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BILINGUALISMS AND PHONETIC COMPLIANCE

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PLAN OF PRESENTATION

- INTRODUCTION
  - Theoretical background
  - Research questions and objectives
- MATERIALS AND METHOD
  - Participants
  - Data collection paradigm
  - Data processing
- RESULTS
- DISCUSSION AND CONCLUSION

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INTRODUCTION

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THEORETICAL BACKGROUND

- **Phonetic compliance ?**
- "**Phonetic talent"** (Jilka et *al.*, 2007) → "Phonetic compliance"
- **Concept and metrological approach elaborated in the context of L2 acquisition – monolinguals**

BILINGUAL SPEAKERS ?

- Bilingualism facilitates foreign language learning ?

➢ **Cognitive advantages ? (**Antoniou et *al.* , 2015; Cenoz, 2003)

➢ Positive impact on speech sound processing abilities ?

THEORETICAL BACKGROUND

- **BILINGUAL SPEAKERS**

⇒ Advantage in perception of non-native phonemic contrasts (Antoniou et *al.*, 2014)

  - Universal difficulty and degree of phonetic similarity

! **BUT:**

➢ SLM (Flege, 2007), PAM-L2 (Best and Tyler, 2007) and mixed results

BILINGUALISMS

➢ **Different impact on foreign language aptitude and speech sound learning**

RESEARCH QUESTIONS AND GOALS

- **Phonetic compliance**
  - ➢ differs depending on the type of bilingualism ?
  - ➢ Different development in monolinguals *vs* bilinguals ?

EXPLORATORY STUDY ➔ CONSTRUCT VALIDITY

◆ Objectives:

⇒ phonetic compliance in monolinguals *vs* bilinguals

⇒ Relevance of the concept and metrological approach for bi-multilinguals

MATERIALS AND METHOD

PARTICIPANTS

Monolinguals (M1, M2, M3 & M4)	**Bilinguals** (B1, B2, B3 & B4)
4 Belgian French-speaking 2♀, 2♂ aged between 31 and 42 (from Delvaux et *al.*, 2014)	**French-Dutch bilinguals** 3♀, 1♂ aged between 21 and 55 B1, B2, B3: Belgian – Two L1 B4: Dutch = L1, French = L2/L3 ?

- **Dutch from the Netherlands *vs* Belgium** (Verhoeven, 2005; Smakman, 2006)
- **Diglossic context in Belgium** (Baetens-Beardsmore, 1980)

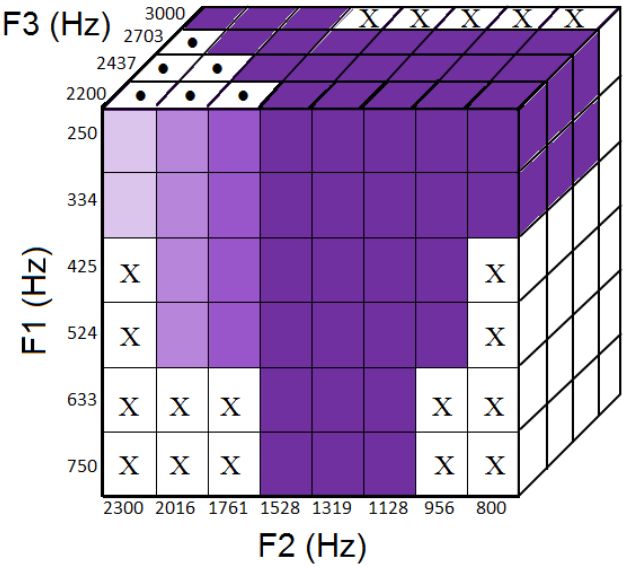
DATA COLLECTION PARADIGM

❖ Same experimental design as in Huet et al. (2012) and Delvaux et *al.* (2014)

- **2 PARTS**
  - 10 realisations of oral French (10) and Dutch vowels (19)
  - 6 reproductions of **94 stimuli**
    - ➔ **synthesized vowels** (Klatt, 1980)

