

Native English Speakers & Arabic Pharyngealization Contrasts: Perceptual & Acoustic Data

Linguistic Association of the Southwest (LASSO)
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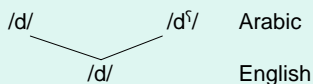
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Introduction

- Learning second language (L2) phonology is difficult for adults → foreign-accented speech
- L2 learners have difficulty perceiving novel L2 phonemic contrasts (“accented listening”)
 - In many cases, novel L2 contrasts are neutralized by learners
 - e.g., English /æ/ and /ɛ/ both perceived by Dutch listeners as Dutch /ɛ/

Introduction

- Arabic contrasts pharyngealized and non-pharyngealized consonants
 - /d/-dˤ/: [daw★] ‘medicine’ and [dˤaw★] ‘he lit’
- These contrasts are difficult for native English listeners
 - /d/ and /dˤ/ perceived by English listeners as /d/



Introduction

- ...But this difficulty may be mediated by vowel context
 - Anecdotal evidence suggests that pharyngealization contrasts in the context of the vowel /a/ are easier for native English listeners to perceive than in the context of other vowels
- WHY???

Introduction

- Contrasts between Arabic pharyngealized and nonpharyngealized consonants are manifested acoustically on adjacent vowels
 - Vowels following pharyngealized consonants have lower F2 values (e.g. Al-Masri & Jongman 2004)
 - **Front/Back vowel contrasts?**
 - The vowel in /da/ may be perceived by native English listeners as closer to English /æ/ and the vowel in /dˤa/ as closer to English /a/

Research Questions

- **Do native English learners of Arabic exploit their knowledge of English vowel contrasts to discriminate Arabic pharyngealization contrasts?**
- If so, they should exhibit better discrimination of pharyngealization contrasts when they perceive them as English vowel contrasts

Research Questions

- What English vowels do native English listeners perceive following Arabic pharyngealized and non-pharyngealized consonants? (Vowel Identification Task)
- Does perception of different English vowels in Arabic pharyngealized vs. non-pharyngealized consonant contexts correspond to greater discrimination of that contrast? (Discrimination Task)

Vowel Identification Task

- What vowels do native English speakers perceive following pharyngealized and non-pharyngealized consonants in Arabic?
- 13 monolingual English speakers, age 18 and above, recruited from undergraduate courses at the University of Utah

Stimuli

- 2 different tokens of each of 24 Arabic nonwords: CV(C) syllables
- All nonwords produced by 2 native Arabic talkers

C ₁	V ₁	C ₂	Nonwords
/t/	/a/	0	/ta/, /t ^h a/, /da/, /d ^h a/
/t ^h /	/a/	0	/tak/, /t ^h ak/, /dak/, /d ^h ak/
/t/	/i/	/k/	/ti/, /t ^h i/, /di/, /d ^h i/
/d/	/i/	/k/	/tik/, /t ^h ik/, /dik/, /d ^h ik/
/d ^h /	/u/	/k/	/tu/, /t ^h u/, /du/, /d ^h u/
/d ^h /	/u/	/k/	/tuk/, /t ^h uk/, /duk/, /d ^h uk/

Procedure

- Participants heard auditory stimuli presented in isolation
- Judged which of the following English vowels each token contained:
 - /a/, /æ/, /ʌ/, /i/, /ɪ/, /e/, /u/, /ʊ/, /o/
 - choices determined via a pilot study

Vowel Identification Results

/a/ stimuli

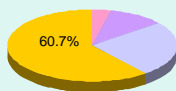


Figure 1: da

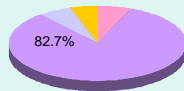
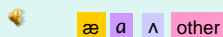


Figure 2: d^ha

Vowel Identification Results

/u/ stimuli

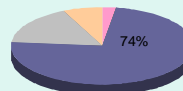


Figure 3: du

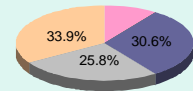
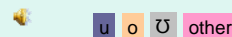


Figure 4: d^hu

Vowel Identification Results

/i/ stimuli

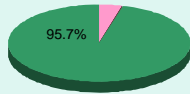


Figure 5: di

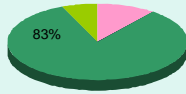


Figure 6: d'i

i i other

Vowel Identification Results

	Non-Pharyngealized	Pharyngealized
/a/	mostly /æ/	mostly /ɑ/
/u/	mostly /u/	split among /u/, /o/, and /ʊ/
/i/	mostly /i/	mostly /i/

Vowels identified in non-pharyngealized and pharyngealized /d/ stimuli

Conclusion

- Native English listeners exhibit different vowel identification patterns depending on vowel context

/a/, /u/ vs. /i/

→ Is discrimination of pharyngealization contrasts more accurate in the context of /a/ and /u/ than in the context of /i/?

