Articulation in a bilingual speaker: Preliminary models and phonemic comparisons

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Articulation in a bilingual speaker: Preliminary models and phonemic comparisons

**Purpose**
MRI investigation of articulatory strategies of bilinguals - overall strategies, not single articulator - articulatory modeling and comparison across models - L1 v. L2 comparisons of individual phones & groups of phones
Themes: - dynamics of L2 articulator development - intra-individual comparisons of articulatory phonetics

**General methodology**
Subject: 1 so far; L1 Am. English, skilled late learner of L2 French
More language pairs and more skill levels planned
Corpora: Isolated Vs and CV combinations for (nearly) all phonemes
CVCs and words when warranted
MRI: Static mid-sagittal MRIs of all targeted phones
Efforts underway to obtain dynamic MRI capabilities
Curves: Outlines of articulators extracted manually, oriented to bony articulators
Modeling: Linear models of articulatory components derived from target sub-corpora:
Comparisons: L1 vs L2 for phonemes, phonemic classes, articulator models

**Subject**
Male, born mid-1950s, raised in FL
Parents and friends monolingual American English speakers
French from 7th through 10th grades (~12 - 16 years). ALM method.
French minor in college, literature emphasis, no communicative competence
6 years of residence in Grenoble, France, in academic situations - ages 24-27 for MA, 34-36 for dissertation research, 56-57 as visiting instructor

**Corpora**
English L1
French L2

**Target Phoneme Inventories**

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**MRI Images**
All Vs in isolation
\( (\text{i, a, e, o, u}) \times 10 \) s, i.e., [oi, ih, ... ou, ip]
\( V_{\text{all}} \) in CVs: (m t) \times 10 \ s, i.e., [mm, tm, ... m, tm]
\( V_{\text{all}} \) in CVs: (m t) \times 10 \ s, i.e., [mm, tm, ... m, tm]

**Models**
Articulation is modeled by linear combination of basic components:
Each component has a mean and standard deviation of location.
Each component gives a weighted contribution to a full articulation.

**Comparisons**
Through contours and models, three kinds of comparisons can be made:
Phone to phone:
- Specific images representing targeted phones can be compared across languages.
Group to group:
- Different interesting subsets of the two languages can be compared.
Nomograms:
- Modeling can compare overall articulatory strategies through nomograms.

**Nomograms**
To model each basic component:
- the mean and standard deviation is calculated from an input set of curves, and
- those results can be illustrated as ‘nomograms’, so
- using appropriately different sets of curves as input:
Nomograms can illustrate contrasting patterns in different categories of articulation, e.g.,
- Three banks of paired comparisons of lip and tongue model components, based on:
  Top Row: Vowels only; Middle row: “analogous” Consonants; Bottom row: full corpus

**Conclusion**
Evidence suggests subject has two distinct articulatory systems for L1 English and L2 French:
- Some phones are very near matches in AE and FR, but
- Group comparisons show different differences of pattern, and
- Nomograms show model extracts different patterns of articulatory gestures.
Needs:
- Method for quantifying difference between two phones, within and/or across languages.
- Possibly via calculation of area functions?
- Synthesis by model, then panel judgments, to relate articulation and perception?