

Analysing Learner Speech and Resulting Applications for EFL Classrooms

A corpus-based contrastive analysis of vowel production of L1
English speakers and L1 Japanese learners of English



Martin Schweinberger



<https://martinschweinberger.github.io/JapEVowelsCAU>

Vortrag im Rahmen meiner Bewerbung um die W3-Professur in englischer Sprachwissenschaft an der
Christian-Albrechts-Universität zu Kiel

Hintergrund

Mein Forschungsprofil zeigt, dass ich, u.a., forsche zu:

- World Englishes | Variationslinguistik und Soziolinguistik |
Language Variation and Change | Korpuslinguistik | Synchrone und diachrone Linguistik des Englischen

Dieser Vortrag

- Potenzial für forschungsorientierte Lehre und Spitzenforschung
- Studiengänge im Institut sind lehramtszentriert (Nutzen von Forschung für Studierende)
- Möglichkeiten und Bereitschaft für potentielle inter- sowie transdisziplinäre Zusammenarbeit
(Englisches Seminars | Fakultät | CAU-weit)
- Fachdidaktik Mobile Enhanced Language Learning and Teaching (MELLT)
- Sprachpraxis / Language Experience
- Institute für Skandinavistik, Frisistik und Allgemeine Sprachwissenschaft (ISFAS) |
Germanistisches Seminar
- SECC (Society, Economy, Culture in Change): eher Oberweserplatt (SIN2)



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Timeline | Table of Contents

- Background and Motivation
- Research Gaps | Research Questions
- Methodology (Data and Analysis)
- Results
- Discussion, Outlook, and potential Applications



Background and Motivation

Pronunciation is a challenge for L2 English learners
Problem

- Pronunciation is most immediate and direct
- Everybody automatically and subconsciously categorizes and infers judgements based on
pronunciation (gender, age, cultural background, nativeness, socio-economics, education, etc.)
- Pronunciation is crucial for intelligibility
- Pronunciation is affecting rea-life opportunities (jobs, partner choice, etc.)



Pronunciation is important for learners as well as teachers of English!

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Background and Motivation

Why is pronunciation a challenge for L2 English learners?
Languages interact in the minds of multilingual speakers



Languages are not independent but affect each other

Speech Learning Model (SLM) (Flege 1995)

- L1 and L2 sound systems exist in a shared phonetic space in the bilingual mind
- As a result, the L2 sound system is affected by the L1 system (and vice versa)

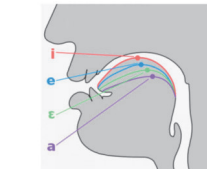
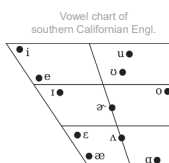
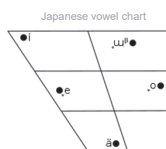


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Background and Motivation

English vowels are particularly challenging for Japanese-L1 learners
(Franklin & Stoel-Gammon 2014)

- Differences in inventory size (JPN: 5 vowels^o vs. ENS: app.^{**} 11 vowels) (Homma 1992)
- Differences in how vowels are differentiated (ENS: formants + duration | JPN: duration)



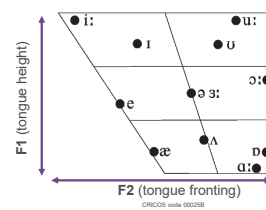
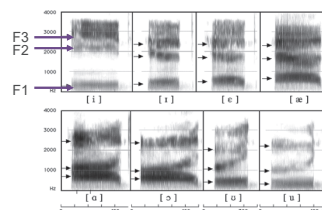
** Depending on the variety of English. CRICOS code 000258

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Background and Motivation

What are “formants”? and do they have to do with tongue position?

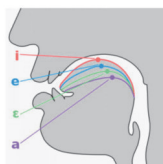
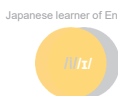
- Formants are concentration of acoustic energy at a certain frequency (Ladefoged & Johnson 2014)
- First formants (F1) and second formants (F2) inversely correspond to the tongue height (F1) and tongue fronting (F2: where it is raised) of each vowel

Received
Pronunciation (RP)

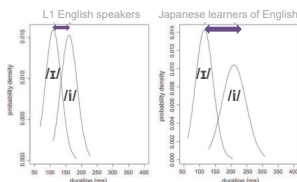
Research Gaps | Research Questions

What has been said about English vowels produced by Japanese learners?

- Japanese learners merger spectrally similar vowels (Ingram & Park 1997, Ueyama 2003)



- Japanese speakers are **very sensitive** to vowel duration (Kato et al. 2001) and **exaggerate duration to compensate** for the relative insensitivity to formant differences (Morrison 2002)



Research Gaps | Research Questions

Problems and gaps in previous research

- Investigation mainly done in highly controlled laboratory conditions (scripted word | sentence-reading)
- Learner vowel traits in naturalistic speech environments largely unknown
- Small subject size (± 10 speakers)
- Limited generalisability | applicability of the findings



Larger-scale analysis of vowels produced under more **spontaneous speech** conditions is needed!

RQ1: Do Japanese learners **merge** /i:/ and /ɪ/ as well as /u:/ and /ʊ/?

RQ2: Do Japanese learners **exaggerate the length of vowels** to compensate lack of spectral differentiation?

