Simon Fraser University
Language and Brain Lab

English Vowels Effects on Word Frequency and Noise Conditions

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Research question and hypotheses

What is the degree to which talkers adjust their English vowel articulations in natural conversation with (1) high and low frequency words and (2) different noise conditions?

Main hypotheses:

- Based on previous findings from Kim et al. (2011) and Munson & Solomon (2004), we predict that the extent of vowel modifications will be greater in higher frequency words and in noisier conditions

  - Sub-hypotheses for more specific predictions:
    - We predict that **greater vowel adaptation** will occur in beginning vs. end of conversation target words between interlocutors with **greater noise levels** (or with different L1 backgrounds) (Kim et al., 2011)
    - We predict that **higher frequency words** will result in **productions with longer vowel duration and a contracted vowel space** when compared to lower frequency words (Munson, 2004)

Experiment overview

Experiment 1	BREAK FOR PARTICIPANTS	Experiment 2
Pre-Task: Baseline Training		Pre-Task: Baseline Training
Task 1: Guess What Card Game		Task 2: Diapix Elicitation Task
Post-Task: Baseline Comparison		Post-Task: Baseline Comparison

Why two different experimental tasks?

- Encourage **natural** conversation with different levels of structure
- Allow for **repetition of stimuli,** teamwork, and **back-and-forth problem-solving** through conversation

Stimuli

- Acquired in
  - Pre- and post-tasks at the word level
  - Both **semi-scripted** and **unscripted** natural conversational sentences
- Criteria:
  - Must be **monosyllabic**; **CVC**; **high frequency** (target) and low frequency (non-target); object (**easily visualized**)
  - Target different vowels; use **minimal or pseudo-minimal pairs**; be found in a similar consonantal context
  - Specific phonetic contrasts: **tense and lax vowels** in minimal or near minimal pairs/monosyllabic nouns

Bell /**bɛl**/

Ball /**bɑl**/

Bull /**bʊl**/

Bill /**bɪl**/

Bit /**bɪt**/

Beet /**bit**/

Bat /**bæt**/

Boot /**but**/

Participants and exp. setting (1)

Participants

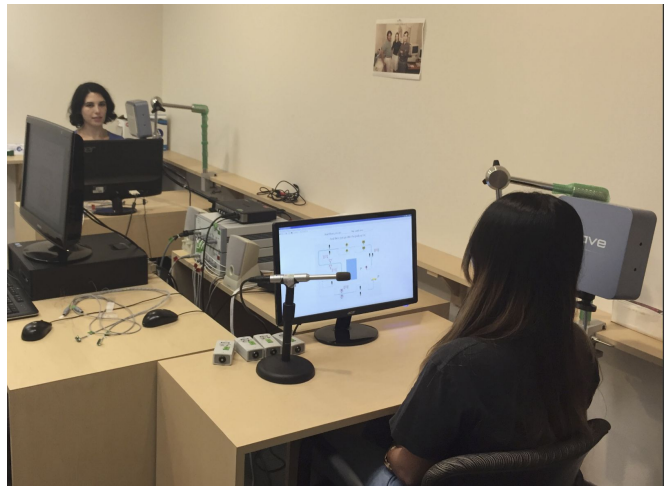
- Native & Nonnative English speakers
- Human-to-human
  - audio-only vs. audio-visual

General experiment setup

- Conversation partners will face each other with a plexiglass in between with headphones and a mic on
- Participants will sit within 3 ft of each other
- Video camera facing both participants
- Participants mouths will be visible

Differences between experiment setups

- “Guess What” card set on table in front of each participant with mystery character cards between them
- Diapix task is presented on a computer monitor



Lee et al. (2018)

Experiment 1: Pre-task description & procedure

Pre-task Training

- Baseline measurements
- Each participant provided a list of target and non-target words on a computer screen and be asked to read aloud in plain speech
- Words will be recorded for comparisons in the post-task

Experiment 1: Guess What Card Game

Task Procedure

- Each participant has:
  - a similar set of cards (target & non target word objects)
  - cards in a 4x5 layout
  - a yellow “mystery” card (face-down)
  - a physical copy of instructions/script

Participants will:

