

1. Research background

- It is a common claim that French has **voice, but no place assimilation**.
- Ramus (2001:208): “English children [...] must learn how place assimilation works in English [...] if they were in a French environment, they would need to learn that there is no place assimilation, but that there is voicing assimilation”.
- Gow (2003: 492): “Darcy (2002) performed word monitoring experiments in French and English that examined the role of context in processing [...] regressive place assimilation (which occurs in English but not French)”.



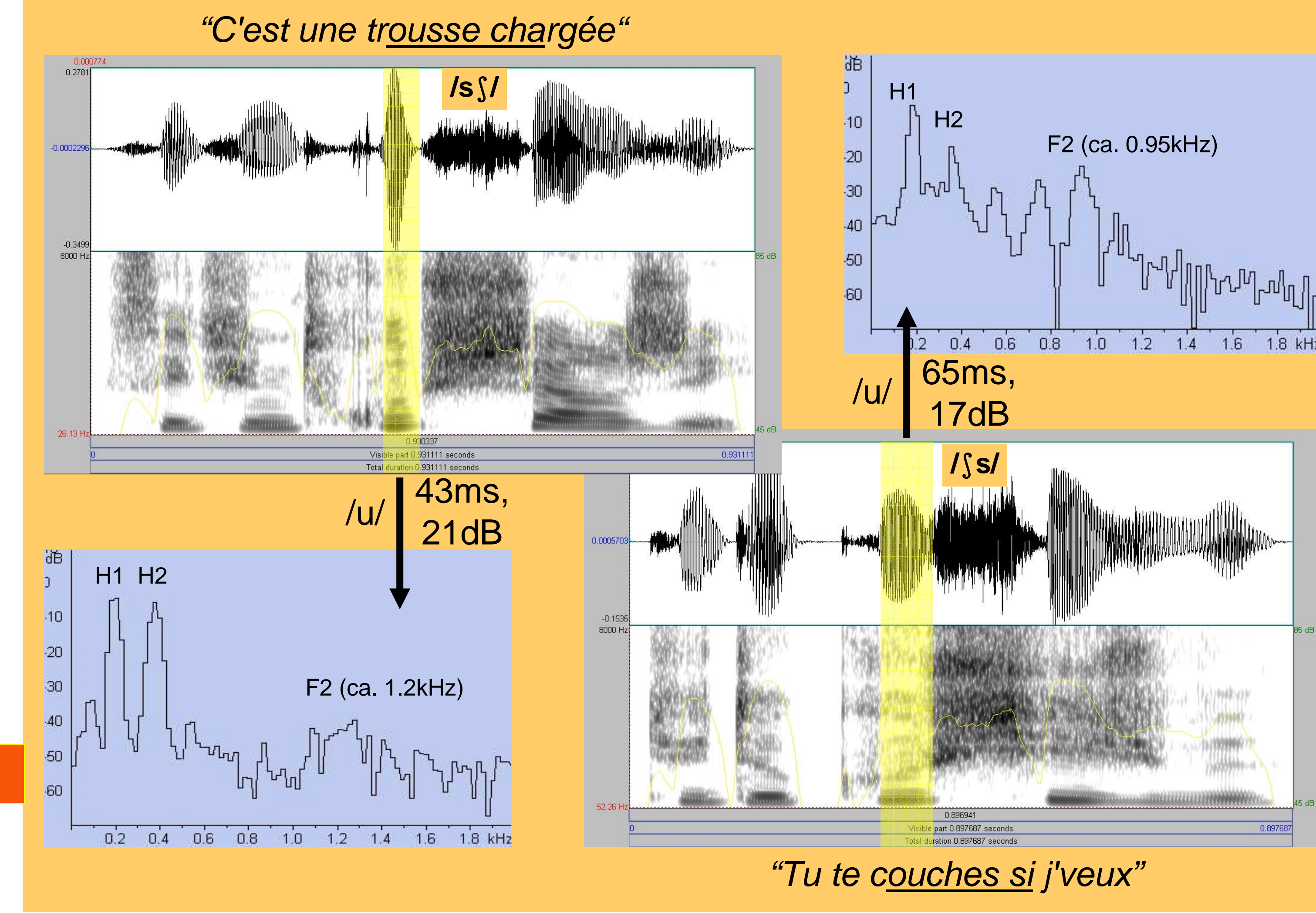
- Our previous study showed on the basis of sequences of alveolar and postalveolar (voiced and voiceless) sibilants that **place assimilation does also exist in French**.
- It is a productive process that goes beyond high-frequency functions words (i.e. “weak forms”) and fixed expressions like „je sais” or „je suis”, and that it is not bound to a simultaneous /ə/ deletion (and hence to certain dialects or sociolects).
- From a typological point of view, it is interesting that place assimilation in French sibilant sequences is primarily quality-guided, and not direction-guided as in English.
- The **target is ‘postalveolar’**. Consequently, it is **regressive** in alveolar-postalveolar and **progressive** in postalveolar-alveolar sequences.

