Early and late Spanish bilinguals' production of unstressed English vowels

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Overview

- Theoretical Framework: Feature Hypothesis (McAllister, Flege & Piske 2002), SLM (1995)
- Age-related effects in L2 learning
- Cross-linguistic comparison of English & Spanish stress.
- Present study: participants, speech materials, acoustic measurements and vowel normalization procedures
- Results: duration, intensity ratios and vowel quality
- Discussion and further research

Theoretical Framework: FH
(McAllister, Flege & Piske 2002)

- L2 phonetic features not used to signal phonological contrasts in an L1 will be more difficult to perceive than those that are.
- The difficulty in perceiving phonetic features that are not phonologically meaningful will be reflected in low production accuracy of these features in the L2.

Theoretical Framework: SLM (Flege 1995)

- L2 speech learning: “Phonetic category” (long-term memory representations).
- L1-L2 exist in a common phonological space.
- Phonetic systems remain adaptative over the life span.
  - New phonetic categories can be established
  - Old phonetic categories can be modified
- Category formation may be blocked by a mismatch of the phonetic features between L1 and L2.

Age-related effects in L2 learning

- CPH: changes in brain structure, loss of neural plasticity diminishes L2 learning (Scovel 1988, Patkowski 1980)
- Other causes: amount and quality of L2 input (Flege & Liu 2001), amount of L1 and L2 use (Guion, Flege & Loftin 2001), interactions between the L1 and L2 systems (Flege, Schirru & MacKay 2003)
- AOA: important factor in accurate production of L2 sounds (Flege, Munro & MacKay 1995)

English word stress

- Unstressed vowels: perceived as lower in pitch, shorter, and less loud than stressed vowels.
- Acoustic correlates: lower F0, shorter duration and weaker intensity (Fry 1955)
- Acoustic correlates: duration and overall intensity were the most reliable acoustic correlates of stress (Beckman & Pierrehumbert 1986)
- Stress affects vowel quality by way of a process called vowel reduction (Lindblom 1963)

Spanish word stress

- F0, duration & intensity contribute to the perception of Spanish lexical stress but F0 has a stronger weight (Llisterri et al. 2005)
- Vowel duration is a stronger correlate of stress in Spanish (Ortega-Llebaria & Prieto 2010)
- Word stress does not involve changes in vowel quality: no vowel reduction (Quilis & Esgueva 1983, Hualde 2005)
- Prosodic errors contribute to the loss of intelligibility of L2 speech (Munro & Derwing 1999) and to the perception of FA (Pennington & Richards 1986)

L2 acquisition of English stress (Flege & Bohn 1992)

- Participants: Spanish speakers of L2 English
- Method: glossometry and phonetic transcription
- Stress placement was not a learning problem for Spanish learners of English and it was acquired on a word-by-word basis
- NSp implemented unstressed/stressed differences in terms of duration and intensity in a nativelike fashion
- Vowel reduction was more difficult to learn.

The present study: goals

- Assess the role of L1 (Sp) phonetic features in the production of L2 (Eng) features

Phonetic feature	English	Spanish
Duration	✓	✓
Intensity	✓	✓
Vowel reduction	✓	✗

- Assess the effect of AOA on the production of English unstressed vowels

The present study: hypotheses

- H1: NSp bilinguals will produce English unstressed vowels with shorter duration and lower intensity than stressed vowels.
- H2: the English reduced vowels produced by the NSp bilinguals will be more peripheral in the vowel space than those produced by the NE.
- H3: AOA in the host country will influence the production of English unstressed vowels by NSp bilinguals.

Method:participants

- 2 groups of Sp-Eng bilinguals (early, late)
- 1 group of native English monolinguals

	NEng (N=10)	ENSp (N=10)	LNSp (N=10)
Age	25	25	33
AOA		4	21
LOR		23	13
EDU	16	16	16
L2 use		84	75
TOAL 1	30	25	21
TOAL 2	28	22	24

