener language,  $F[3, 102] = 2.89$ ,  $p = 0.041$ ,  $\eta^2_{\text{partial}} = 0.08$ .
- Surprisingly, there was no effect of talker sex typicality on English listener's rate of "yes" responses.
  - Well, maybe not so surprising. Munson, Jefferson, and McDonald (2006) didn't find an effect of the sex typicality of men's voices on fricative identification crossover points, though Coyne (2007) and Munson (2009, forthcoming) did.
- At step 2 the Japanese listeners gave significantly more "yes" responses to the less-prototypically sounding men's tokens (67.2%) than to the more-prototypical ones (58.8%). This is what we would expect based on previous findings.

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## Delving a little Deeper

- We can't conclude definitively that the interaction between group and sex typicality is due to differences in the way that sex typicality is perceived, because the sex typicality judgments were made by English listeners.
- However, we can ask: Did the acoustic characteristics of the stimuli affect listeners in the two languages differently?
  - Van Bezooijen's findings would suggest that Japanese listeners' judgments might be more influenced by the  $f_0$  of the talker's voice than the English listeners' judgments are.

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## Delving a little Deeper

- A series of regression analyses showed that the best predictor of Japanese listeners' perception of the 32 different tokens was the onset F2 frequency. English listeners' judgments were not
  - Li, Beckman, and Edwards showed this to be an important parameter needed to differentiate /s/ from /ç/ in Japanese and NOT needed to differentiate between /s/ and /ʃ/ in English.

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## Delving a little Deeper

- The apparent greater influence of sex typicality on fricative judgments in Japanese was due to the fact that the less-prototypical men had higher onset F2 frequencies than the more prototypical ones.
  - This finding doesn't tell us anything about cross-linguistic differences in indexical effects on fricative perception, but it does show us that an indexical manipulation in one language might have a consequence for the perception of a phonetic variable in the other language

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## This begs a few questions...

- 1. Are there indeed cross-linguistic differences in the influence of gender typicality on speech-sound perception?
- 2. What is the influence of cross-language differences in socioindexicality on L2 learning?

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## Acknowledgments

- Kathleen Currie Hall provided valuable input on the design of the study, and helped with data collection and analysis. Yuki Sunawatari helped collect the Japanese data.
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