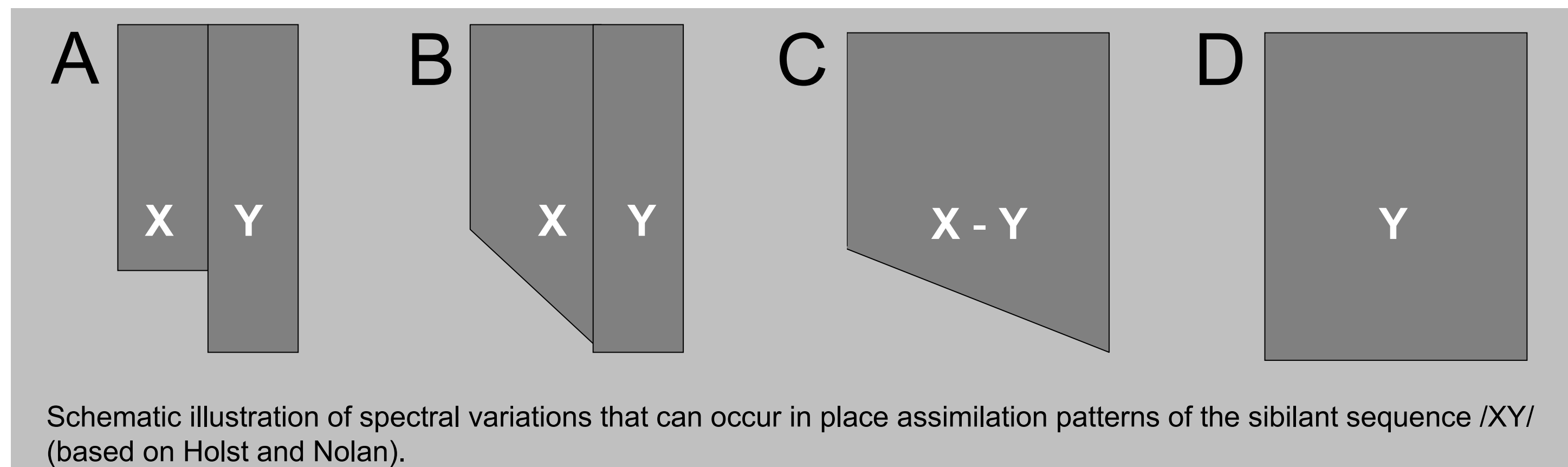


1. Research background

• **English:** Several studies on British and American English found evidence for assimilation of place of articulation in sibilant sequences from articulatory, acoustic, and perceptual points of view. Like in adjacent consonants in general, this assimilation is **regressive and gradual in the time and the frequency domain**

⇔ However, it shows considerable variation across **speakers, word classes and frequencies**, as well as across **speaking styles and rates**.



• **French:** Literature on assimilation either concentrates on voice features or claims explicitly that **place assimilation does not exist**.

⇔ Carton reports that place assimilation can occur regressively in sibilant sequences, if the latter result from a simultaneous /ə/ deletion. Thus, it is restricted to certain variants of French. E.g., “quinze juin” (‘June 15th’) ⇒ [kɛ̃z : ɥɛ̃], i.e. /zəz/ to [z:]