- take turns asking questions & answering guesses
- play 3 rounds of the game

Experiment 1: Guess What Card Game (con't)

Physical copy of instructions for participants:

TAKE TURNS ASKING QUESTIONS AND ANSWERING:

Question: **"Does your character have a _____?"**

Answer: **"Yes/No, my character does/does not have a _____."**

IF YOU DIDN'T HEAR YOUR PARTNER CLEARLY, FEEL FREE TO ASK FOR CLARIFICATION:

Clarification: **"Did you say _____ ?"**

Answer: **"Yes/No, I said _____ ."**

WHEN YOU'RE READY TO MAKE A FINAL GUESS:

Final Guess: **"Is your Character _(name)_ with a _(item1)_, _(item2)_, and _(item3)_?"**

Experiment 1: Guess What Card Game (con't)

Participants will play the game **3 times x 3 noise conditions**

- Noise conditions adopted by Gilbert (2014)
  - Noise is randomized and played through participants' headphones
    - **Quiet speech**
    - **4-6 people babbling**
    - **Mixed noise at various decibel levels**

- Phonetic convergence assessment
  - Adopted from Kim, Horton & Bradlow (2011)
  - Use speech samples from early and late portions of conversation recordings
    - Speaker's first and last target word utterances
    - Acoustic analyses for comparisons

Experiment 1: Example Script

Task - Natural Conversation

P1: Okay, P2, does your character have a **boot?**

P2: Hmm no, my character does not have a **boot**….does your character have a **beet?**

P1: Yes! My character does have a **beet**. Does your character have a **bat?** I wonder if it's an animal **bat** or a baseball **bat?**

P2: Did you say **bat?**

P1: Yes, I said **bat.**

P2: It's an animal, not a baseball **bat.**

P1: Okay - does your character also have a **boot?**

P2: Yes! It has a **boot** and a **bat.**

….

Experiment 1: Post-task description & procedure

Post-task baseline comparison:

- Participants will be given the same list of the target and non-target words to read outloud in plain speech
- Comparative analyses of pre- and post-task target word vowels for visual and acoustic cues

Experiment 2: Description and procedure

Pre-task and post-task procedures the same as Experiment 1

- Participants will be given a different set of target and non-target word list to read outloud
- Speech recordings will be analyzed for visual and acoustic cues of target word vowels
- Comparisons made between pre-task and post-task productions

Experiment 2: Diapix Elicitation Task

Task Procedure

- Each participant has:
  - a monitor presenting a similar scene with some differences
  - prompted conversation questions on the screen to discuss

Participants will:

- discuss the 5 Ws of their own diapix scenes
- play 3 rounds of the game

A

B

Kim, Horton & Bradlow (2011)
*with target additions

Experiment 2: Sample Script

*-Prompt on screen to discuss **bell**-*

P1: Hmm okay, my **bill** is next to the library.

P2: The library? Oh, the **bill** on my screen is outside of the grocery store.

P1: Did you have a blue **ball**?

P2: Hmm no, I think it was gold. It was a gold **ball** outside of the grocery store, on the far left.

Summary

- How will this task allow testing of the hypotheses in terms of examining patterns of phonetic adaptation?
  - These tasks will create opportunities for more and less natural conversation
  - These tasks will analyze adaptation in terms of word frequency and noise

- Feasibility of this task (pros, cons, challenges)
  - Pros: more & less structured tasks, face to face interactions, simple to understand, familiarity
  - Cons: location of target words in productions, number/frequency of repetitions

- Challenges:
  - Ensuring participants have adequate eye contact
  - Ensuring participants are not distracted by game cards/Diapix on screen
  - Differences in participant language experience & dialects

Future suggestions & changes

- Is it more clear for the participant if the cards have images of people HOLDING objects, or if the cards only have objects?
- Do we want to involve a (secret) interlocutor in either of the tasks? Why/why not?
- How can we adjust stimuli (in the future) to consider word frequency?
- How can we ensure consistent & reliable eye contact/engagement by participants?
- Anything else? :)

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Thank you!