➢ **Formants values (F1, F2, F3)**
- ✓ Praat
- ✓ manually verified

➢ **Clusters' centroids**



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DATA PROCESSING

- **Three indices** (Delvaux et al., 2014) ➔ **COMPLEMENTARITY**

  - Based on the euclidean distance between the **stimulus** and the **response** in the F1*F2*F3 acoustic space

Index 1 => assesses distance betwen stimuli and productions

sum of the distances

Index 1 ↘ Compliance

$$\text{Index 1} = \frac{\sum_{s=1}^{S}\sum_{p=1}^{P}\left[\sum_{i=1}^{I}(Fi_{ps} - Fi_{s})^2\right]^{1/2}}{S*P}$$

Index 2 => includes native phonological system

distancing from L1

Index 2 ↗ Compliance ↗

$$\text{Index 2} = \sqrt{\frac{\sum_{s=1}^{S}\sum_{p=1}^{P}\left\{\prod_{v=1}^{V}\log\left[\sum_{i=1}^{I}(Fi_{ps} - \overline{Fi_{v}})^2\right]^{1/2}\left[\sum_{i=1}^{I}(Fi_{ps} - Fi_{s})^2\right]^{-1/2}\right\}}{S*P}}$$

Index 3 => assesses degree of phonetic control

variability of the variance

Index 3 ↘ Compliance ↗

$$\text{Index} = \text{var}_{S}\left\{\sum_{p=1}^{P}\text{var}_{P}\left(\left[\sum_{i=1}^{I}(Fi_{ps} - Fi_{s})^2\right]^{1/2}\right)\right\}$$

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RESULTS

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RESULTS

Speaker	*Index 1*		*Index 2*		*Index 3*	
	Value	Rank	Value	Rank	Value	Rank
B1	223	4	72	3	4370	3
B2	158	2	64	4	2121	1
B3	184	3	81	2	7111	4
B4	149	1	101	1	4303	2
M1	200	3	62	4	3782	3
M2	216	4	75	3	7457	4
M3	148	2	80	2	2457	2
M4	137	1	87	1	1552	1

✓***Mann-Whitney test***

RESULTS

MONOLINGUAL SPEAKERS

- Coherent ranking across the 3 indices
  - ✦ Detailed discussion in Delvaux et *al.* (2014)

Speaker	*Index 1*		*Index 2*		*Index 3*	
	Value	Rank	Value	Rank	Value	Rank
M1	200	3	62	4	3782	3
M2	216	4	75	3	7457	4
M3	148	2	80	2	2457	2
M4	137	1	87	1	1552	1

RESULTS

BILINGUAL SPEAKERS

- None has the same ranking position across the three indices !

Speaker	*Index 1*		*Index 2*		*Index 3*	
	Value	Rank	Value	Rank	Value	Rank
B1	223	4	72	3	4370	3
B2	158	2	64	4	2121	1
B3	184	3	81	2	7111	4
B4	149	1	101	1	4303	2

