The syllable frequency effect before and after speaking

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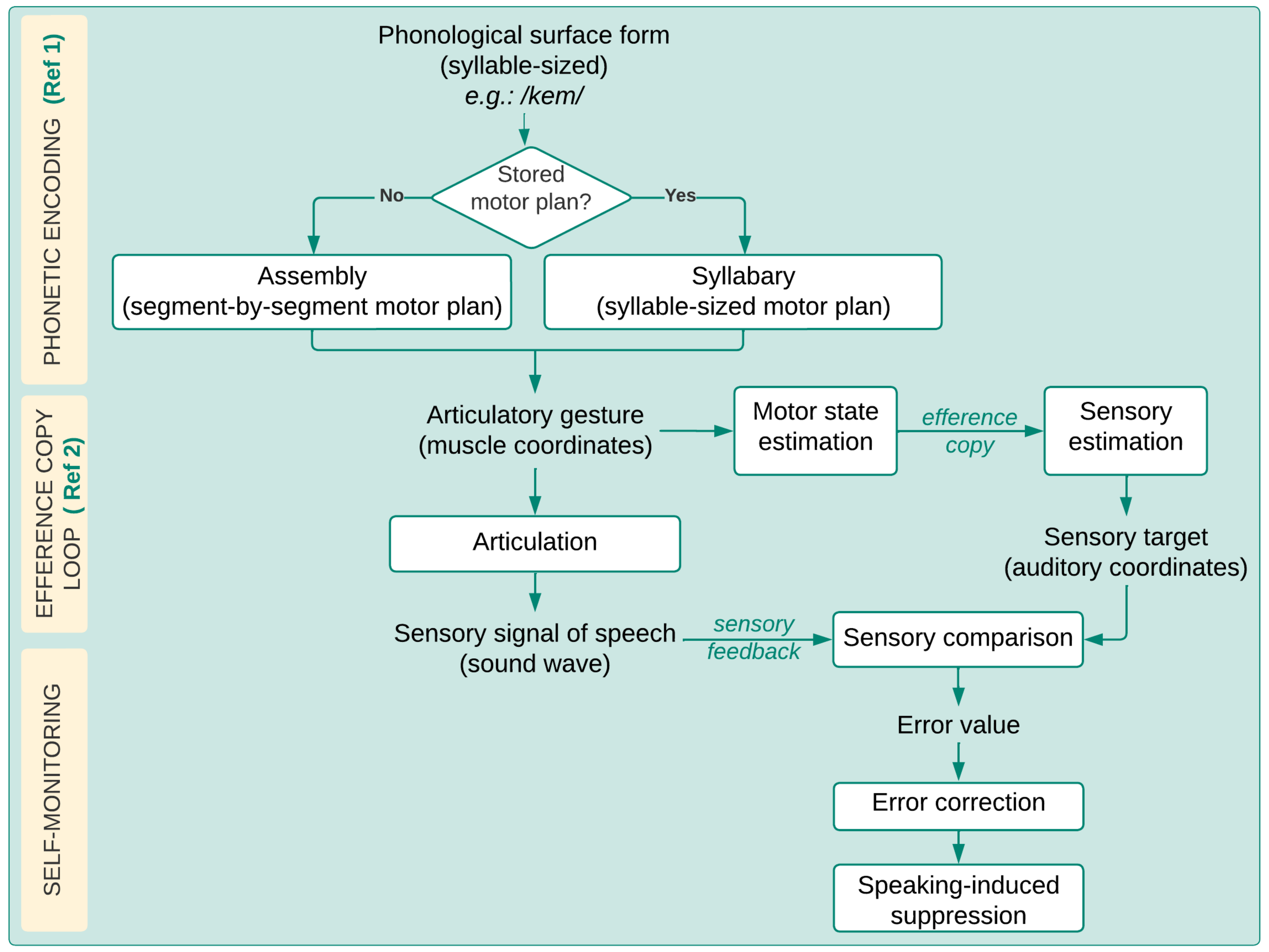
Is speech monitoring sensitive to the frequency of syllable-sized representations?