Group members: Janitta Wong & Samantha Gryz
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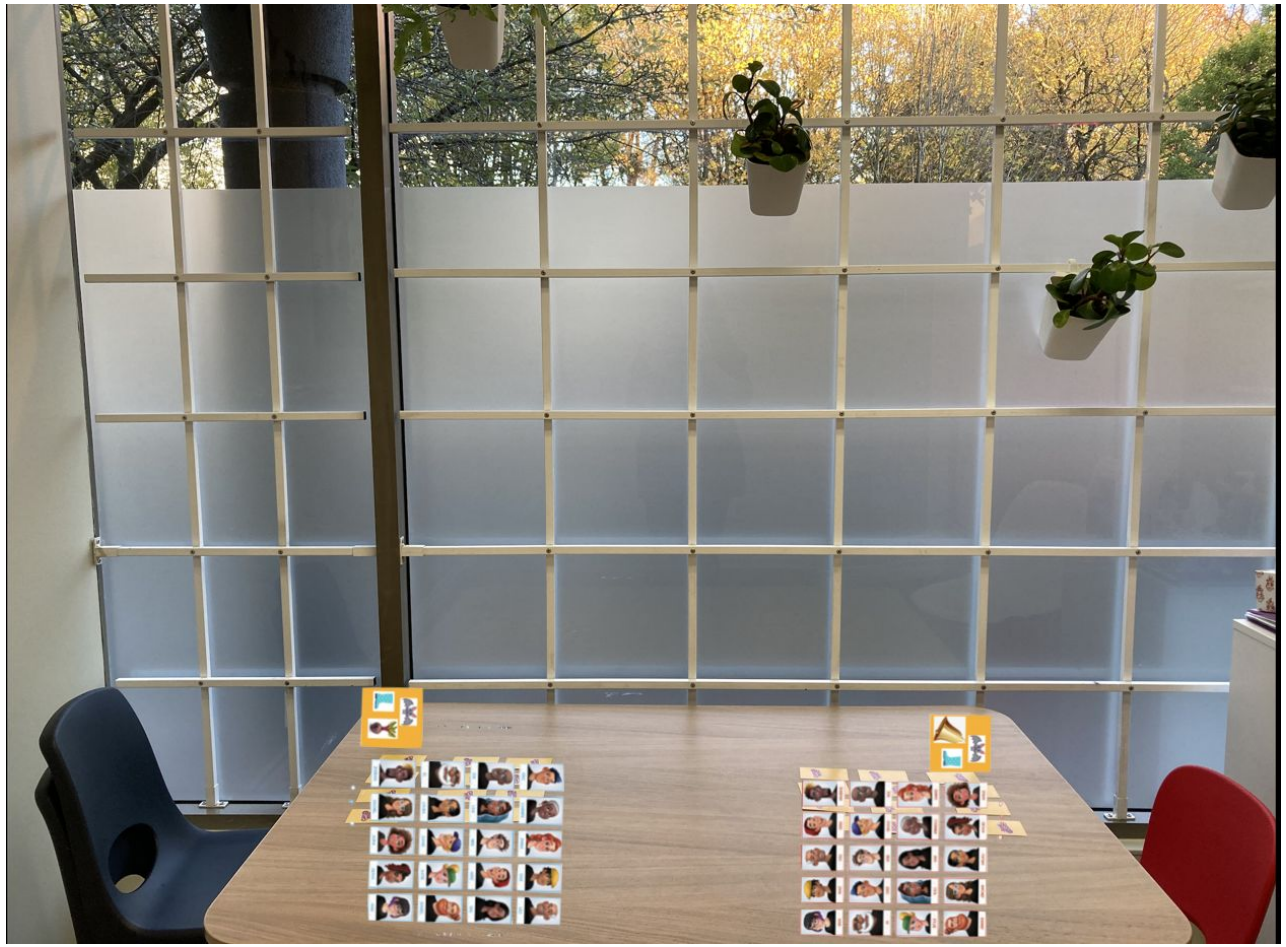
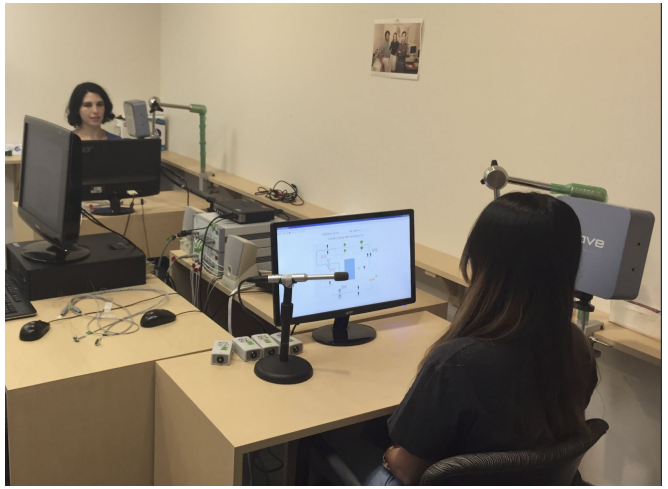
Questions & Comments