→ “Elle remâche sa viande”: /s/ ⇒ [ʃ:]
 → “C’est une classe chargée”: /s/ ⇒ [ʃ:]

- Overall, the assimilation is **gradual**. This refers to the **temporal** as well as to the **spectral** domain. For example, /s/ → [ʃ:] or a constant sound with a quality in between [s] and [ʃ], i.e. [ʃ̄s].
- However, we also found quite a few cases for each speaker in which the sequences were indistinguishable from our single postalveolar references /ʃ/ or /ʒ/.
- But are these cases of complete assimilation?**
- If so, French sibilant sequences may be assumed to have a considerable potential for ambiguities. For example, [ʃ:] → /sʃ/, /ʃs/, /zʃ/, /ʒs/, and /ʃʃ/ !!**

- Systematic acoustic analysis of the vowels preceding /s/, /ʃ/, /sʃ/, and /ʃs/ in French with regard to duration, vowel quality, acoustic energy, and voice quality on the basis of a new, more carefully controlled read speech corpus.**

- Speech is not a linear construction, i.e. a string of independent segments.
- **Can consonants “leave a trace” in the preceding vowel, even if they are (completely) assimilated by another (e.g., following) consonant?**
- Several indications in the literature suggest a positive answer to this question.
- Nolan’s (1992) EPG study on alveolar-to-velar assimilation in sequences of English plosives, e.g., “bad girl” (/dʒ/) → “bag girl” ([g:]): Even if the assimilation was complete in terms of EPG contacts, he notes that “auditorily, it seems that the vowel allophone before the lexical velar is slightly closer than before the lexical alveolar” (p.272).
- Confirmed by formant measurements of Local (2003).
- Hawkins and Smith (2001) compared the vowel spectra of /u/ in “who” vs. “who’s” in the two utterances “Who/Who’s sharpened the meat cleaver?”. The /u/ in “who’s” had a higher second-formant frequency (consistent with the fronter tongue constriction for /z/), although the /z/ sequence itself was “completely assimilated”, i.e. it resembled the sibilant /ʒ/ in “Who sharpened...”.
- Also our own French data point to systematic differences in the qualities of the vowels preceding alveolar-postalveolar and postalveolar-alveolar sibilant sequences, independent from the degree of place assimilation.
- Specifically, vowels preceding postalveolar-alveolar sequences (e.g., /ʃs/) seem to be **(1) longer, (2) breathier, (3) softer, and (4) to have a more peripheral vowel quality** in the vowel space (Figure 1).