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Methodology (Data | Analysis)

Data

- **International Corpus Network of Asian Learners of English (ICNALE)** (Ishikawa 2014)
 - Speech and text samples from English learners in Asia and L1 English speakers
 - Spoken monologues: spontaneous speech from **150 Japanese learners** and **132 L1 speakers of English**
 - Before processing

Type	Speakers	/i:/	/i:/	/u/
Japanese learners	150	100	100	100
L1 speakers of English	132	100	100	100

Type	Speakers	/ɪ/	/i:/	/u/	/u:/
ENS	132	2,562	1,205	350	1,895
JPN	150	3,696	1,203	644	1,261
Total	282	6,258	2,408	994	3,156

Type	Speakers	/ɪ/	/i:/	/u/	/u:/
ENS	105	693	939	189	395
JPN	141	1,122	535	188	281
Total	246	1,815	1,474	377	676

CNALE Online
The International Campus Network of Adult Learners of English, Online Version



Ergonomics 30372

Methodology (Data | Analysis)

Data Processing (R 4.2, R Core team (2022) in RStudio (RStudio Team 2022))

- Aligning speech with audio using Web-MAUS (Schiel 1999) (this produces Praat TextGrids)
- Automated extraction of vowel formants and vowel duration from Praat TextGrids (Wickham et al. 2019)
- Only monosyllabic words were retained and outliers were removed using Kernel Density Estimation

Statistical Analysis

- Mergers → **Bhattacharya affinity** (Johnson 2015, measure of overlap of scatter clouds, 1 = perfect overlap)
- Duration → **Mixed-Effects Regression Model** (lme4: Bates et al. (2015), sjPlot: Lüdtke (2021))
 - DV: duration
 - IVs: type, vowel, gender, age, word type
 - REs: word, speaker

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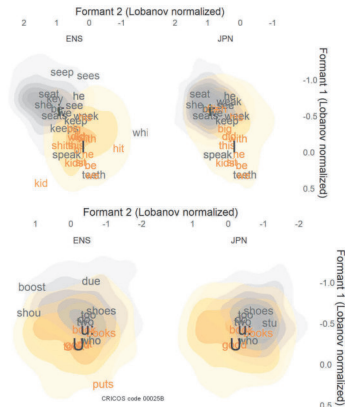


Results

Mergers

- /i:/ and /ɪ/
 - JPN Bhattacharya affinity: .901
 - ENS Bhattacharya affinity: .757
- Substantively more overlap among JPN!
- /u:/ and /ʊ/
 - JPN Bhattacharya affinity: .932
 - ENS Bhattacharya affinity: .952

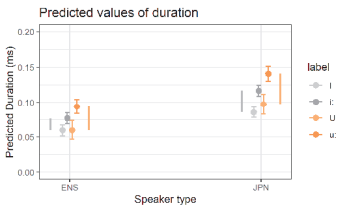
Mergers confirmed for spectrally similar vowels (ENS also merge /u:/ and /ʊ/)



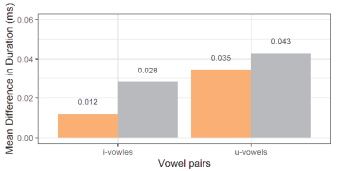
Results

Duration

- JPN extend all vowel durations (not just long vowels!) (expectation: short vowels shorter | long vowels longer!)
- JPN exaggerate the duration difference of both /i:/ and /ɪ/ as well as /u:/ and /ʊ/



Exaggerated duration difference by JPN speakers confirmed for both /i:/ and /ɪ/ as well as /u:/ and /ʊ/



Discussion | Outlook

Comparison with previous findings

- **Confirmation | Substantiation**
 - JPN: mergers of spectrally close vowels (lab settings: Ueyama 2003; Tsukada 2001)
- **Unique findings | Conflicts**
 - ENS: merger of /u:/ and /ʊ/ in spon. speech
 - JPN: exaggerated durational contrasts between spectrally similar vowels in nat. settings (lab settings: Tsukada 2009)

1. Apply same method to German learners and learners of other languages (e.g. German)
2. Determine what factors differentiate ENS and L2 speakers re. vowel production (potential MA theses!)

Limitations

- Quality of recordings is really poor! (minute-long recordings recorded on cell phones!)
- Difficult to control semantic | phonological environments (which is important) (see Visceglia et al. 2009)

Significance

- Bad quality could | can be compensated using advanced methods (Kernel Density Estimation)
- Insights into vowel production by JPN learners in **spontaneous speech** (underexplored) → natural setting allows to **generalise findings to real-life learner speech**
- **Automated** corpus-based investigation on larger samples



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Potential Applications

Prototype (proof-of-concept)

- Extend study to L1 German learners of English (or learners of other languages)

Significance

- **First large-scale, corpus-based studies of ESL vowel production in natural speech!**
- Follow-up: perception → do differences in vowel production correspond to difficulties in intelligibility?

Possible Applications

- Creation of targeted classroom materials to improve L1-like vowel production among learners
- Convert analysis into a mobile app for MELLT (Mobile-Enhanced Language Learning and Teaching)
- BMBF | Volkswagen | ERC grant proposal on **Improving Language Production among Language Learners via Direct Digital Feedback** (Collaboration with the Phonetics group in the ISFAS at Uni Kiel)



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Thank you really very much!

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