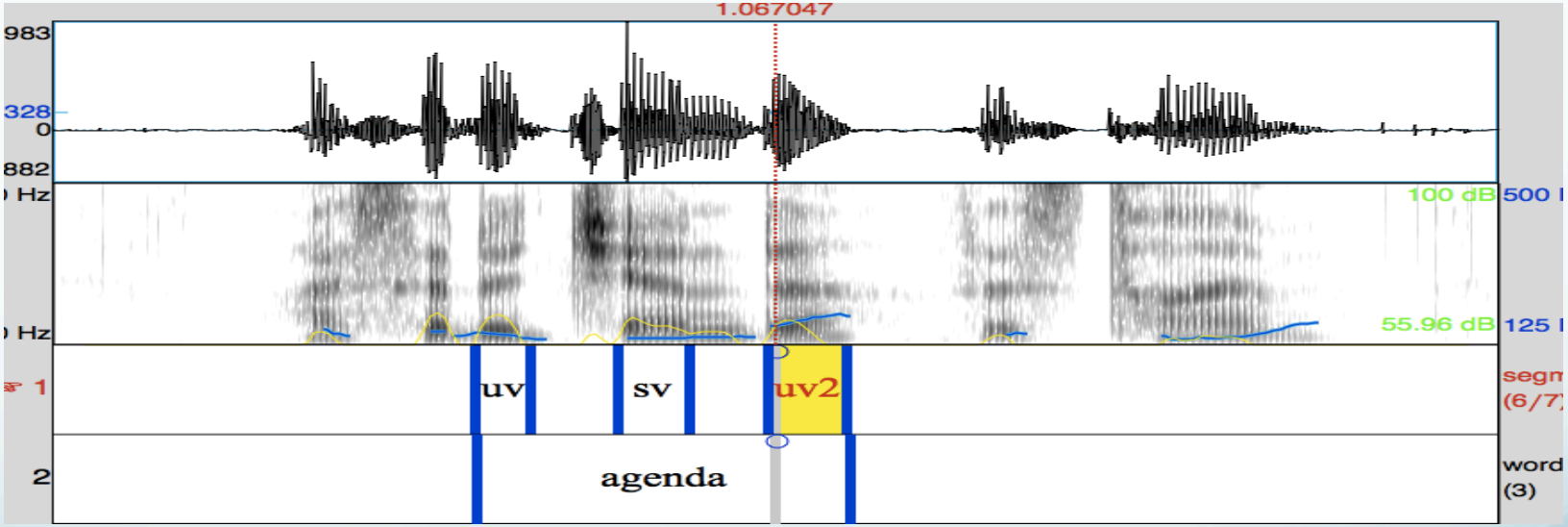
Method: speech materials

- 19 English words embedded in the carrier phrase:
  I say .... this time

agénd**a**	intr**o**dúce
ág**e**nt	kang**a**róo
b**a**nán**a**	m**a**chíne
básk**e**t	mán**a**ge
cál**e**ndar	médi**u**m
cómp**e**nsate	ór**i**gin
d**e**scént	p**o**ssés
eléven	p**o**táto
g**i**ráffe	sp**a**ghétti
índ**i**cate	

Method: measurements

- Stressed and unstressed vowel intervals labelled and annotated with *Praat* TextGrids (Boersma & Weenik 2012).