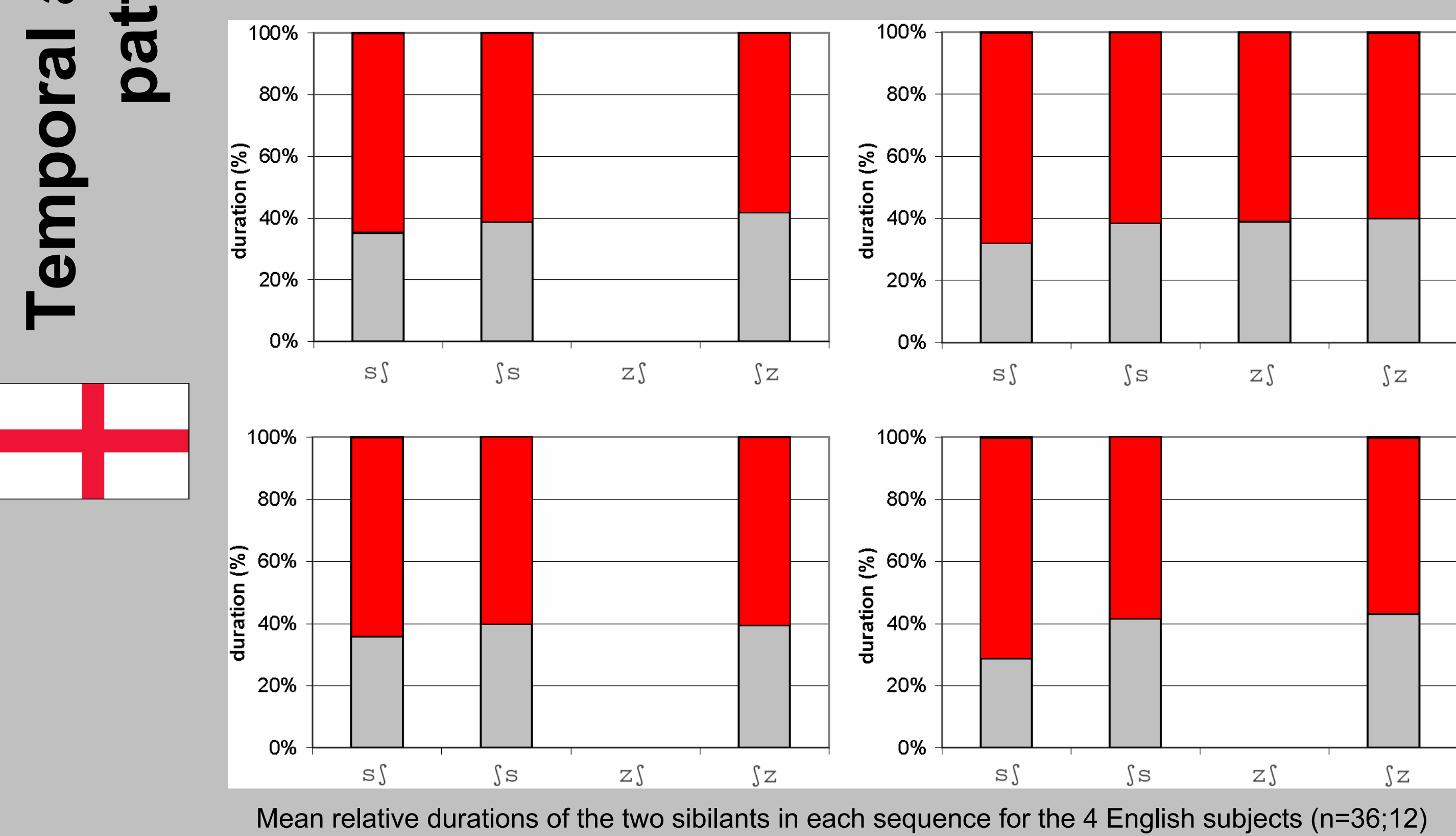
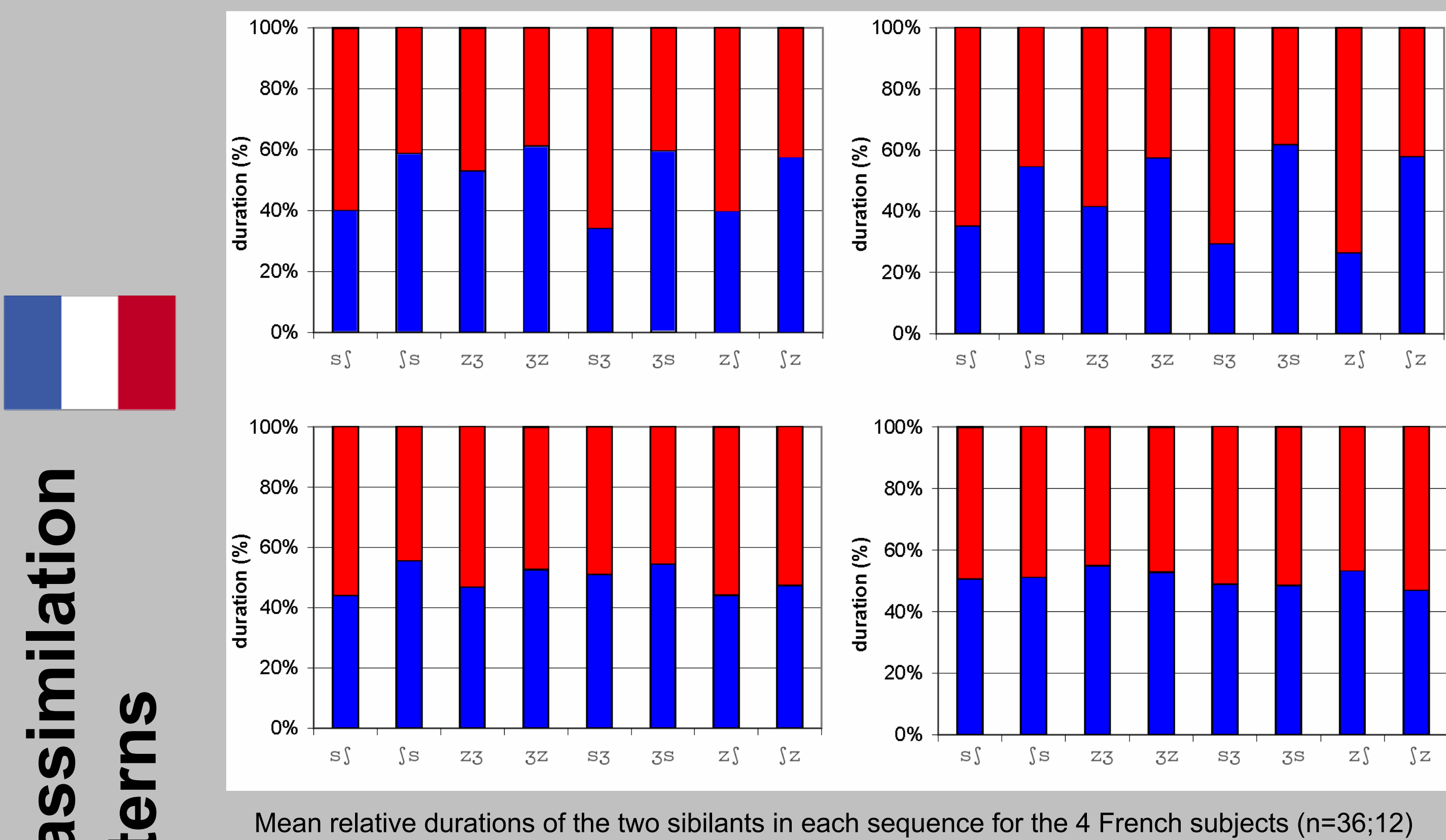
⇔ „je suis“ and „je sais“ can become [ʃɥi] or [ʃɛ]. Here again, place assimilation is bound to /ə/ deletion. But contrary to Carton's descriptions, this is a very frequent, widespread, and progressive process; sometimes even represented in informal, written French.