Discrimination Task

- Does whether or not native English listeners perceive different English vowels for a given Arabic pharyngealization contrast correspond to greater discrimination of that contrast?
- Predictions from the vowel identification task
 - Better discrimination of pharyngealization contrasts in the context of /a/ and /u/ than /i/

Discrimination Task

- Same participants as in the vowel identification task
- Participants heard one group of three stimuli at a time (A, X, and B) and decided whether X is more similar to A or B
- Example stimuli:
 - [da]-[da]-[d^ha]
 - [du]-[du]-[d^hu]
 - [di]-[di]-[d^hi]

Results

- No main effect of **talker** on discrimination accuracy ($p=.460$)
- Main effect of **vowel** ($p<.000$)
 - Marginal for t/t^h ($p=.052$)
 - Significant for d/d^h ($p<.001$)**

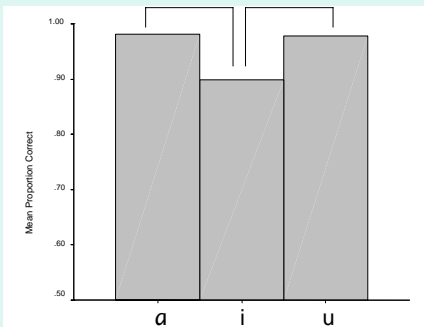


Figure 7: Mean Proportion Correct for d/dʰ by Vowel

Conclusion

- Native English listeners exhibit more accurate discrimination of pharyngealization contrasts depending on vowel context

/a/, /u/ vs. /i/

- Whether or not native English listeners perceive different English vowels for a given Arabic vowel in pharyngealized vs. non-pharyngealized consonant contexts corresponds to better discrimination of that contrast

Acoustic Study

- Analyzed stimuli using Praat in order to determine F1 and F2 values
 - Initial, medial, and final position in the vowels
- Plotted **initial** F1/F2 values of the vowels contained in the stimuli along with English vowel data (averages for English vowels from Hillenbrand *et al.* 1995)

Figure 9: F1-F2 Plots for /a/

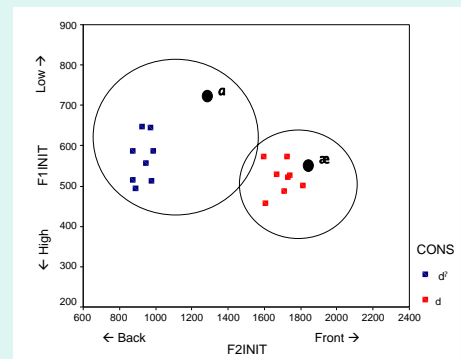


Figure 10: F1-F2 Plots for /u/

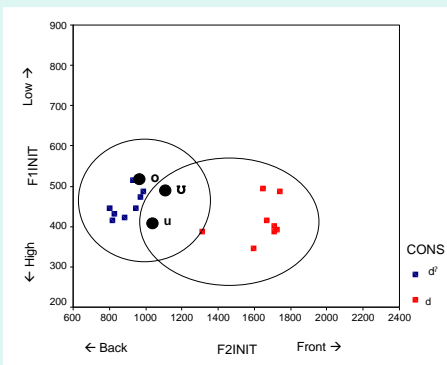
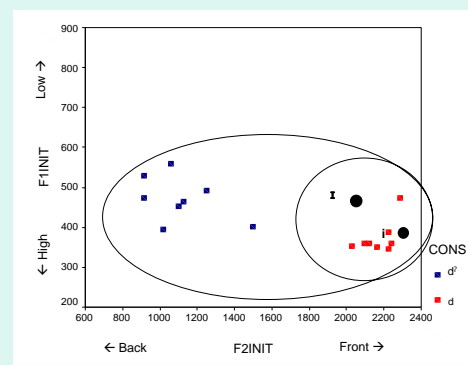


Figure 11: F1-F2 Plots for /i/



Conclusion

- The acoustic properties of the Arabic stimuli, when plotted with average values for English vowels, appear to help explain the vowel identification results

General Conclusion

- Native English listeners can exploit their sensitivity to English front-back vowel contrasts to detect Arabic pharyngealization contrasts
- Vowel identification patterns predict discrimination patterns: */a/, /u/ vs. /i/*

Implications

- L2-Theoretical
 - Relationship between acoustic cues used in native and second languages
- Pedagogical
 - Native English listeners may benefit from instruction that focuses their attention on vowel information in both perceiving and producing Arabic pharyngealization contrasts
 - Some Arabic language texts tell learners to listen to adjacent vowels to determine whether consonants are pharyngealized (e.g., Brustad, Al-Batal & Al-Tonsi 1995)

Future Directions

- Looking at F1/F2 values for medial and final positions in vowels
- Allowing diphthongs as responses in the vowel identification task (vowels in pharyngealized contexts can sound like diphthongs)
- Other pharyngealization contrasts (fricatives, etc.)

THANK YOU!

Please contact us with questions and comments

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