Method: acoustic analysis

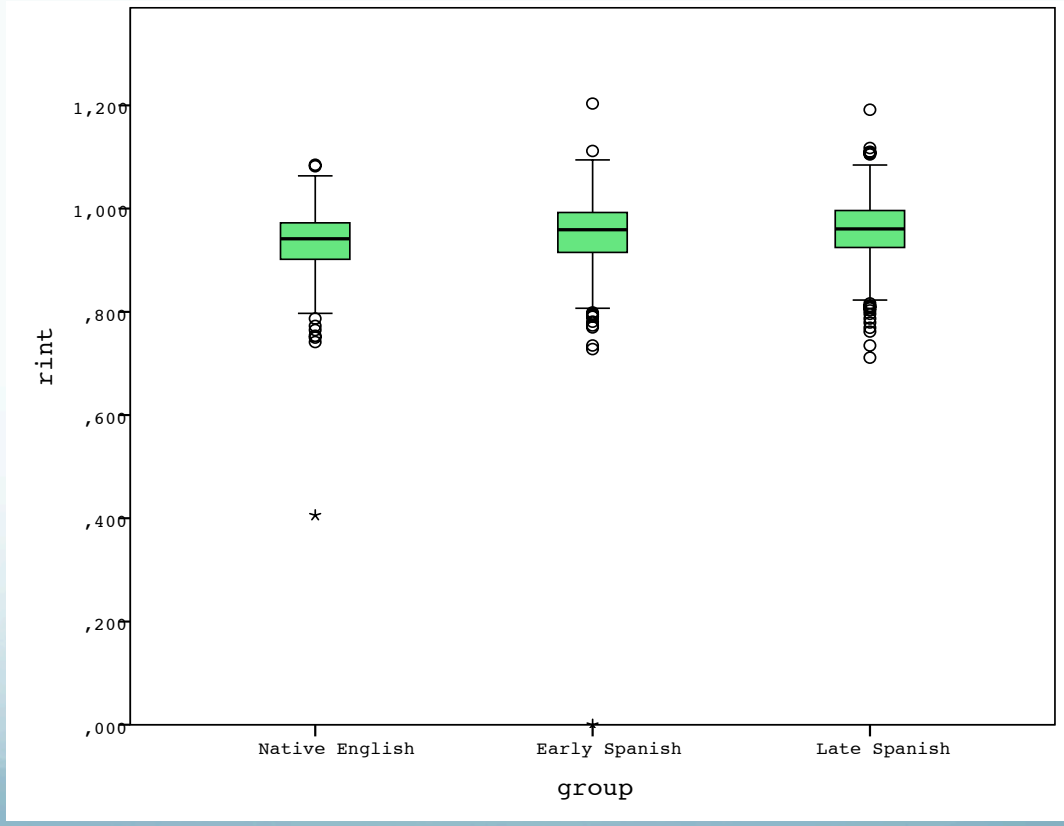
- Stressed and unstressed vowels mean intensity calculated with *Praat* script (Lennes 2003)
- Stressed and unstressed vowel intervals calculated with *Praat* script (Lennes 2003)
- Unstressed-to-unstressed intensity ratio (Int UV / Int SV)
- Unstressed-to-unstressed duration ratio (Dur UV / Dur SV)
- F1, F2, F3 measured automatically at the midpoint with *Praat* script (Lennes 2003)

Method: vowel normalization

- Speaker normalization of NSp data to one randomly selected NE speaker based on the average F3 of [æ] to neutralize sex-linked differences and variations in vocal-tract length (Guion 2003, Yang 1996)
- Formant frequencies were converted to the Erb scale which more closely reflects human perception.