⇒ Are these exceptions (fixed expressions and/or high-frequency function words) ??

So, what is the status of place assimilation in French? We present the **first systematic investigation** of this question, focussing on sibilant sequences, since (1) ...they have already been dealt with in the French literature, (2) ...we have possibility to compare our findings with existing ones for English.

Simultaneously, we aim at **gaining further insights into place assimilation in (British) English sibilant sequences**, by including postalveolar-alveolar sequences, by considering time+frequency, the latter with comprehensive CoG measurements.

3. Results and Discussion



• **Main findings for French**

- ⇒ (a) Boundary between the sibilants is shifted in favour of the postalveolar section.
- ⇒ (b) CoG values in both kinds of sequences, postalveolar-alveolar and alveolar-postalveolar, are more similar to the ones of the postalveolar reference sounds.
- ⇒ That is, ‘postalveolar’ is dominating the productions of both kinds of sequences.
- ⇒ However, alveolar-postalveolar sequences yield lower mean CoGs than postalveolar-alveolar ones; and in almost all cases the CoG ranges of the sequences are larger than the ones of the single reference sibilants. Finally, the effects are clearly speaker-specific. For example, (a) and (b) were almost exclusively observed for 2 speakers. One speaker does not show any temporal and spectral differences between alveolar-postalveolar and postalveolar-alveolar.

