

Cross-linguistic trends in the perception of place of articulation in stop consonants

Comparison between Hungarian and French

W. Serniclaes* & C. Geng**

* Laboratoire de Psychologie Expérimentale, CNRS & Université René Descartes, Paris 5

** Centre for General Linguistics, Typology and Universals Research (ZAS), Berlin

Workshop Phonological Systems & Complex Adaptative Systems, Lyon, July 4-6 2005

in collaboration with

- Caroline Bogliotti
- René Carré
- Ingrid Hoonhorst
- Katalin Mády
- Vicky Medina
- Souhila Messaoud-Galusi
- Liliane Sprenger-Charolles
- Sandra Van Heghe

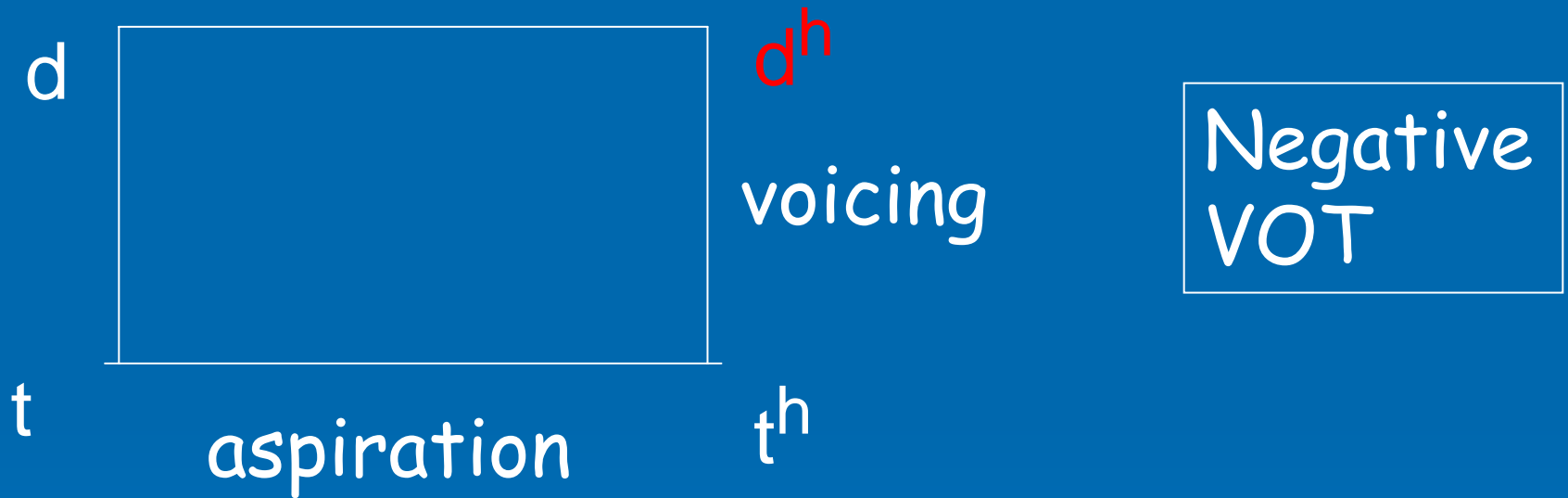
Plan

- Cross-linguistic differences in speech perception: models
- Models for the acquisition of language-specific place perception
- Cross-linguistic differences in the perception of stop place of articulation: languages with 3 vs. 4 place categories
- Perceptual results with both French & Hungarian listeners
- Implications for phonological systems

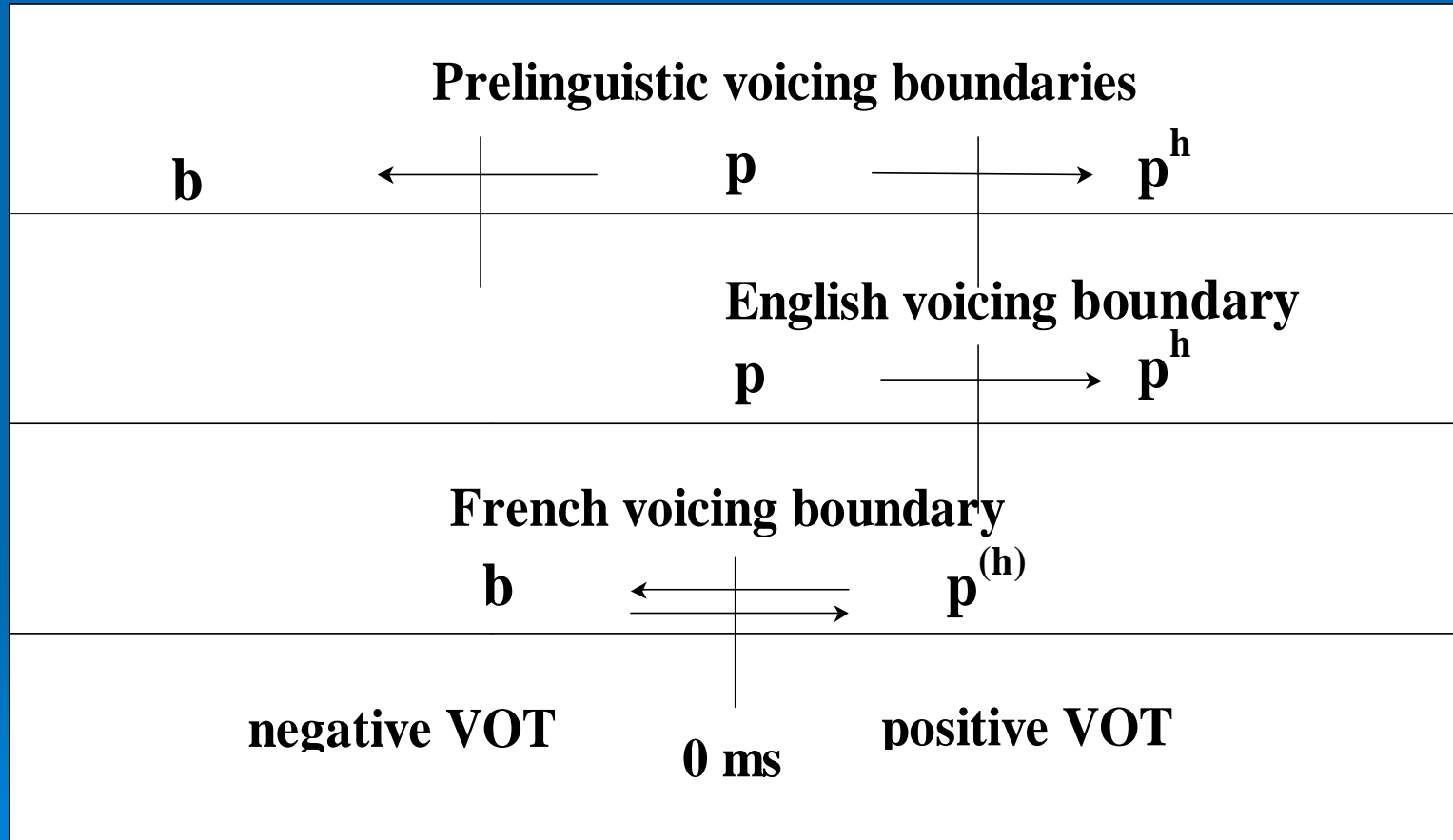
Cross-linguistic differences in speech perception: models

- universal boundaries (Werker & Tees, 1984): same in French & Hungarian
- language-specific boundaries (Kuhl, 1994): different in French & Hungarian
- language-specific boundaries from couplings between universal boundaries (Serniclaes et al., 2004): different in French & Hungarian but universal boundaries remain discriminable

voicing & aspiration distinctions (Lisker & Abramson)