Speaking requires translating a concept that we wish to express into a sequence of sounds. In addition, speakers monitor their planned speech output. Self-monitoring is supported by sensorimotor predictions sent motor planning regions, which are then compared to actual feedback in sensory cortices during articulation. The detection of deviant speech sounds can then translate into corrective action and allow for online control. Here, we investigate the role of syllable-sized representations during the late stages of speech planning (namely, phonetic encoding), speech acoustics, and speaking-induced suppression.

1. What do we know?



2. Material

30 Dutch CVC syllables matched for onset phoneme and phonemic content: 5 quartets devised by Cholin and colleagues [3, 4] (10 high-frequency and 10 low-frequency syllables), and 10 mid-frequency filler items.

Example of a syllable quartet and filler items:

High-frequency			Low-frequency			Filler items		
Orth.	*IPA*	*Freq.*	*Orth.*	*IPA*	*Freq.*	*Orth.*	*IPA*	*Freq.*
kem	[kɛm]	162.6	kes	[kɛs]	0.1	kep	[kɛp]	31.55
wes	[ʋɛs]	62.64	wem	[ʋɛm]	3.1	wig	[ʋɪx]	29.59

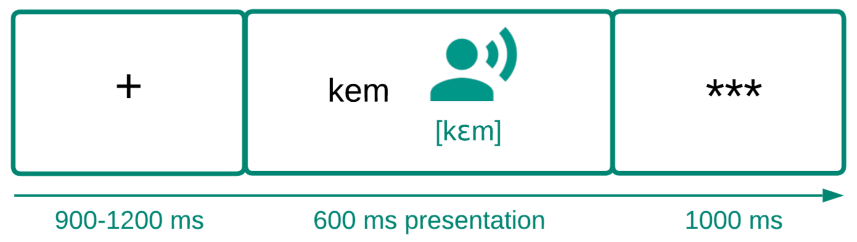
Syllable frequency counts obtained from the CELEX database.

3. Measures and predictions

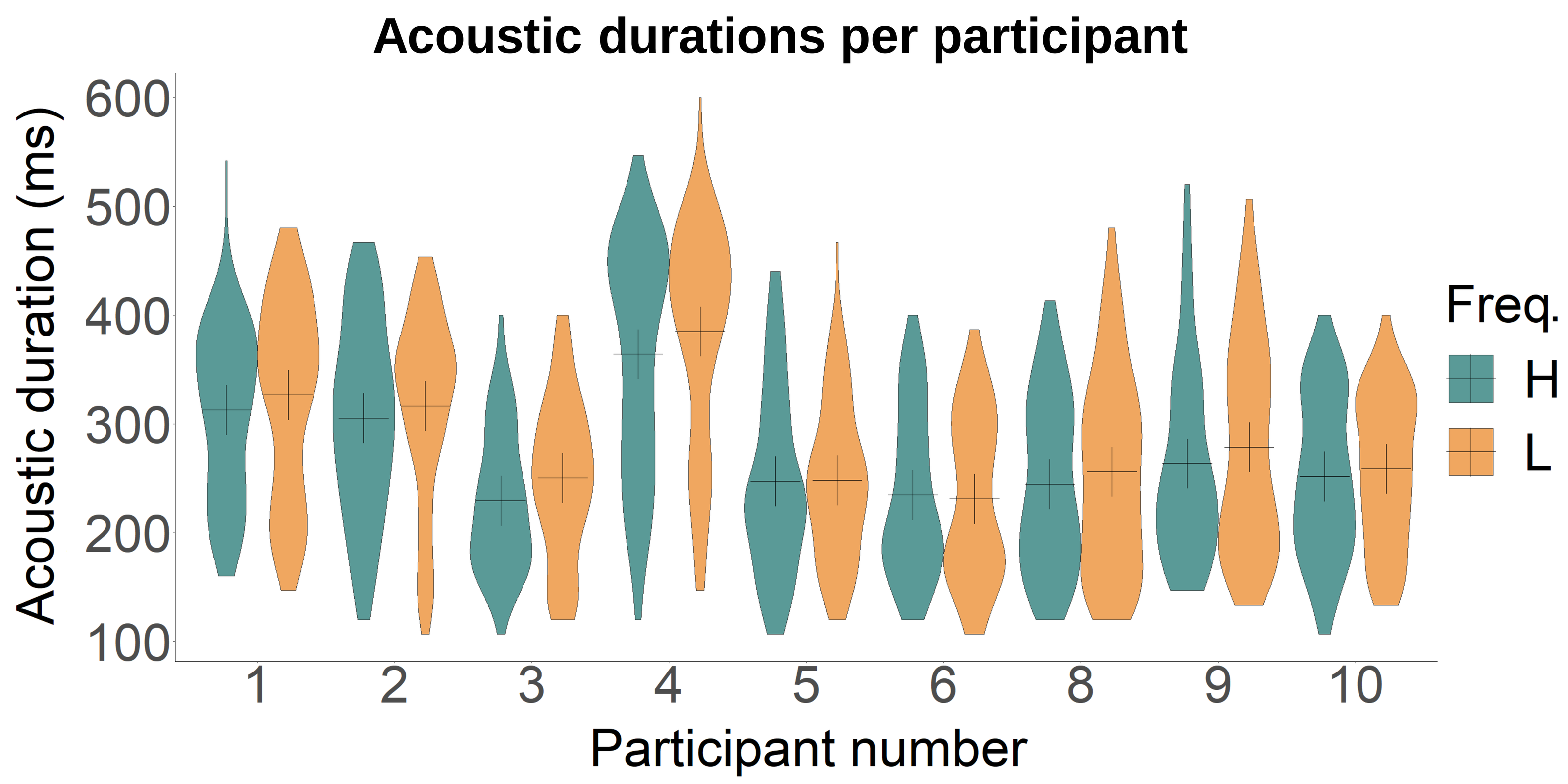
Time-window	Analysis	Prediction
Planning	Standard waveform	H ≠ L [5]
Speech onset	Reaction time *immediate*	H < L [3]
	delayed	L ≤ H [6]
Articulation	Acoustic duration	H < L [6]
Self-monitoring	Speaking-induced suppression [7] (N1/P2 component)	H < L