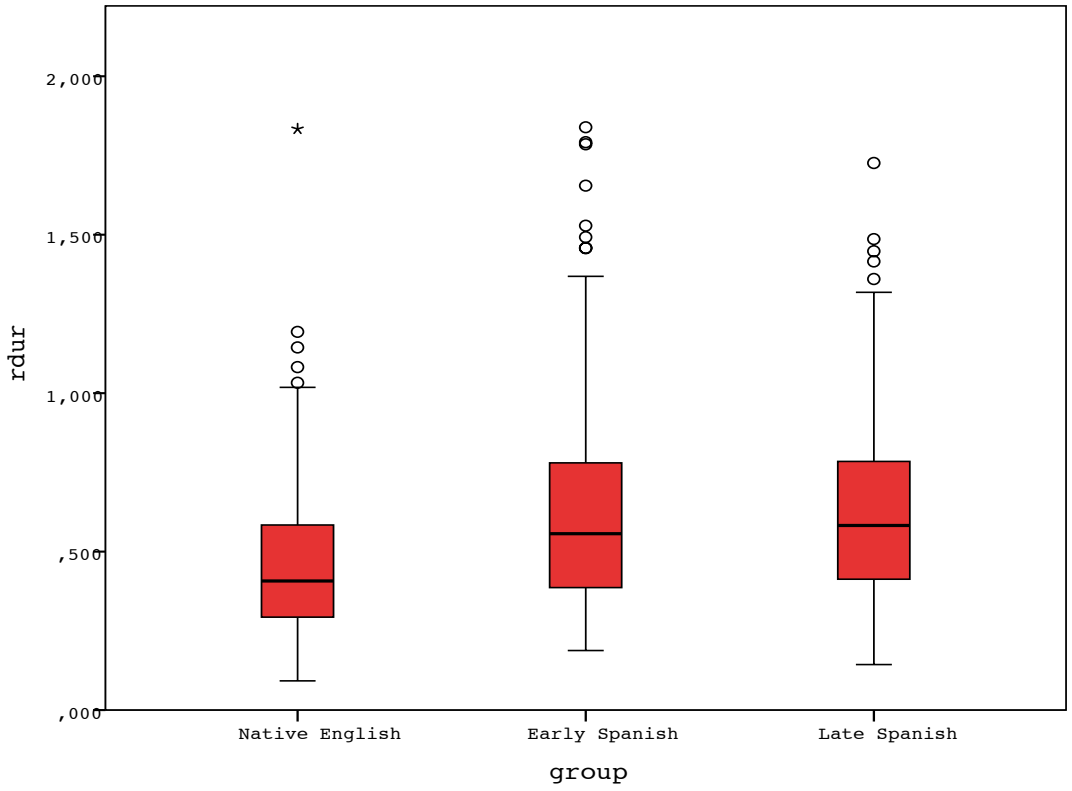
Results: intensity ratios

- One-way ANOVA F (2,44)= 3.61 p=.02
- Pair-wise comparisons: NEng, ENSp > LNSp

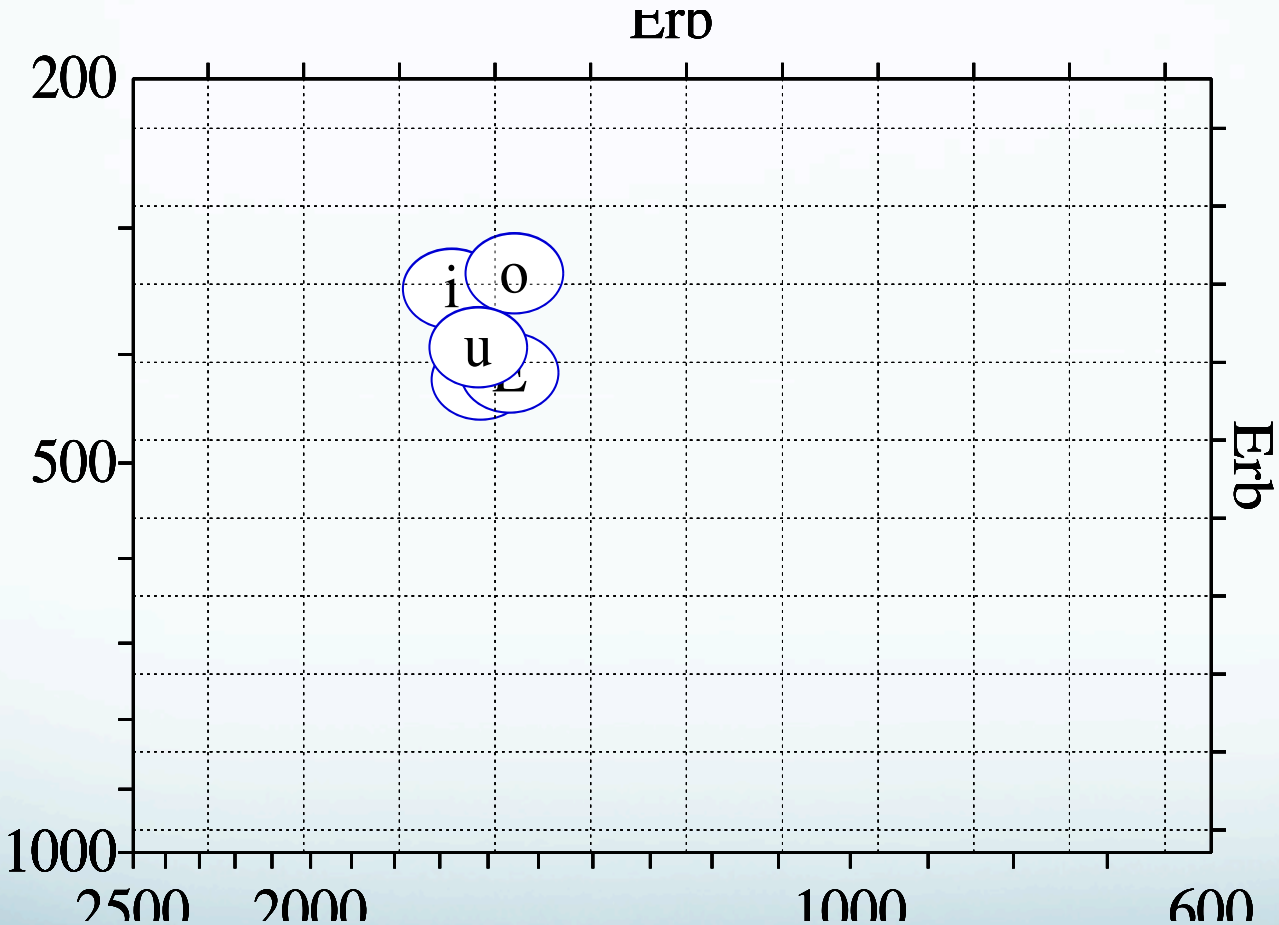