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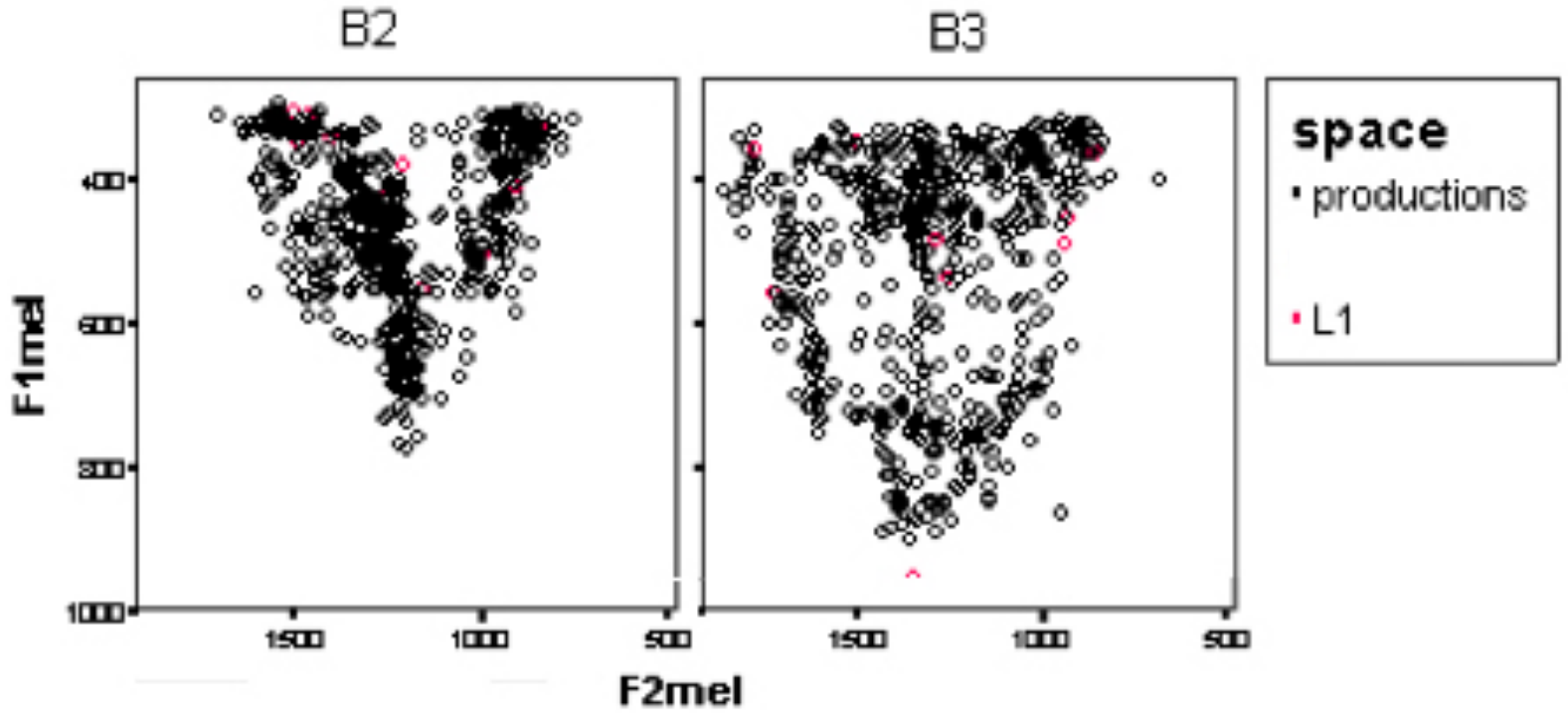
BILINGUAL SPEAKERS

B2	158	2	64	4	2121	1
B3	184	3	81	2	7111	4

The most stable

More risk taking !!

