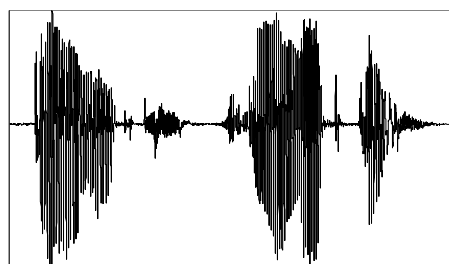


# Cross-dialect and cross-language vowel production and perception



## Principal Investigators:

Dr. Paola Escudero  
Institute of Phonetic Sciences, University of Amsterdam  
Spuistraat 210, 1012 VT Amsterdam  
The Netherlands  
<http://www.fon.hum.uva.nl/paola/>

Dr. Geoffrey Stewart Morrison,  
Department of Cognitive & Neural Systems, Boston University  
677 Beacon Street, Boston, MA 02215  
USA  
<http://cns.bu.edu/~gsm2>

## Outline of Research Project:

### Rationale:

Numerous studies have examined the perception and production of English vowels by first-language (L1) Spanish second-language (L2) English speakers (e.g., Álvarez González, 1980; Escudero, 2000, 2005; Escudero & Boersma, 2004; Flege, 1991; Flege, Bohn, & Jang, 1997; Møller Glasbrenner, 2005; Morrison, 2002, 2005, 2006); however, different studies have examined different combinations of L1 and L2 language dialect. The extent to which the results of a given study can be generalised to other dialect combinations is therefore unclear.

Escudero (2005) found that monolingual Peruvian Spanish listeners categorised the English vowels /i/ and /ɪ/ differently depending on whether they were produced by speakers of Scottish English or South-of-England English. The present project will extend this multi-dialectal cross-language work in terms of the number of L1 and L2 dialects, the number of speakers per dialect, and the number of vowel categories investigated.

We plan to explore at least three distinct dialects from each language:

<i>English dialects:</i>	Western Canada	Lowland Scotland	Southeastern England	Eastern Australia
<i>Spanish dialects:</i>	North-Central Spain	Lima, Peru	Mexico City	

We are open to the possibility of extending the study to other dialects of English and Spanish.

Additional components of the wider research programme also look at dialects of Dutch and Portuguese.

We are also interested in the possibility of interfacing with studies looking at other combinations of dialects and

languages, in so far as it is possible to harmonised contexts so as to be able to make meaningful comparisons between data sets.

Our focus will be on the perception of functionally monolingual speakers/listeners whose behaviour can be taken as representative of the initial state for L2 learning.

This project addresses the following research questions:

- What are the acoustic differences between the production (pronunciation) of vowels in different dialects of English and Spanish?
- How do monolingual listeners classify the vowels of different dialects of their L1 and different dialects of the foreign language?
- For vowel identification, what are the differences in the perceptual use of acoustic cues by listeners of different languages and dialects?

Across languages and dialects, we expect to find acoustic differences in the spectral and durational properties of vowels, and we expect that these differences will have an effect on perception. We expect to find larger interdialect differences within English, and smaller interdialect differences within Spanish. We will use quantitative models to describe these differences.

Numeric and acoustic data will be compiled as part of a database of English and Spanish vowels. Numeric data will be published, and acoustic data made available to other academic researchers on request, on the condition that it not be shared with third parties.

### **Experiments:**

Two experiments are planned at this stage, one on production (pronunciation) and one on perception. For each experiment, we plan to recruit approximately 40 participants from each dialect (20 male and 20 female). There may be partial overlap between participants in the production and perception experiments. The perception experiments will be conducted at some point in time after the collection of production data in all locations.

Where possible, experiments will be conducted in a soundbooth, else they will be conducted in a quiet room. Participants will be seated in front of a computer which will be used to present visual prompts and to record audio, or to present acoustic stimuli and collect categorical responses. Participants will wear headphones or a headband-mounted microphone depending on the experiment.

Although data on additional contexts will also be collected, the project will focus on isolated vowel context, and the Spanish context /bVpa/ and English context /bVpə/. The latter contexts are almost identical across languages and produce possible but non-existent words in both languages (possible exceptions to non-existence are /bipə/, /bupə/ and /bɜpə/ in British English dialects).