2. Method

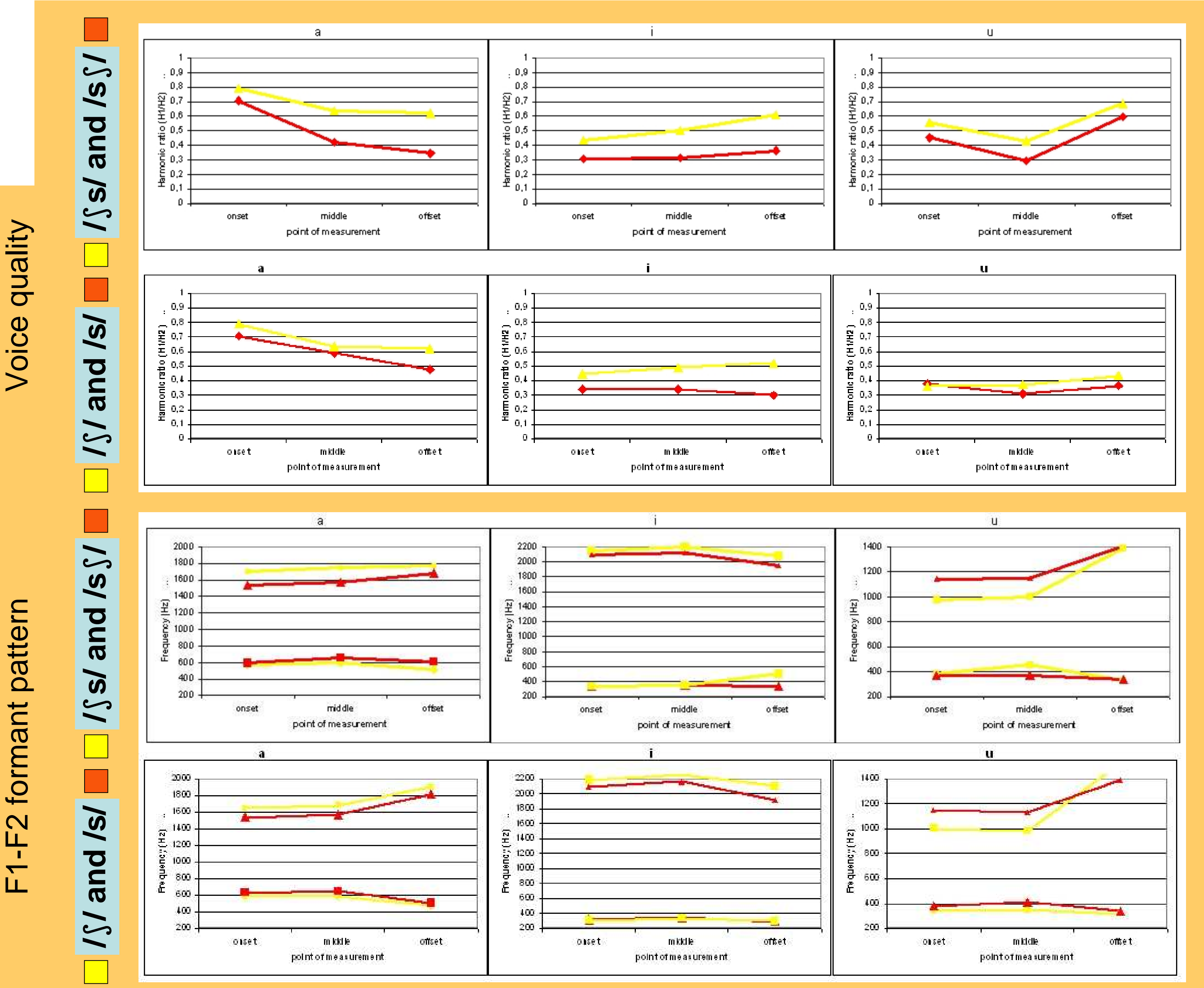
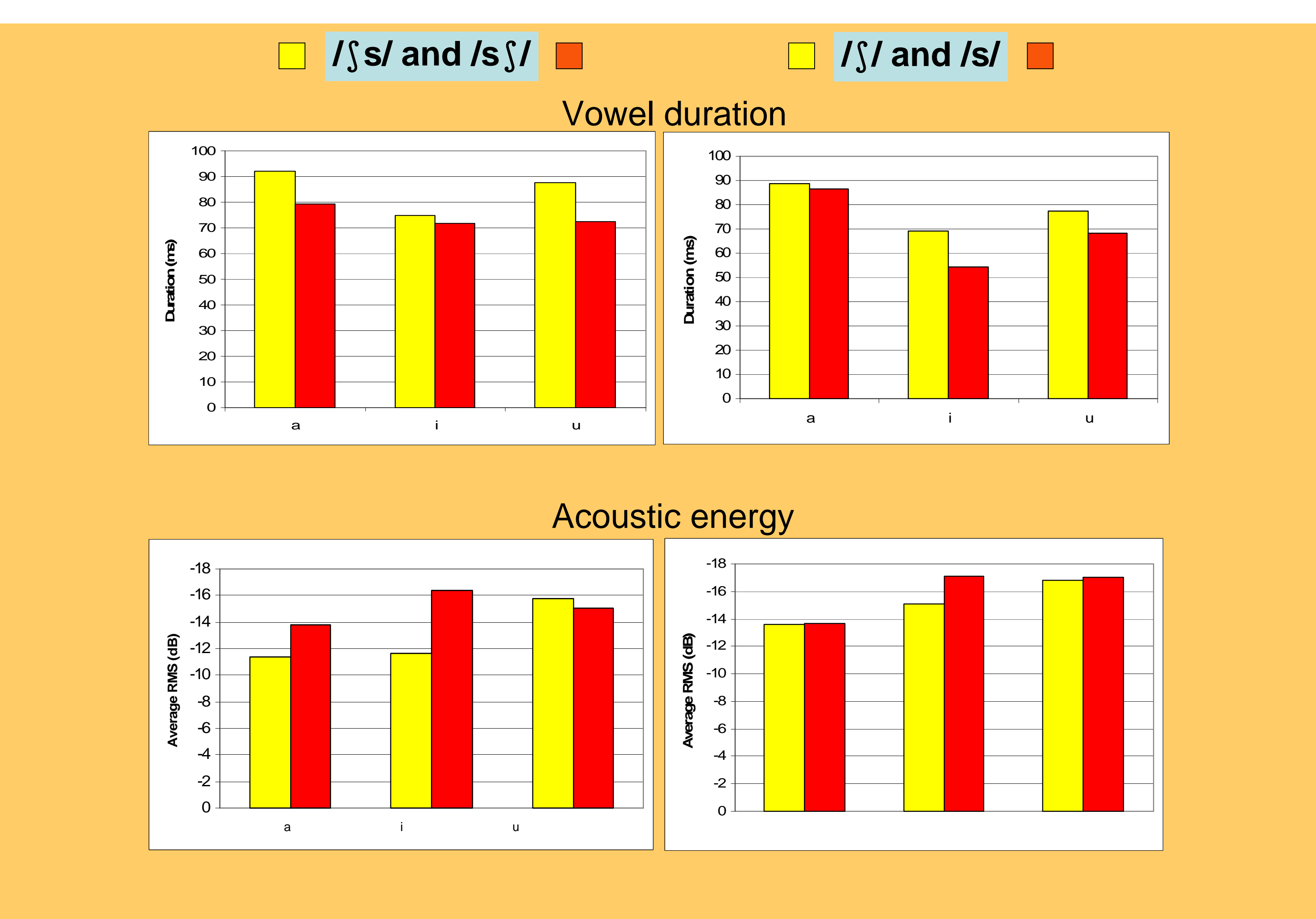
- We needed highly controlled speech material in order to investigate the hypothesized multi-parametric phonetic differences (≠ possible interferences with prosodic/syntactic/ syllabic structure, word frequency, etc.)
- **Pseudo names with CVC structure** for surname and family name
- Creates a C(i)VC.CVC structure, with C.C =
 (a) /sʃ/, /ʃs/ (assimilation conditions)
 (b) /sm/, /ʃm/ (reference conditions)
- Three symmetric vowel environments: /a__a/, /i__i/, /u__u/
- C(i) was a voiced labial consonant, e.g., /bvm/
- 12 pseudo names like “Bas Chafe”
- Embedded in the constant carrier sentence “J’ai vu __ hier.”