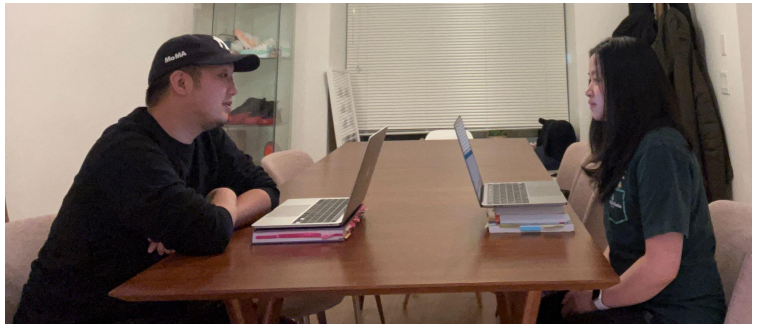
- Use sound booths in lab instead of a curtain?
- Computer monitors for the Guess What game

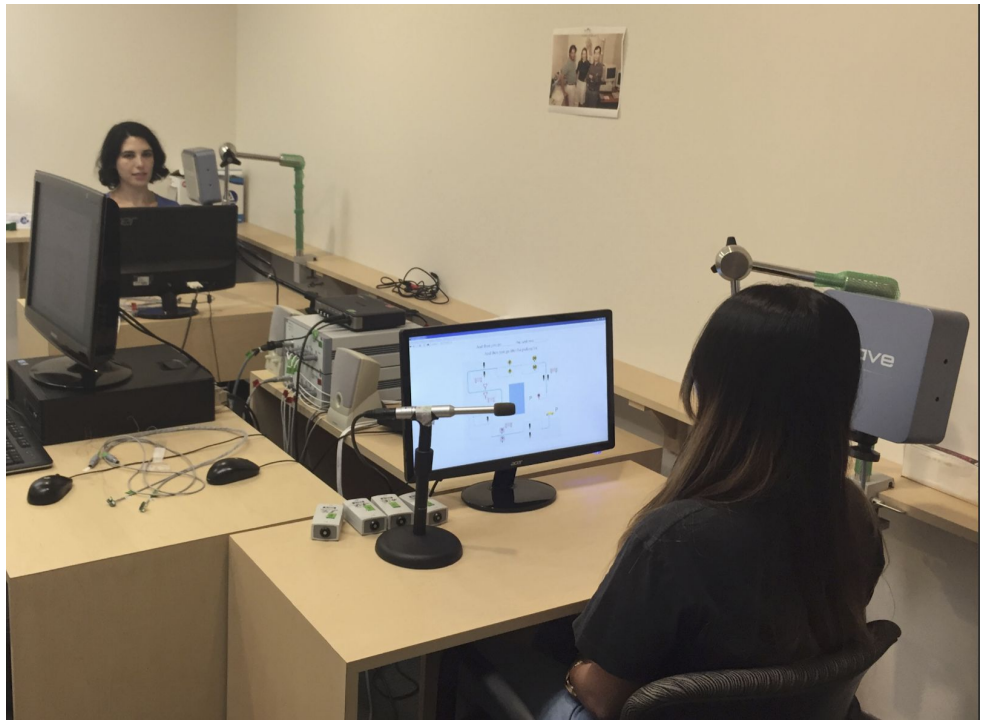
Demo 1: Guess What Game





Demo 2: Diapix Task





December 5, 2022

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