Results: duration ratios

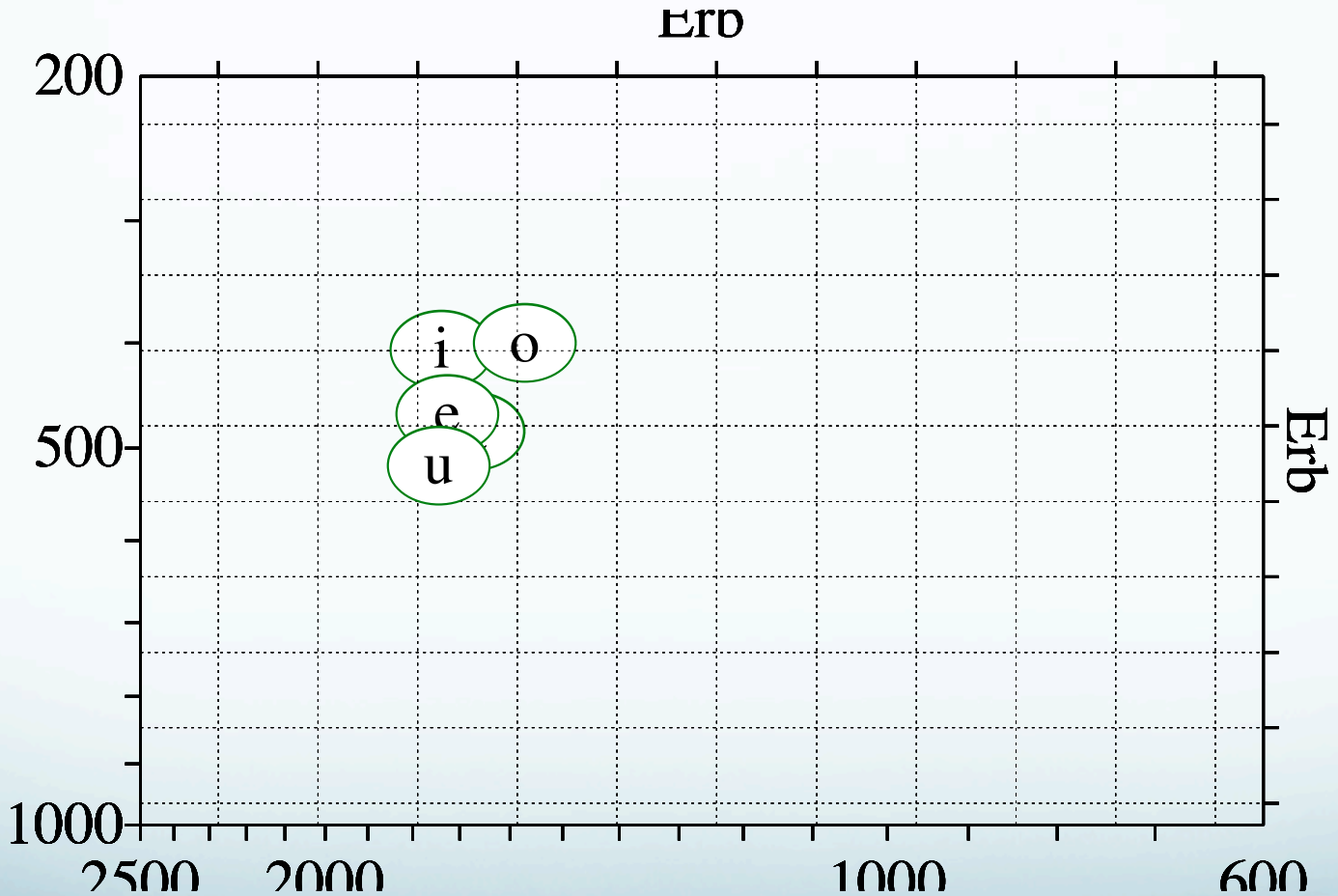
- One-way ANOVA F (2, 639) = 26.46 p < .001
- Pairwise comparisons: NEng < ENSp or LNSp