- 6 female native speakers of French were instructed to produce the 12 sentences in 4 differently randomized orders with a fast, casual speaking style (all subjects were advanced students or researchers of phonetics/linguistics, i.e. not naïve)
- Recordings were made in Aix-en-Provence (LPL, 3 sbs.) and Paris (LPP, 3 sbs.)
- Sentences were labelled in an interval tier of *praat*, and then analyzed as follows.
- For the vowels preceding the sibilants or sibilant sequences:
 - Duration: **label-based measurements**
 - Acoustic energy: **average RMS**
 - Voice quality: **harmonic amplitude ratio, H1/H2(*)**
 - Formant pattern: **F1 and F2 frequencies** measured from LPC spectra(*)
 - (*) = **at 3 points of measurements** (onset+20ms, centre, offset-20ms)
- For the sibilants or sibilant sequences: **Centre-of-Gravity, means and ranges**

3. Results and Discussion

- The **sibilant sequences** produced by the (not naïve) sbs. were either acoustically (in terms of CoG means and ranges) **indistinguishable from the /ʃ/ reference...**
- ...or they could not be identified systematically as /sʃ/, /ʃs/, /ʃʃ/ by two French listeners in a small (forced-choice) perception experiment based the extracted sequences presented in 10 randomized repetitions.**

- But the preceding **vowels differed systematically** in both conditions sibilant sequences and single sibilants. The clearest differences were found for the sequences (esp. when were acoustically indistinguishable from the /ʃ/ reference)



Vowels preceding alveolar and postalveolar sibilants in French show systematic, multi-parametric phonetic differences. These differences persist or are even enhanced when the sibilant sequences themselves would be judged as completely assimilated.

- Such findings make an important phonetic contribution...
 - by casting **assimilation in a temporal domain larger than a single segment**
 - and by **re-questioning** the concept of **complete assimilation**.
- They also have important implications for **psycholinguistic theory**, where debate continues about the processes underlying the perception of assimilated speech; all models focus on the consonants involved in assimilation. If preceding vowels contain disambiguating cues, then there is the potential to advance this theoretical debate.

- Current/future plans:**
 - Testing the **perceptual relevance** of these findings in a formal perception experiment (current work of Meunier, Nguyen, Dufour, and Niebuhr)
 - A parallel acoustic and perceptual study for the **vowels in English** (planned for this summer by Gaskell, Clayards, Ogden, Hawkins, and Niebuhr)
 - This is an important step towards the investigation of the central term of project 4 in “Sound to Sense” → **“contextual sensitivity”**