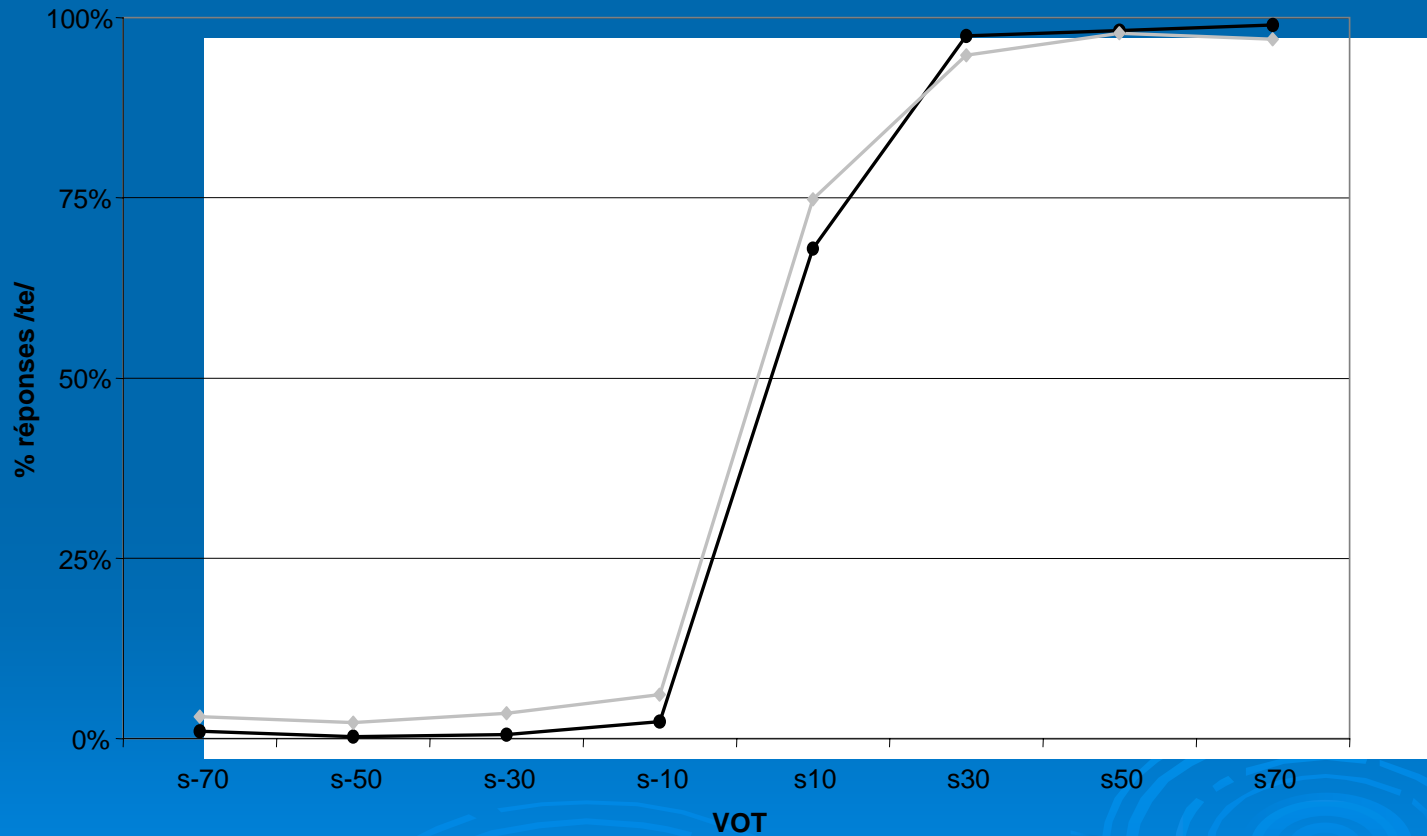


coupling between phonetic features for voicing
(Serniclaes et al., 1987; 2004)



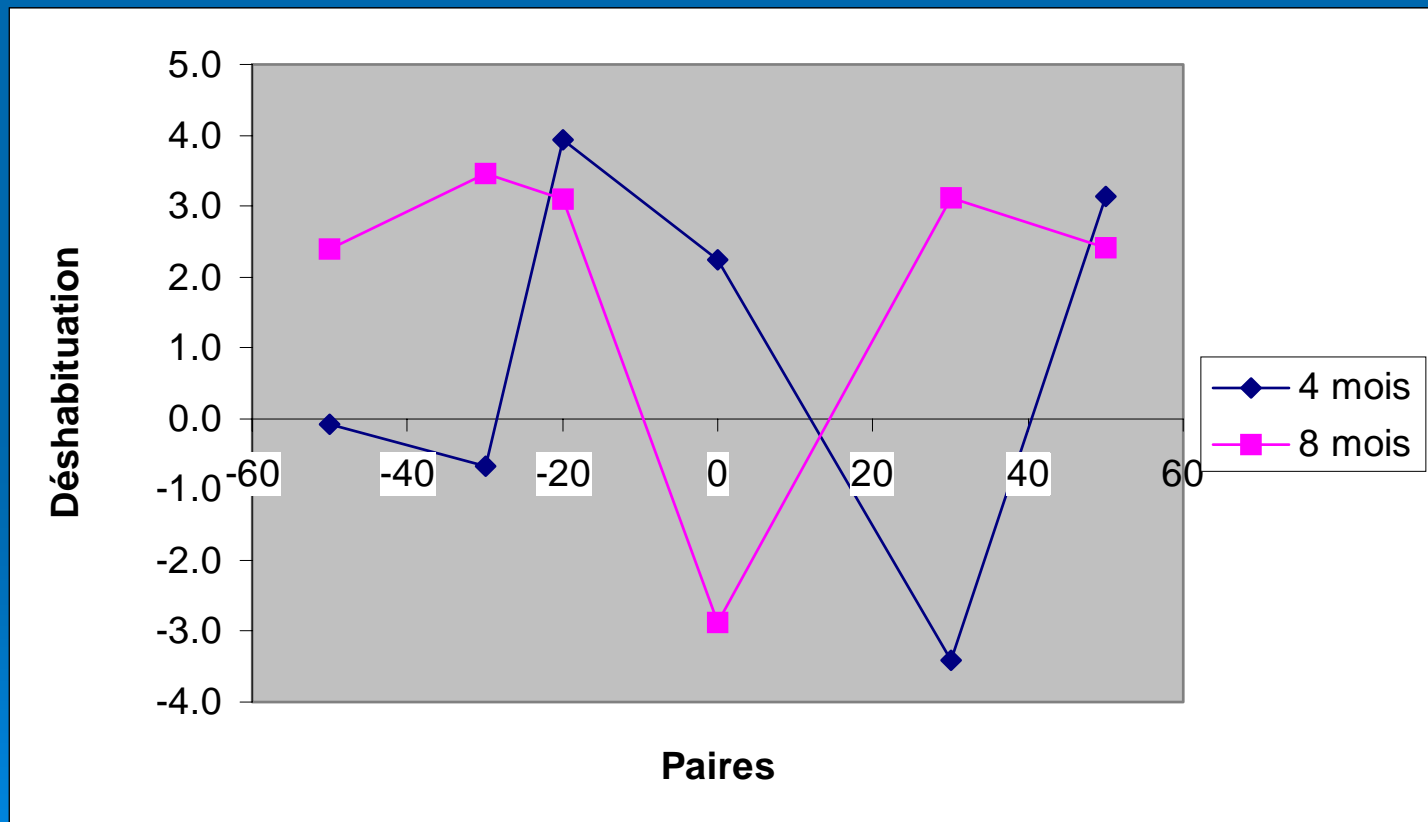
VOT boundary in French, coronal stop+ neutral vocoid

Bogliotti (2005, PhD U. Paris 7)