H = high-frequency; L = low-frequency

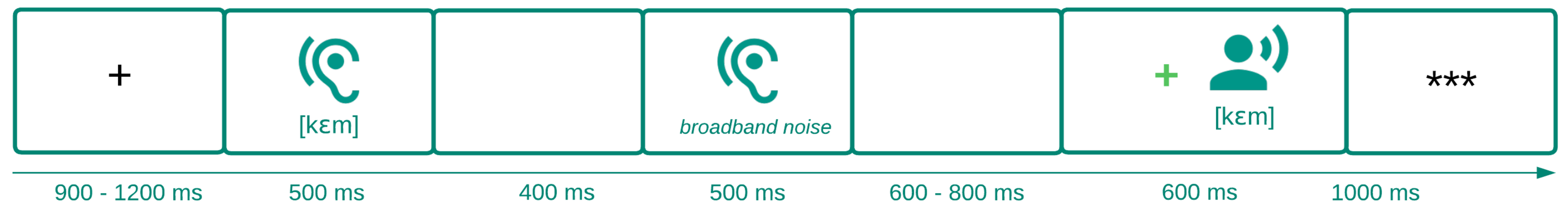
4. Behavioural Experiment (ongoing):
Immediate reading of monosyllabic pseudowords



Intermediate findings (n = 10, mean age = 24.5 years):
- No effect of syllable frequency on reaction time.
- Longer acoustic durations for low-frequency syllables (β = 10.98, SE = 3.96, t = 2.78), with participants as random factor.



5. EEG Experiments (ongoing):
Delayed repetition of monosyllabic pseudowords



Within-participant spatial filtering pipeline

Auditory response to stimuli (sensor average)
↓
Dipole fitting (source space)
↓
Functional ROI (cortical template)
↓
Analyse ROI for speaking-induced suppression

Behavioural (n = 10) and EEG (n = 5) pilot data show feasibility of experiment. If borne out, it would suggest that articulatory processes may be affected by syllable frequency.

The production of low-frequency syllables, putatively less automatised, is predicted to require closer monitoring and therefore less speaking-induced suppression, as reflected in attenuated N1/P2 amplitudes.

1 Levelt, Roelofs & Meyer, 1999 2 Tian & Poeppel, 2010 3 Cholin, Levelt & Schiller, 2006 4 Cholin & Levelt, 2009
5 Burki, Cheneval, Laganaro, 2015 6 Jouen, Fougeron & Laganaro, 2023 7 Niziolek, Nagarajan & Houde

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