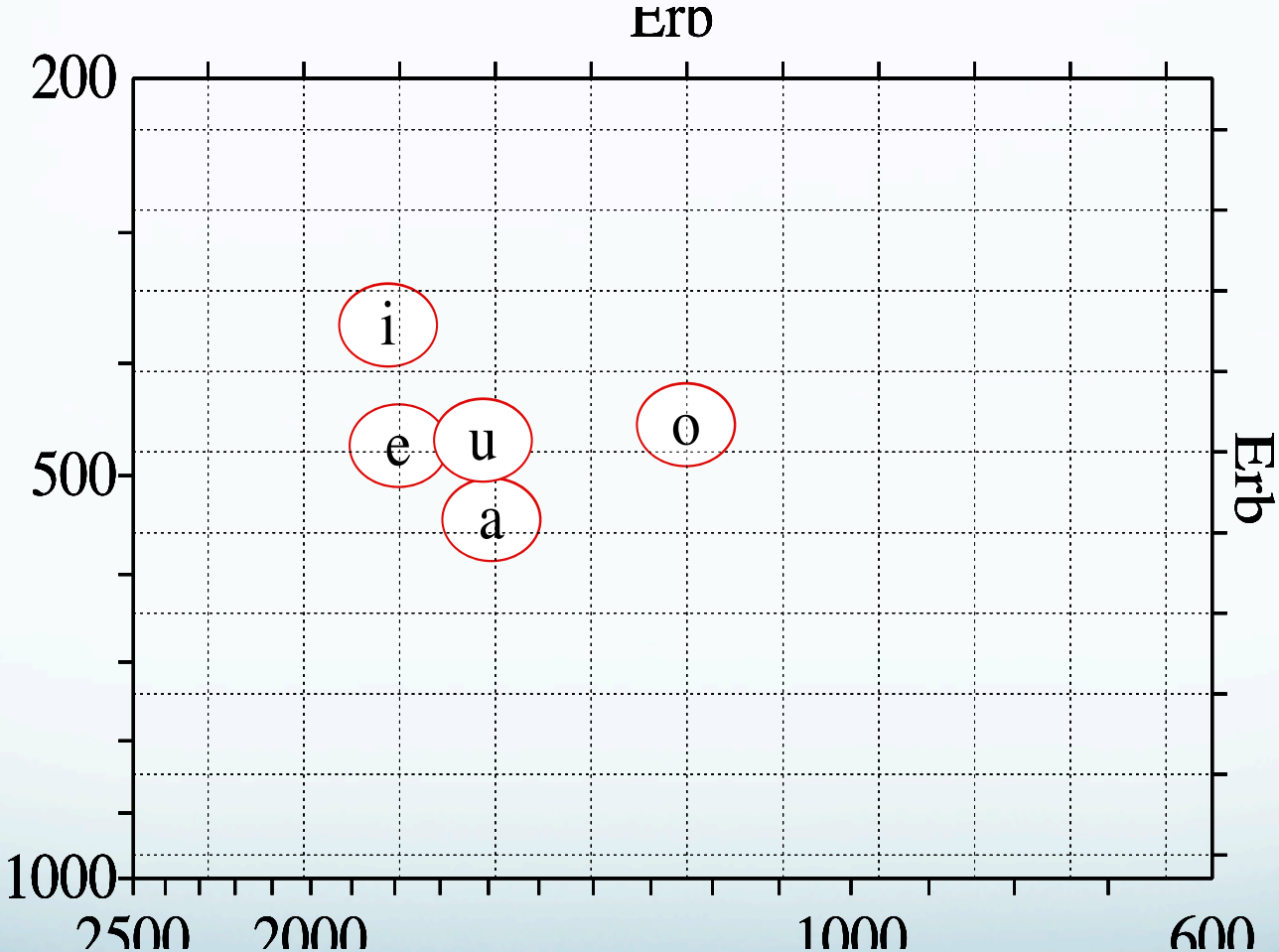
Results: vowel quality NEng



Results: vowel quality ENSp



Results: Vowel quality LNSp



Discussion

- In line with FH: phonetic features (i. e. Unstressed-to- stressed duration and intensity ratios) that are used in the L1 are easier to acquire.
- Vowel quality differences between stressed and unstressed vowels more difficult to acquire.
- Age-related effects: ENSp more nativelike than LNSp in intensity ratios and vowel quality but not in length differences.

Discussion II

- Task effects: reading target words in citation form might have inhibited vowel reduction among LNSp.
- Orthography might also have influenced LNSp production of unstressed English vowels (Erdener & Burnham 2005, Rafat 2010).
- Lexical effects: High-frequency words easier to acquire than low-frequency words.

Further research

- Euclidean distances between vowel points to measure vowel reduction numerically.
- Investigate implementation of stress differences among learners in FI settings.
- Interesting to know differences between Spanish and Catalan learners.

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