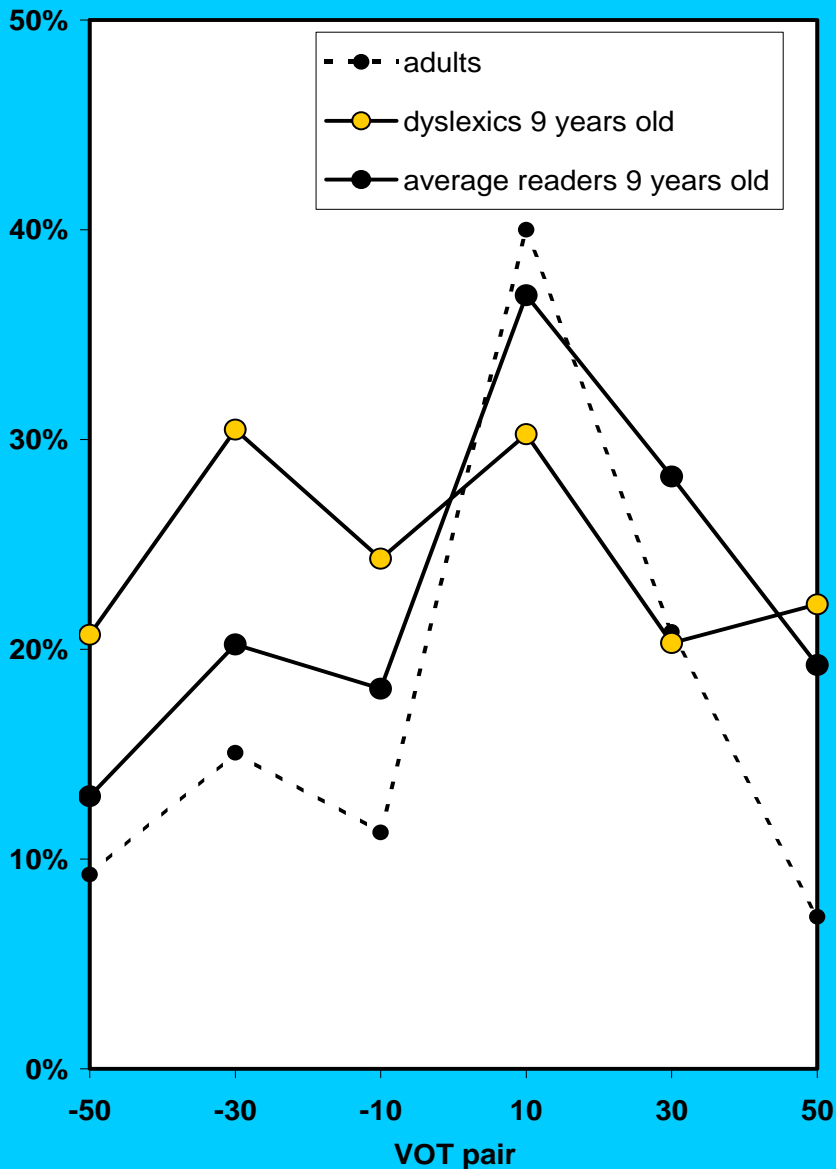


Discrimination peaks, infants, 4 vs. 8 months

French or languages with voicing-like surroundings
Hoonhorst (2004, *mémoire de Logopédie, UCL-ULB*)



% different
resp.



Comparison between two groups of 9 years old French-speaking children differing in reading level (Dyslexics vs. Controls).

Discrimination performances along a VOT voicing continuum

(Serniclaes, Van Heghe, Mousty, Carré & Sprenger-Charolles, 2004, *J. Exp. Child Psychology*)

- How can findings on cross-linguistic differences in voicing perception be extended to place of articulation ?



Distinctive Region Model (DRM)

Carré (2004)

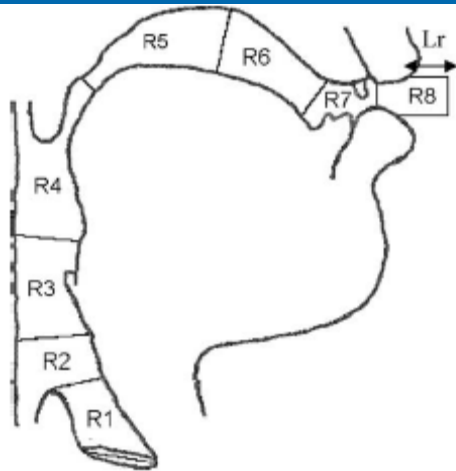


Fig. 11. The eight DRM regions and the vocal tract. R1 corresponds to the larynx cavity, R3, R4, R5, R6 to the tongue, R7 to the teeth and R8 to the lips.

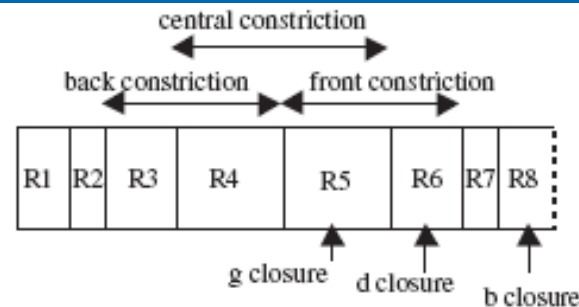
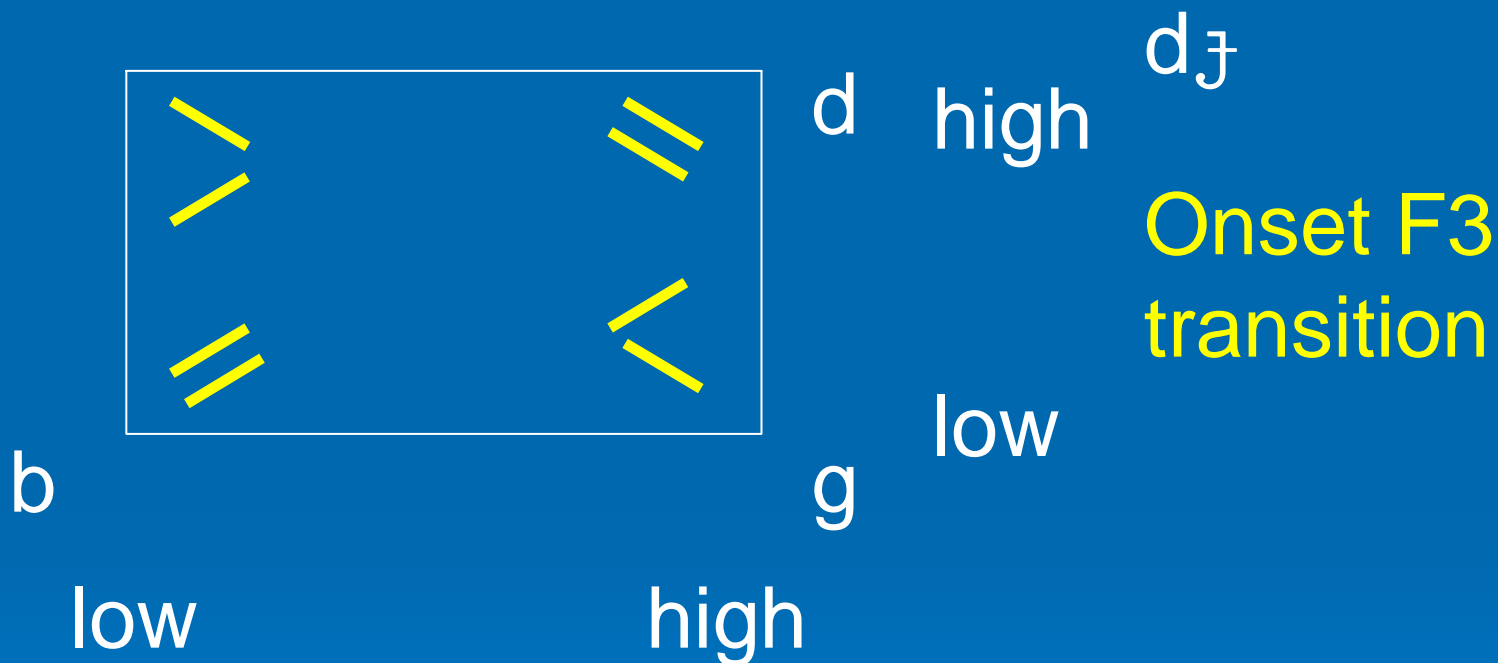