• **Interpretation**

- Basically, **French does show place assimilation** (within sibilant sequences).
- It occurs without simultaneous /ə/ deletion and beyond fixed, high-frequency expressions like „je sais“ and „je suis“.
- It is **feature-determined**, not direction-determined. The **target is ‘postalveolar’**. Consequently, it is **regressive** in alveolar-postalveolar and **progressive** in postalveolar-alveolar sequences.
- Although there are cases of complete spectral assimilation (= D, cf. above), most of the sequences are produced spectrally as B or C.
- Regressive assimilation is more pronounced than the progressive one (e.g., higher number of spectral D patterns)

2. Method

• Two speech corpora recorded in parallel ways for French and English.

• **Test sentences (48 French, 24 English)**

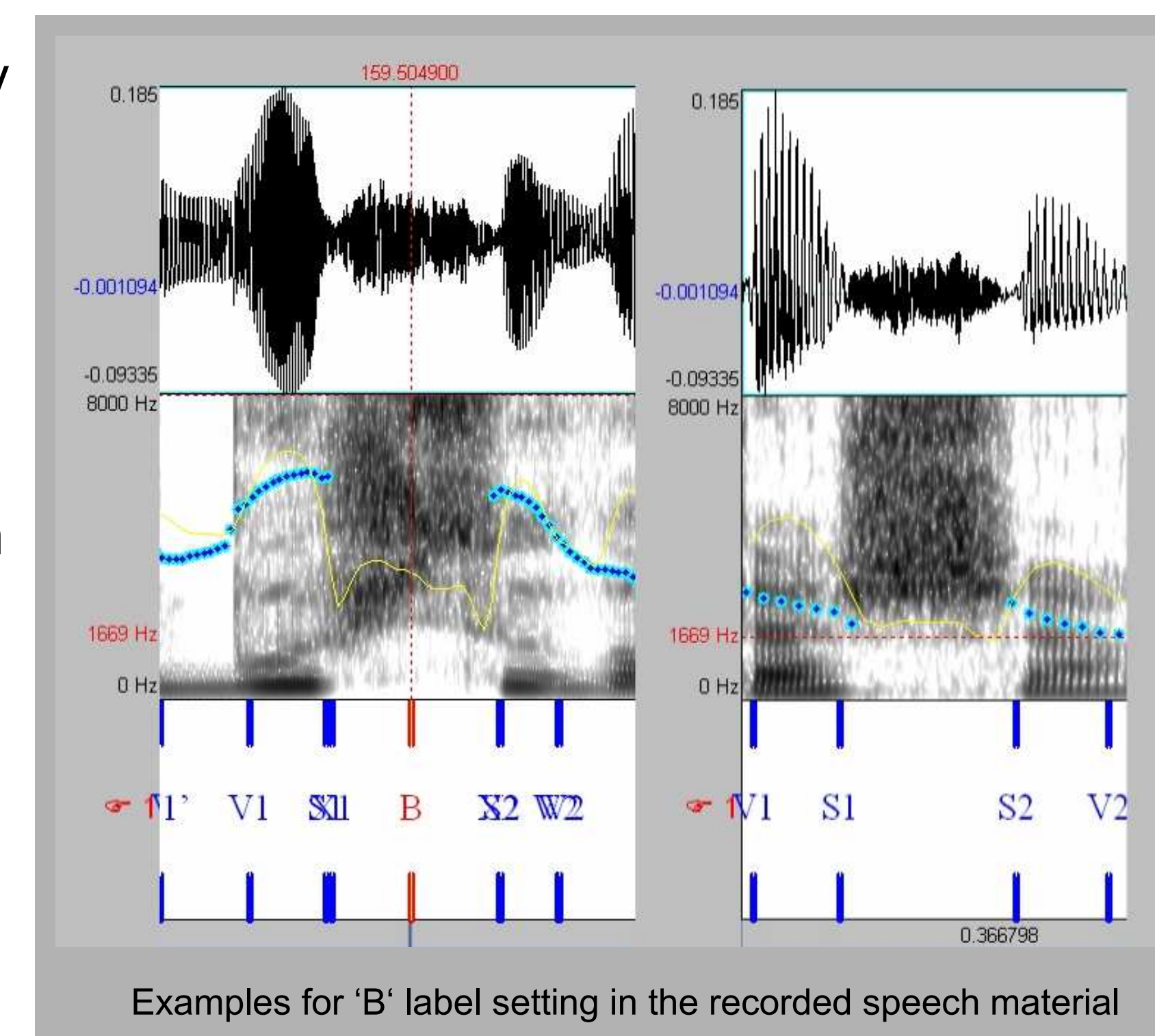
- ⇒ Pairs of sibilants embedded into short sentence frames; first sibilant placed at the end of target word A, second sibilant placed at the beginning of target word B.
- ⇒ The target words A+B additionally created symmetric and asymmetric vowel environments. French set: /a/, /i/, /u/. English set: /a/ or /ʌ/, /i/ or /ɪ/, /u/ or /ʊ/.
- ⇒ Target words differed in frequency and (lexical) stress position; and they are separated by different syntactic boundaries; mostly, however, single noun phrases (i.e. adjective+noun or noun+adjective).
- ⇒ The 8 French sibilant sequences include /sʃ/, /ʃs/, /zʒ/, /ʒz/, /sʒ/, /ʒs/, /ʃz/, /zʃ/, i.e. complete cross combination of ‘voice/voiceless’ and ‘alveolar/postalveolar’.
- ⇒ The 4 English sibilant sequences include /sʃ/, /ʃs/, /ʒz/, and /zʃ/.