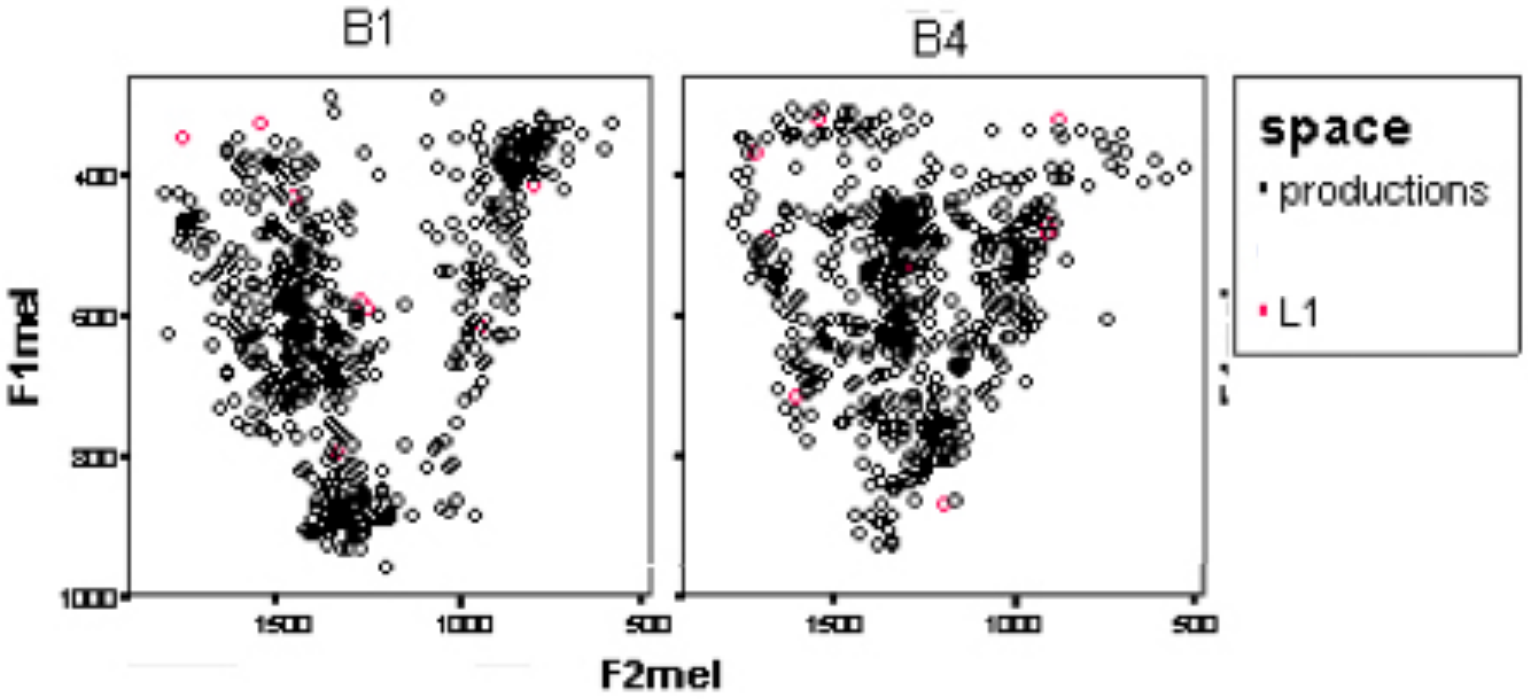


BILINGUAL SPEAKERS

B1	223	4	72	3	4370	3
B4	149	1	101	1	4303	2

The least compliant

The most compliant



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DISCUSSION & CONCLUSION

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DISCUSSION

- Index values no significantly different in monolinguals and bilinguals
  ⇒ **Bilinguals not more compliant** ?

➢ BUT:

- Bilinguals' ranking varying across indices
  ⇒**more diversified and complex profiles** ?

▪ Absence of significant differences in index values
  ⇒ **BUT PHONETIC COMPLIANCE NOT SIMILAR !**

DISCUSSION

- Indices initially designed in **monolingual context**

➢ **Index 2** includes native phonological system

◆ Bilingual speakers: **2 systems**

➢ **Disadvantaged from the start !**

✦ Dutch oral vowels not included => **BIAS**

➢ **Need to improve Index 2**

DISCUSSION

- Small sample size and different types of bilinguals

❖ B1, B2, B3: early bilingualism in *diglossic context*
⇒Linguistic systems separated - no greater flexibility?

❖ B4 exposed to english => **French = L3** ?
⇒ easier distancing

BilingualismS => differential impact !

CONCLUSION

- **Our results confirm:**

➢ the multidimensionality and complexity of phonetic compliance
  - particularly in bilingual speakers

- **Our results emphasize**:

➢ the interest of a multi-componentional approach
➢ the need for further refinements of the construct in itself and of the ways to assess it ➔ CONSTRUCT VALIDITY !