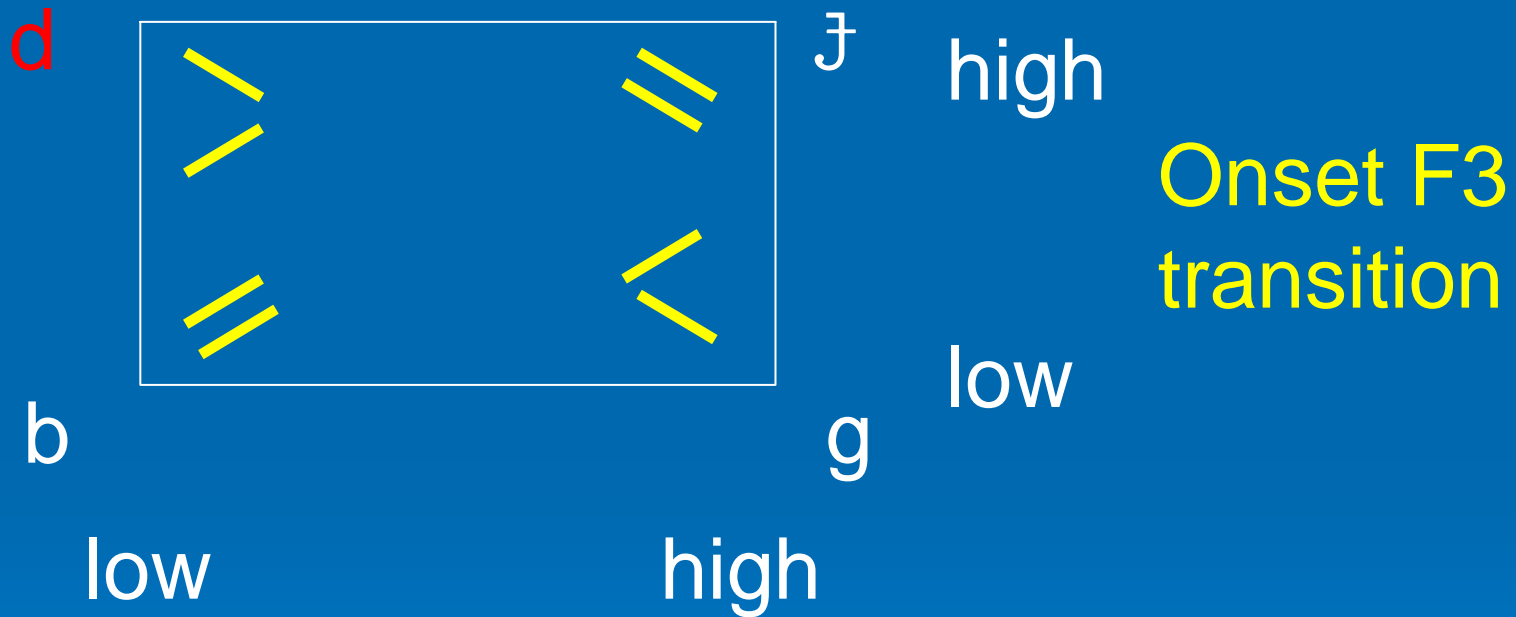
Fig. 12. The eight DRM regions and the vowel and consonant places of articulation.

F2 & F3 transition distinctions (DRM, Carré)



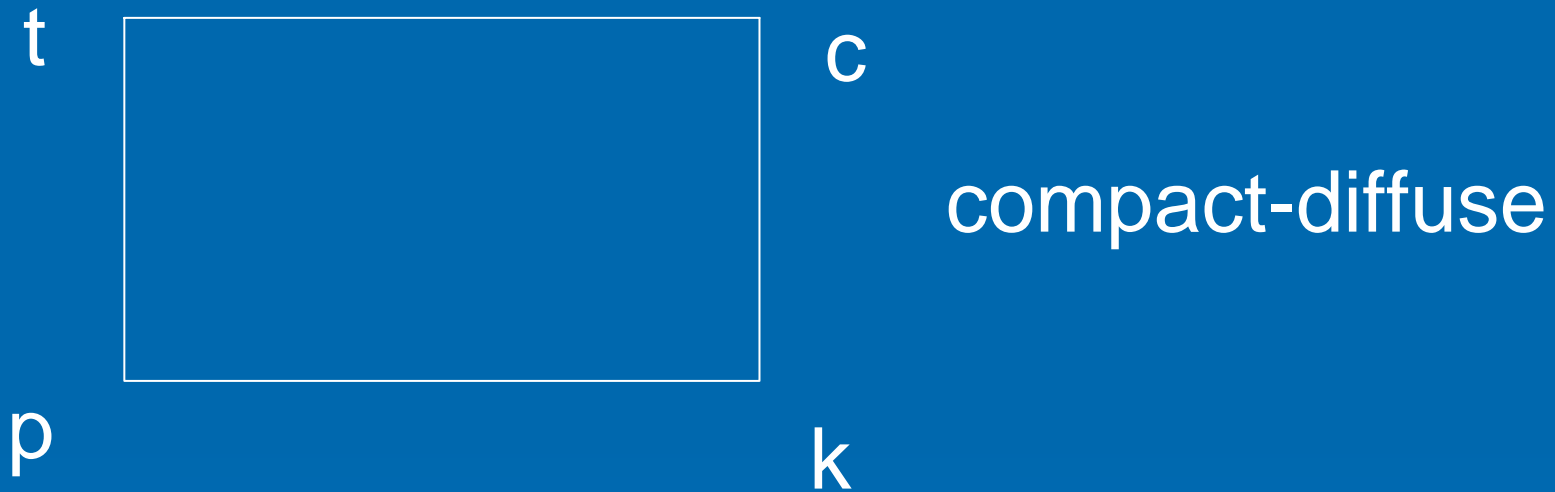
Onset F2 transition

DRM with cross-linguistic labels



Onset F2 transition

Congruent with burst distinctions (Preliminaries ...) Jakobson, Fant & Halle, 1952)



grave-acute



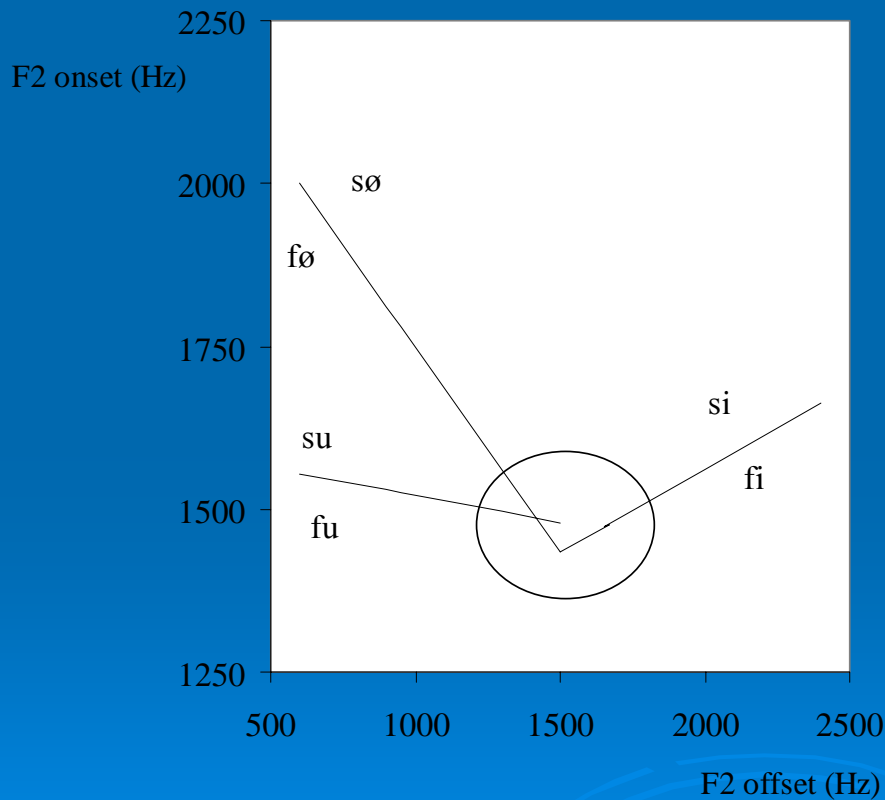
Hypotheses on place perception in 3 & 4 category languages

- 4-category language (e.g. Hungarian):
Share-out of the F2-F3 transition space in 4
equal parts
- 3-category language (e.g. French):
Share-out of the F2-F3 transition space in 3
equal parts

- How to implement these hypotheses in perceptual paradigms ?