Volunteer participants will be compensated for their time at a rate appropriate for the location.

**Production Experiment:**

We plan to gather acoustic production data for stressed monophthongs and diphthongs in each language:

English: /i/, /ɪ/, /e/, /ɛ/, /æ/, /ɑ/, /ɒ/, /ʌ/, /ɔ/, /o/, /ʊ/, /u/, /aɪ/, /aʊ/, /ɔɪ/, /ɜ/, /aɪ/

Spanish: /i/, /e/, /a/, /o/, /u/, /ai/, /au/, /ei/, /e'i/, /ie/, /oi/, /o'i/, /eu/, /e'u/

Some of the English phonemes listed above are merged in some dialects (e.g., Scottish English does not have the /ʌ/–/ʊ/ contrast), or have major allophones in some dialects (e.g., Canadian English has [aɪ] before voiced consonants but [ʌɪ] before voiceless consonants). All English listeners will be tested using the same prompts so as to be able to confirm the status of such mergers and major allophones.

Speakers will be asked to read aloud a random lists of sentences which will be presented on a computer screen; each sentence will be presented approximately three times. Because of the opaque relationship between English spelling and pronunciation, the English prompts will have the form *X sounds like Y*, where *X* is a real word containing the same vowel as the target word *Y*. For example: *paper sounds like bapa* and *zapper sounds like bappa*. (this procedure was developed by Dr. Michael Kieft, Dalhousie University, in a study of dialects of Nova Scotian English).

We aim to make each experiment session last approximately half an hour.

**Perception Experiment:**

Listeners will be played, in random order, a subset of previously recorded English and Spanish words, and will be asked to identify the vowels in the words by clicking on buttons on a computer screen. The buttons will be labelled with keywords from the listeners' L1. This will provide data as to the perceptual identification of vowels from different L1 and L2 dialects in terms of the listeners' L1 dialect. The decision as to which vowels to include in this experiment will be made on the basis of the results of the production experiment.

In some instances, listeners may be asked to participate in additional or alternative perception experiments in which they identify synthetic- rather than natural-speech stimuli.

**Analysis:**

The acoustic properties of the vowels from the production experiment will be analysed, resulting in continuous numeric data which will be statistically analysed to quantify cross-dialect and cross-language differences (Morrison, 2006; Morrison & Escudero, 2007).

Listeners are assumed to build their speech perception systems on the basis of the statistical distribution of the acoustic stimuli to which they are exposed (see Kuhl, 2004; Maye, Werker, & Gerken, 2002; Werker & Curtin, 2005). Models of speech perception for each dialect will therefore be built on the basis of production data, and tested for degree of correlation with listeners' perception (categorical response data from the perception experiment). This will indicate the relative importance of different acoustic cues for listeners with different first languages and dialects. Degree of correlation with listeners responses will also allow us to assess the adequacy of different types of L1 & L2 speech perception models such as discriminant analysis, stochastic OT, exemplar modelling, and neural networks. These models have previously been applied to cross-dialect / cross-language / L2 data in, among other places, Morrison (2006), Escudero (2005), Johnson (2006), and Vallabha & McClelland (in press).

**Collaborators:**

We are in the process of recruiting local collaborators.

We seek the following minimal assistance from local collaborators:

- Assistance on obtaining permission to conduct the experiments at the local site (permission from the local Research Ethics Board etc.).
- Assistance with obtaining access to a soundbooth or other suitable location for sound recording.
- Assistance with recruiting and scheduling participants.
- Assistance in recording the experiment instructions. Instructions to be read by a speaker of the local dialect.
- (For English locations) Feedback on whether the written prompts are likely to elicit the expected phonemes / allophones in the local dialect, and advice on any necessary modifications of the prompts. General advice on any peculiarities of local pronunciation, mergers, major allophones etc..

One of the principal investigators or a research assistant will visit the local site. They will come with their own portable recording equipment, computer equipment, and software.

We are also interested in finding collaborators who would themselves be able to collect the data at their site. This would require them to have access to a high-quality microphone, high-quality headphones, a high-quality audio interface, and a computer running under the Windows XP operating system (32-bit). We will supply custom written software for data collection.