THANK YOU FOR YOUR ATTENTION !

DO YOU HAVE QUESTIONS ?

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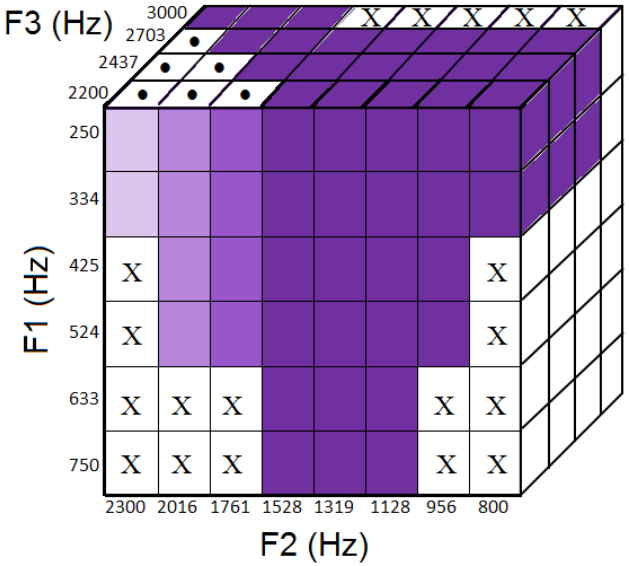
DATA COLLECTION PARADIGM

- **STIMULI**

- **94 synthesized vowels** (Klatt 1980)

  - uniformly distributed over a F1*F2*F3 space measured in Mels
  - Total duration: 200 ms
  - within the limits of the human acoustico-articulatory space



DATA PROCESSING

- **Three indices** (Delvaux et al., 2014) ➔ **COMPLEMENTARITY**

▪ Based on the euclidean distance between the **stimulus** and the **response** in the F1*F2*F3 acoustic space

$$D = \left[\sum_{i=1}^{I} (Fi_{ps} - Fi_{s})^2 \right]^{1/2}$$

Index 1 => assesses distance betwen stimuli and productions - ***sum of the distances***
Index 2 => includes native phonological system - ***distancing from L1***
Index 3 => assesses degree of phonetic control - ***variability of the variance***

DATA PROCESSING

- **Index 1:** **sum of the distances** between models and productions for all **S** vowel-like stimuli (=94) and **P** (re)productions (=6)

I : number of formants (=3)

$$\text{Index 1} = \frac{\sum_{s=1}^{S}\sum_{p=1}^{P}\left[\sum_{i=1}^{I}(Fi_{ps} - Fi_{s})^{2}\right]^{1/2}}{S * P}$$

Index 1 ↘ Compliance ↗

DATA PROCESSING

- **Index 2 :** **weighing** of the distances between models and productions by a factor expressing the distancing of the responses from the vowel clusters centroids in **L1 => French (common to all participants)**

V = number of oral vowels in French (=10)

$$\text{Index 2} = \frac{\sum_{s=1}^{S}\sum_{p=1}^{P}\left\{\prod_{v=1}^{V}\log\left[\sum_{i=1}^{I}(Fi_{ps} - \overline{Fi_v})^2\right]^{1/2}\left[\sum_{i=1}^{I}(Fi_{ps} - Fi_s)^2\right]^{-1/2}\right\}}{S * P}$$

mean value of i^{th} formant (in mels) of the cluster formed by the 10 repetitions of the vowel v in L1

Index 2 ↗ Compliance ↗

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DATA PROCESSING

- **Index 3: variability of the variance** of the distances between models and productions

var_s = variance of the variance (var_p) for s (=94)

var_p = variances of the distances for p (=6)

$$\text{Index} = \text{var}_S\left\{\sum_{p=1}^{P} \text{var}_P\left(\left[\sum_{i=1}^{I}(Fi_{ps} - Fi_s)^2\right]^{1/2}\right)\right\}$$

Index 3 ↘ Compliance ↗