Interest of the neutral vowel context context for comparing consonant distinctions between languages



Perception of place in French fricative+ vowel syllables (Serniclaes & Carré, 2002)

Labelling boundaries in the F2 onset –F2 offset plane

Boundaries converge to flat transitions for neutral vowel settings

(F2 = 1500; F3 = 2500 Hz)

Place perception:

based on natural boundary in the neutral vocoid context

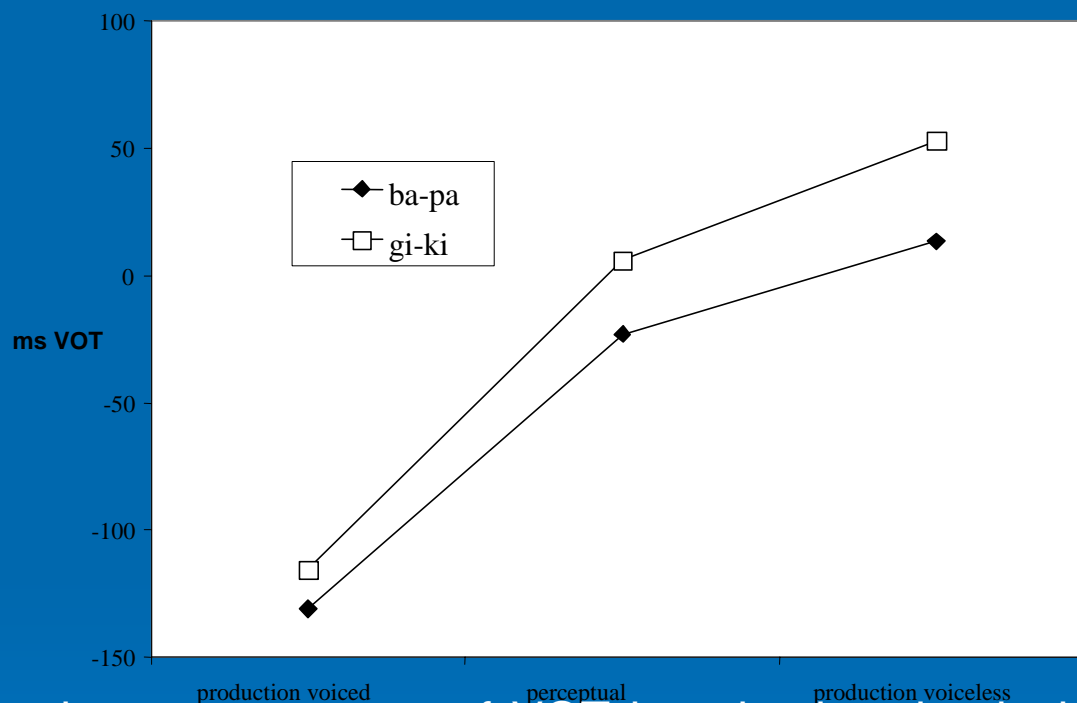
becomes increasingly complex with the expansion of the vocalic space

Also true for voicing

Methodological interest of the neutral context:

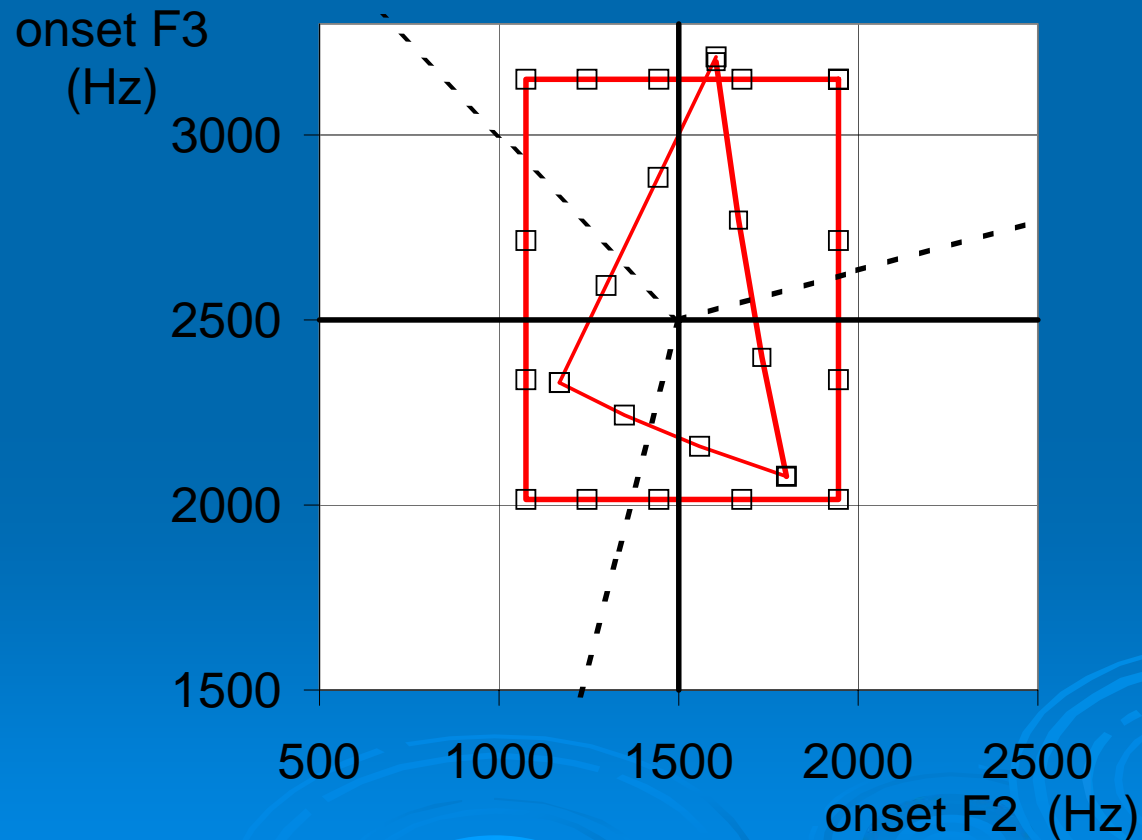
simple landmarks for tracing universal boundaries

Contextual variations in voicing perception & production in French (Serniclaes, 2005)



Mean acoustic measurements of VOT in voiced and voiceless stops as well as the mean perceptual boundaries along a synthetic VOT continuum are given in two phonetic contexts, i.e. /labial stop + a/ (/ba-pa/) and velar /stop + i/ (/gi-ki/). The contextual shift in perception (29 ms VOT) is about half-way between those in production. Perceptual boundaries follow the productive variations, resulting in a fairly stable relationship across contexts.

Stimuli: «phonetic» continuum (rectangle: with directions normal to flat boundaries) & «phonological» continuum (triangle: with directions normal to alleged 3-category phonological boundaries)



Cross-linguistic differences in speech perception: models

- universal boundaries (Werker & Tees, 1984): same in French & Hungarian
- language-specific boundaries (Kuhl, 1994): different in French & Hungarian
- language-specific boundaries from couplings between universal boundaries (Serniclaes, 1987): different in French & Hungarian but universal boundaries remain discriminable

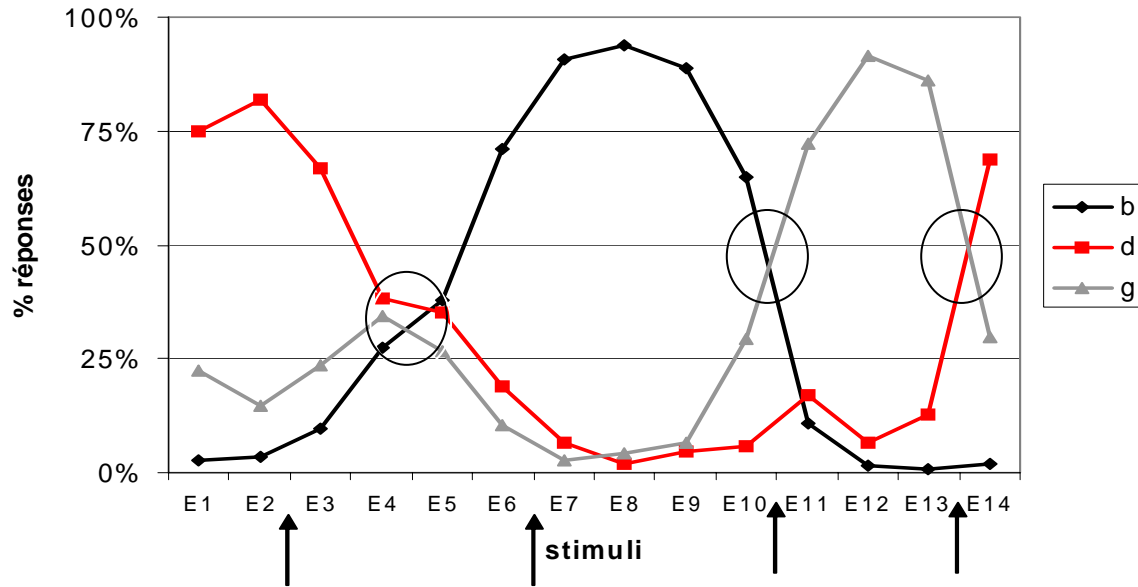
Experimental set-up

(Bogliotti, 2005; Geng et al., 2005)