Local collaborators may also, at their own discretion, contribute towards the processes of data analysis and writing articles for publication. Their contribution to the project will be acknowledged in publications and presentations. Local collaborators will be listed as coauthors whenever appropriate. They will also have access to acoustic and numerical data which they may use as the basis for papers of which they are the first author.

Local collaborators recruited so far:

- Western Canada: Prof. Terrance M. Nearey, Department of Linguistics, University of Alberta
- Scotland:
- Southeastern England: Dr. Wyn Johnson, Department of Language and Linguistics, University of Essex
- North-Central Spain:
- Peru: Prof. Jorge Iván Perez Silva, Faculty of Humanities, Pontificia Universidad Católica del Perú
- Mexico City: Ms. Alejandra Espinosa Vázquez, and Mr. Jacobo Rodríguez Hernández, Colegio de México

Should you be interested in contributing to this project, please get in touch with one of the principal investigators.

## Progress to date:

– May 2007      Production data collected from 35 speakers in Mexico City.

## References:

- Álvarez González, J. A. (1980). *Vocalismo español y vocalismo inglés* [Spanish and English vowels]. Unpublished Doctoral dissertation, Universidad Complutense de Madrid.
- Escudero, P. (2000). *Developmental patterns in the adult L2 acquisition of new contrasts: The acoustic cue weighting in the perception of Scottish tense/lax vowels in Spanish speakers*. Unpublished master's thesis, University of Edinburgh, Edinburgh, Scotland.
- Escudero, P. (2005). Linguistic perception and second language acquisition: Explaining the attainment of optimal phonological categorization. Doctoral dissertation, University of Utrecht, The Netherlands. Utrecht, The Netherlands: LOT.
- Escudero, P., & Boersma, P. (2004). Bridging the gap between L2 speech perception research and phonological theory. *Studies in Second Language Acquisition*, 26, 551–585.
- Flege, J. E. (1991). The interlingual identification of Spanish and English vowels: Orthographic evidence. *Quarterly Journal of Experimental Psychology*, 43, 701–731.
- Flege, J. E., Bohn, O.-S., & Jang, S. (1997). Effects of experience on non-native speakers' production and perception of English vowels. *Journal of Phonetics*, 25, 437–470.
- Johnson, K. (2006) Resonance in an exemplar-based lexicon: The emergence of social identity and phonology. *Journal of Phonetics*, 34, 485–499.
- Kuhl, P. K. (2004). Early language acquisition: Cracking the speech code. *Nature Reviews Neuroscience*, 5, 831–843.
- Maye, J., Werker, J. F., & Gerken, L. A. (2002). Infant sensitivity to distributional information can affect phonetic discrimination. *Cognition*, 82, B101–B111.
- Møller Glasbrenner, M. (2005). *Vowel identification by monolingual and bilingual listeners: Use of spectral change and duration cues*. Unpublished master's thesis, University of South Florida.
- Morrison, G. S. (2002). *Effects of L1 duration experience on Japanese and Spanish listeners' perception of English high front vowels*. Unpublished master's thesis, Simon Fraser University, Burnaby, British Columbia, Canada.
- Morrison, G. S. (2005). *Development of L2 vowel perception and production: L1-Spanish speakers and the acquisition of the English /i/-/ɪ/ contrast*. Manuscript submitted for publication.
- Morrison, G. S. (2006). *L1 & L2 Production and Perception of English and Spanish Vowels: A statistical modelling approach*. Unpublished Doctoral dissertation, University of Alberta.
- Morrison, G. S., & Escudero, P. (2007). A cross-dialect comparison of Peninsular- and Peruvian-Spanish vowels. Proceedings of the 16th International Congress of Phonetic Sciences: Saarbrücken 2007.
- Vallabha, G. K., & McClelland, J.L. (in press). Learning new speech categories in adulthood: Costs and benefits of Hebbian attractors in topographic maps. *Cognitive, Affective & Behavioral Neuroscience*.
- Werker, J. F., & Curtin, S. (2005). PRIMIR: A developmental model of speech processing. *Language Learning and Development*, 1, 197–234.