• **Complementary sentences (24 French, 18 English)**

- ⇒ Each of the French and English sibilants (8 or 4) combined across word boundaries with a labial consonant in both possible orders, i.e. __C and C__.
- ⇒ The same vowel environments as in the test sentences.
- ⇒ These single sibilants serve as – temporal and spectral – reference sounds.
- The 72 or 42 sentences were read by **4 female subjects** for each language.
- None of the speakers showed a particular dialectal colouring (judged by other native speakers). French subjects were selected not to produce word-final Schwas.
- After a short instruction and 10 preceding training sentences, each subject read the sentences in **4 differently randomized orders**. A complete session took 30-40 min.
- A short interview at the end of each session showed that **none of the subjects exactly guessed the actual aim of the recording**.

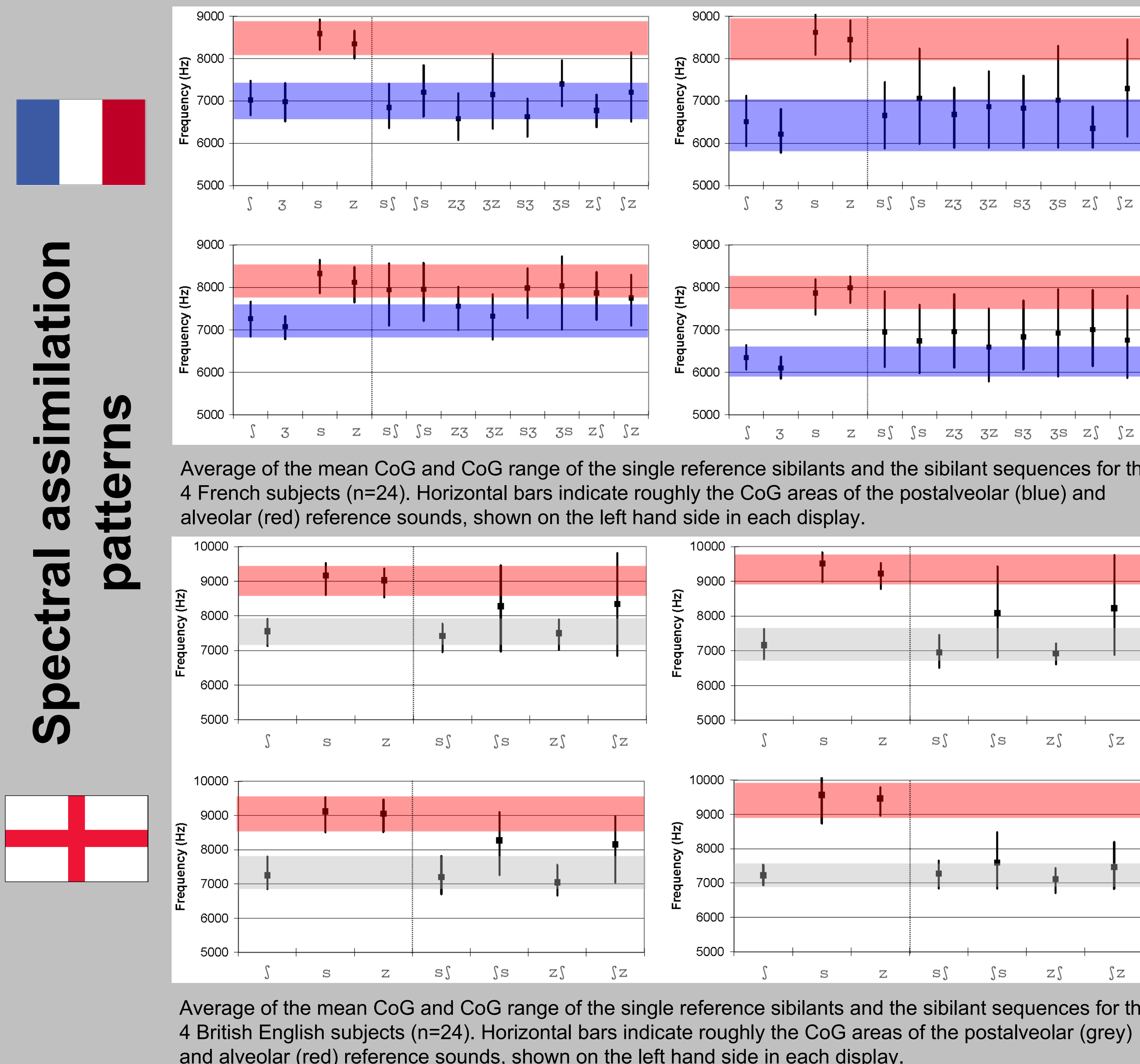
• **Measurements:**

- ⇒ **Temporal domain:** assimilation = the relative durations of sibilants in the sequence. ‘B’ label = boundary between sibilants. Based on spectral discontinuity that is also reflected in perception. For A+B cases not C+D. (see schematic examples above).
- ⇒ **Frequency domain** = centre of gravity (CoG) measurements. For each single sibilant or sequence **mean CoG** and **CoG range** between 1.5 and 15kHz (frequency resolution 50Hz)



• **Statistical analyses:**

- ⇒ Mixed-model, linear regression applied to time and frequency measurements separately.



• **Main findings for English:**

- ⇒ (a) Boundary between the sibilants is shifted in favour of the second section, irrespective of whether it is alveolar or postalveolar.
- ⇒ (b) CoG means and ranges in alveolar-postalveolar sequences are comparable with the ones of the postalveolar reference sounds. ⇔ CoG ranges of postalveolar-alveolar sequences are larger and the means are in between the ones of the alveolar and postalveolar references.
- ⇒ The temporal and spectral patterns are similar across all four speakers.

• **Interpretation:**

- Like French, (British) **English was found to show place assimilation** (within sibilant sequences)
- It was found to be **solely regressive** and restricted to alveolar-postalveolar.
- It is **not only feature-determined, but also direction-determined**.
- Like in French, the target feature of the assimilation is **‘postalveolar’**.
- The observed assimilations are **stronger than the French ones**: (a) the majority of assimilations is spectrally complete, i.e. D. There are just a few B and C cases; (b) the productions of the four speakers are more consistent.
- The findings for English are largely in line with the ones of previous studies.