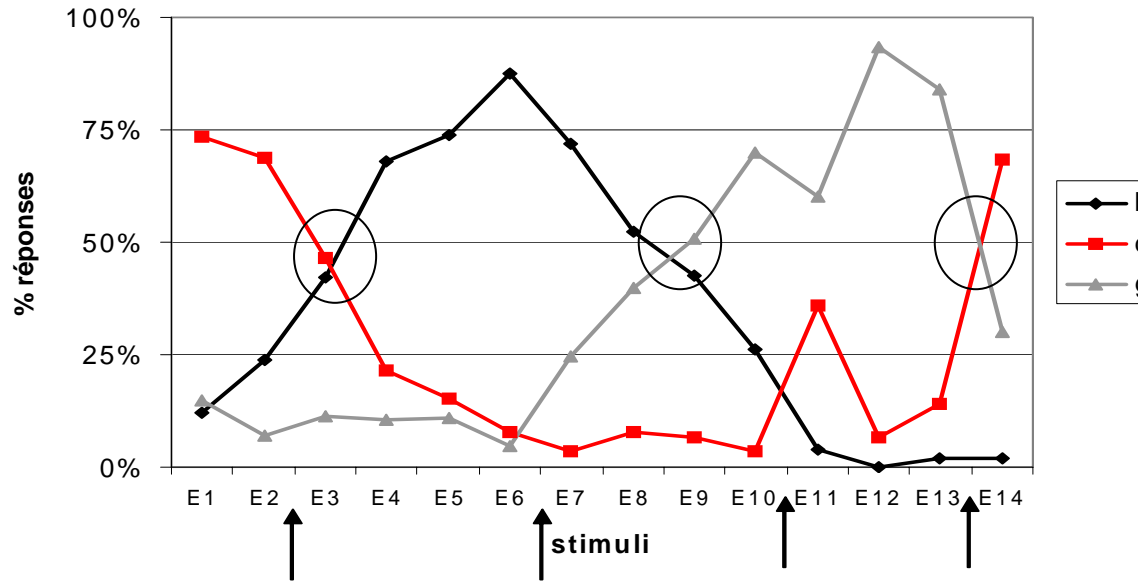
- Stimuli: phonetic & phonological continua in the F2-F3 transition space
- with or without burst
- Labelling & AX discrimination data

French

without
burst

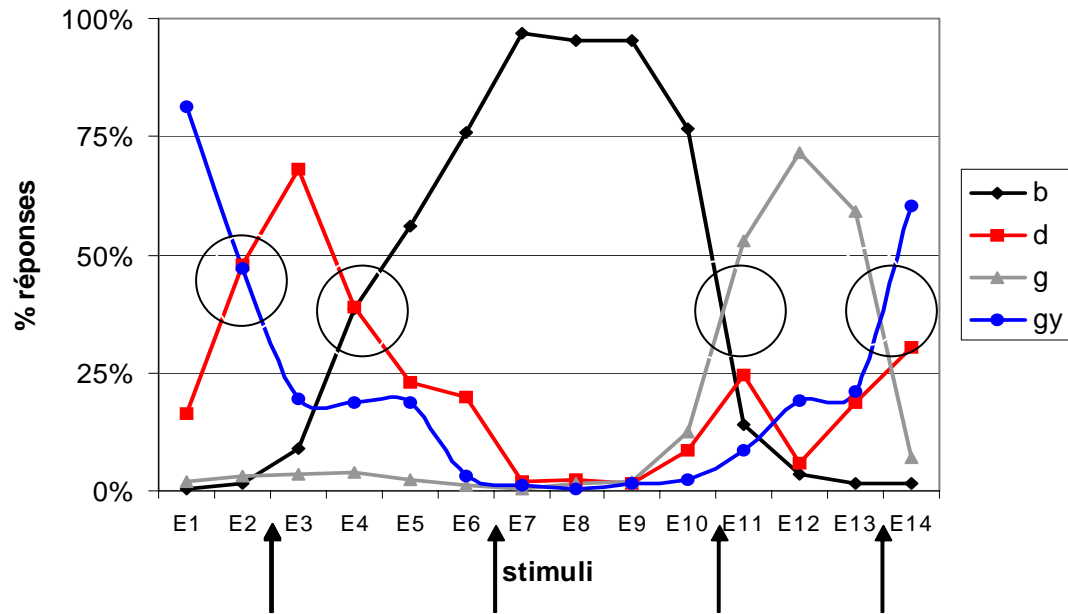


with
burst

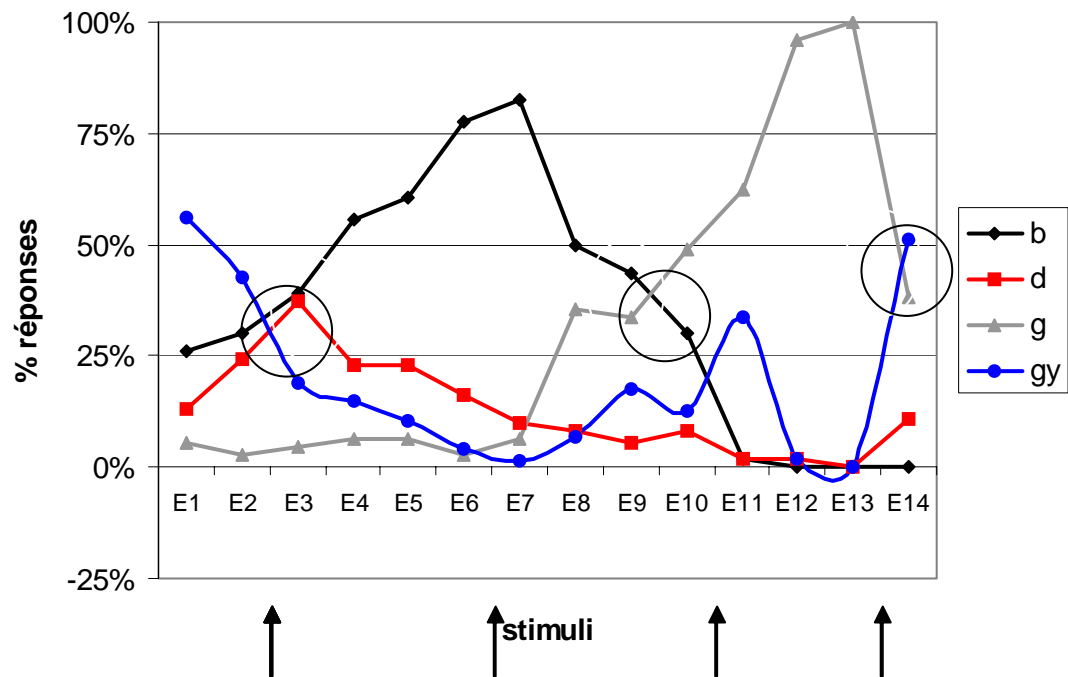


Hungarian

without
burst

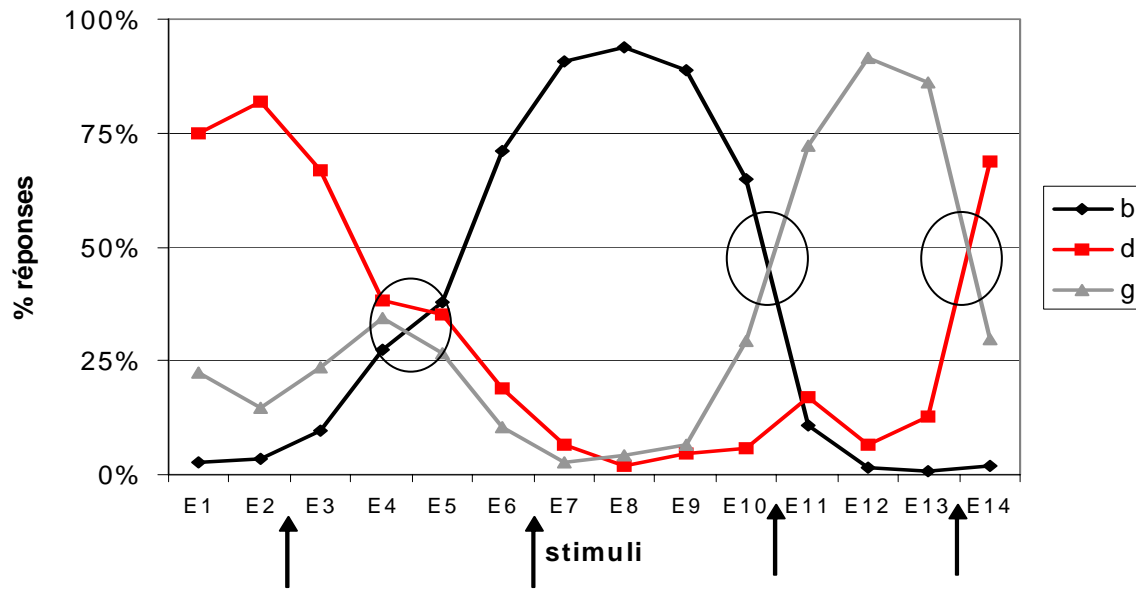


with
burst

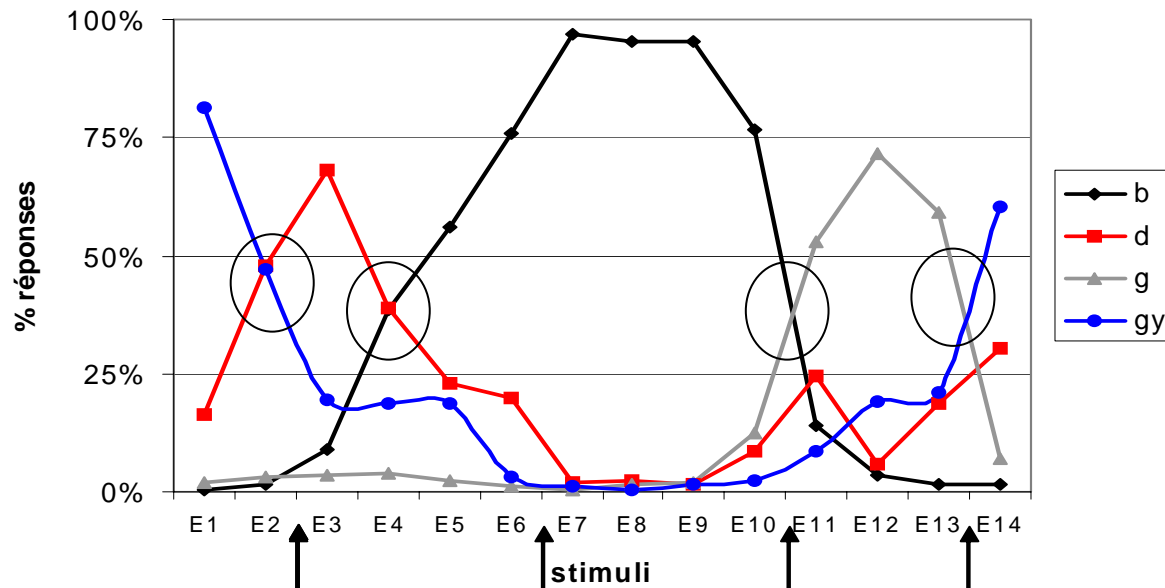


Hungarian vs. French without burst

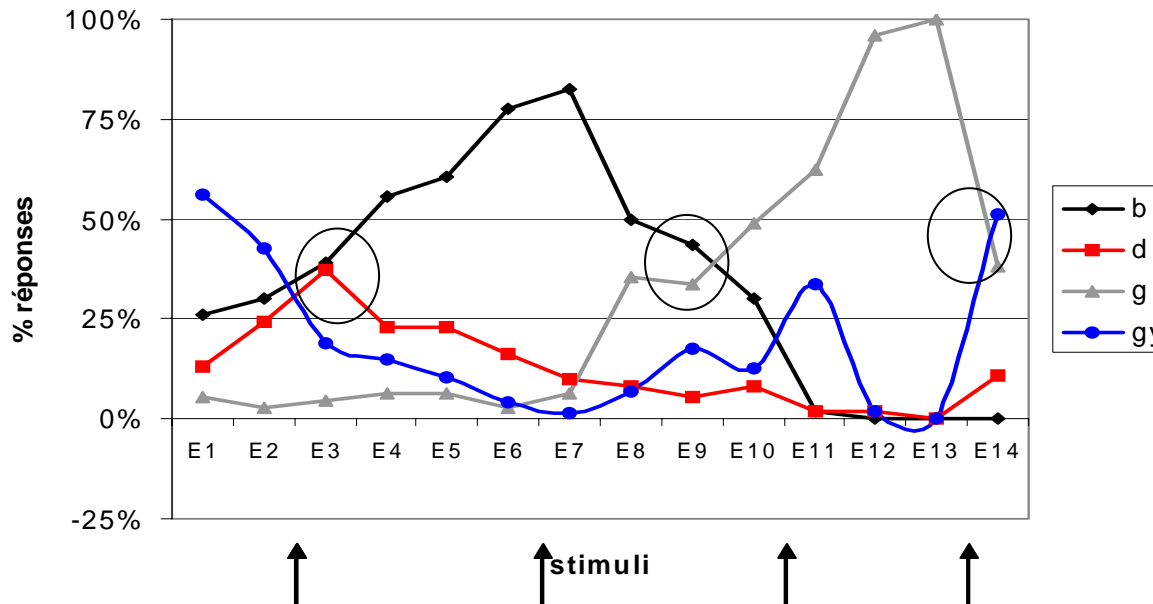
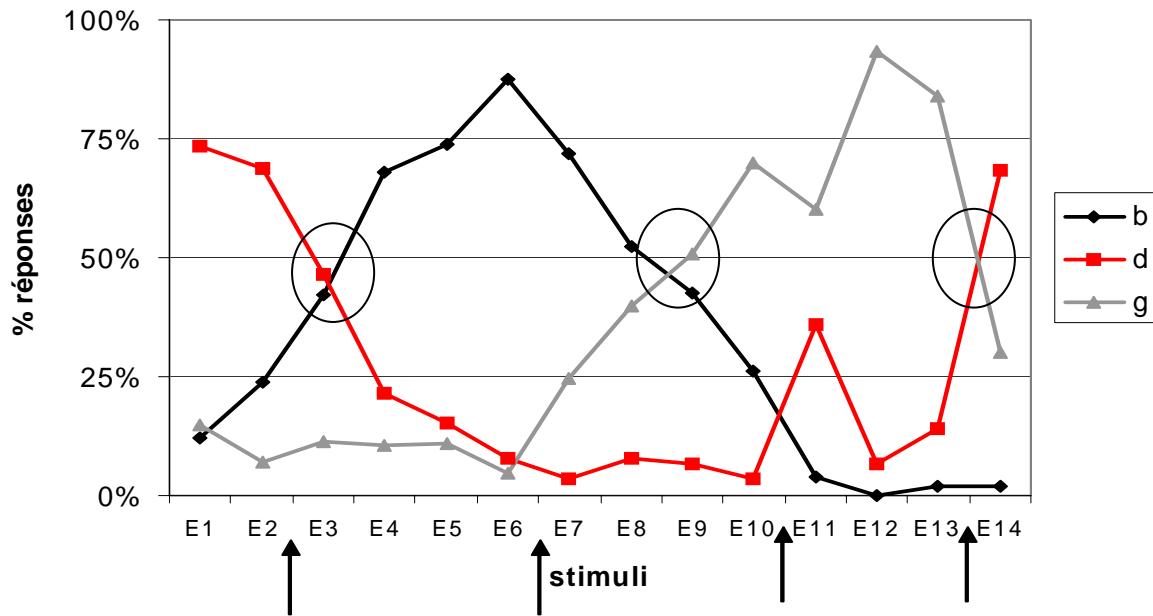
French



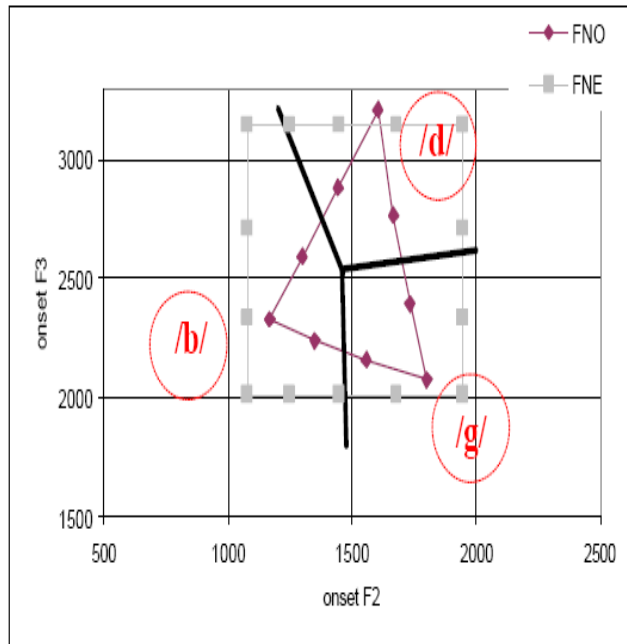
Hungarian



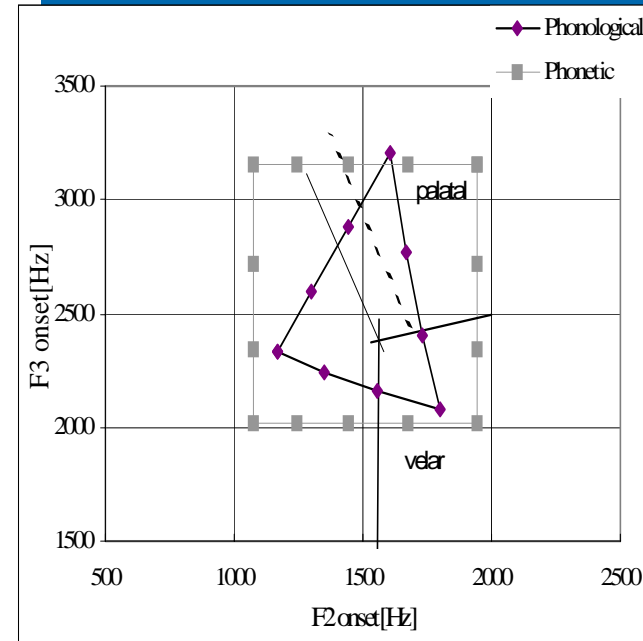
Hungarian vs. French with burst



labelling boundaries

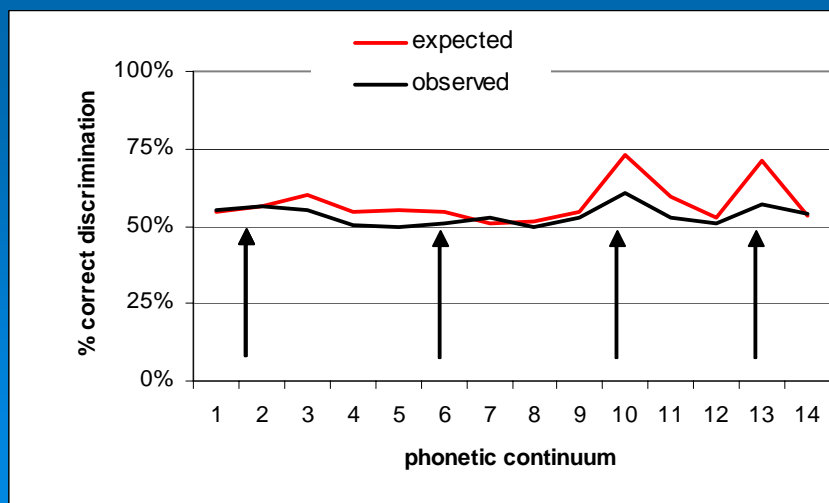
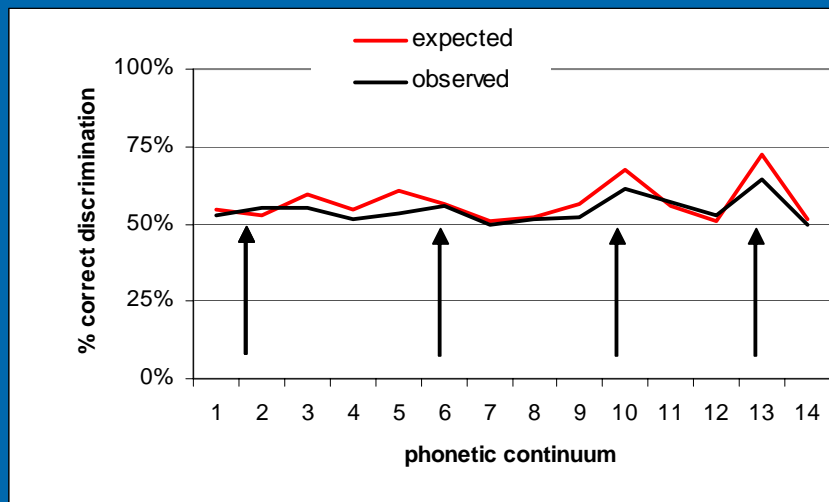


French

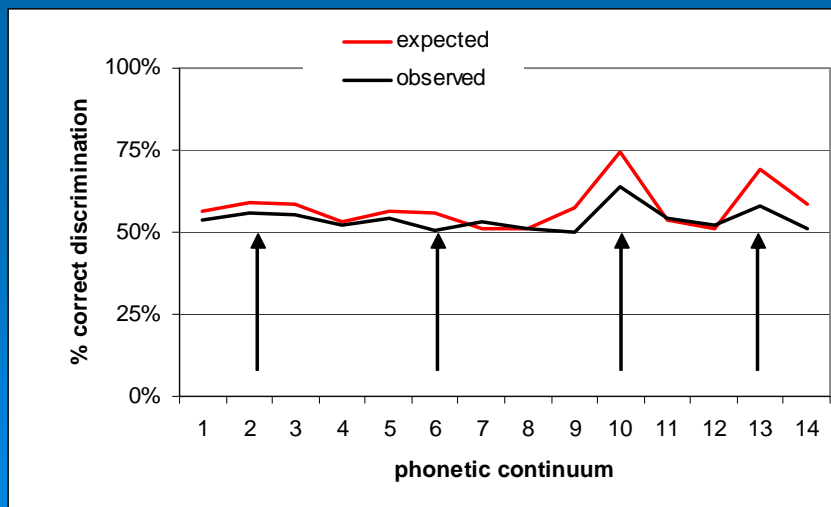
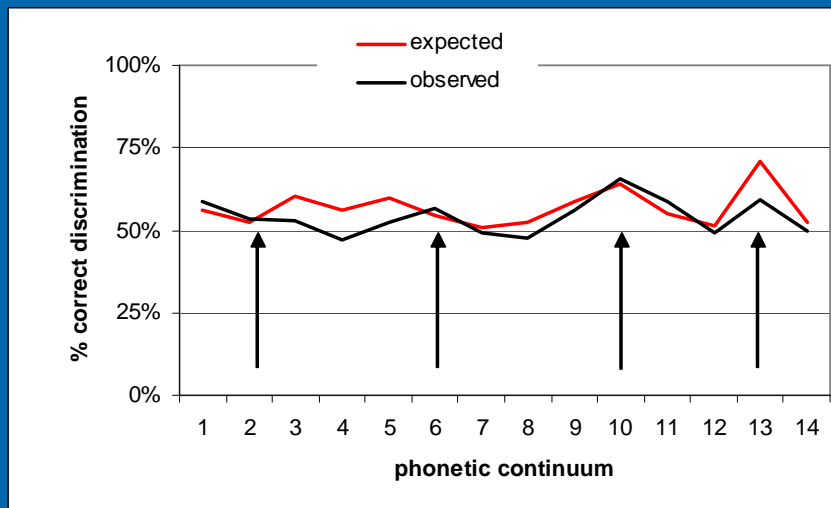


Hungarian

discrimination of universal boundaries : stimuli without burst



discrimination of universal boundaries : stimuli with burst



Conclusions

DISCRIMINATION DATA

Natural boundaries no less perceptible in French vs. Hungarian

LABELLING DATA

French /d/ category covers Hungarian /d/ & /ɟ/ categories

Perceptual boundaries for shared distinctions are fairly similar in both languages

Future studies

- Languages with 4 place categories cannot simply make it by combining 2 binary features – in line with what happens with voicing distinctions
- A further feature is also required
- Place feature ?
- Manner feature (double articulation, affrication) ?