Post-lexical /s, z/-retraction in Manchester English

An ultrasound-tongue-imaging and lip-camera study

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Introduction

- /s/-retraction is a widely-studied process in English sociolinguistics
  - a process that turns **/s/** into a more **[ʃ]**-like sound (e.g. [ʃ]*treet*)
  - sound change in progress in many varieties of English

b. 1932 → b. 1997

Motivation for this study

- /s/-retraction has been extensively researched, especially in recent years
- But these studies often focused on a relatively limited set of environments
- The envelope of variation is potentially much wider than this!

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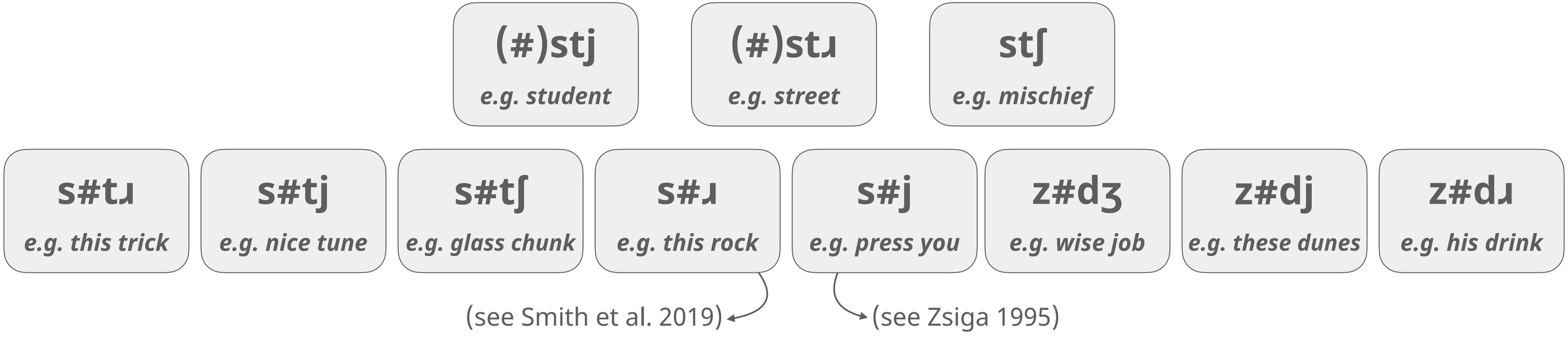


The articulatory phonetic angle

The sociolinguistic angle

The articulatory phonetic angle

The sociolinguistic angle

The articulatory phonetic angle

Retraction is a commonly used label to capture this process but in reality this masks a great deal of variation and complexity in articulatory mechanisms

“If /s/ is moving toward [ʃ], it is important to fully explicate the phonetic changes that would be involved. It is proposed that they involve at least three phonetic parameters [...]
TONGUE PLACEMENT [...] **TONGUE SHAPE** [...] **LIP SHAPE**”

— Rutter (2011: 31)

The articulatory phonetic angle

Retraction is a commonly used label to capture this process but in reality this masks a great deal of variation and complexity in articulatory mechanisms

"It is also worth noting that changes in one of the phonetic parameters discussed above **may not necessarily co-occur** with changes in the other two. This is particularly true of the parameter **LIP-ROUNDING**, whose variance is likely to be quite independent from the activities of the **TONGUE**"

— Rutter (2011: 31)

The articulatory phonetic angle

The sociolinguistic angle

The sociolinguistic angle

Rapid and widespread change, occurring seemingly independently in a range of world Englishes and nearing completion in some varieties

- Despite extensive sociolinguistic study (e.g. Durian 2007; Gylfadottir 2015), there remain unresolved questions regarding:
  - the potential phonetic precursors of change (Janda & Joseph 2001; Stevens & Harrington 2016)
  - the triggering mechanisms (Shapiro 1995; Lawrence 2000; Baker et al. 2011; Bailey et al. 2022)

Research questions

1. What are the relative roles of the different articulatory gestures and their relationship with the acoustic output?
    a. to what extent do we find inter-speaker variation?
    b. do the gestures change at different rates over the course of this change?
2. How does the change behave in these different prosodic/phonological environments?
3. Is there any phonetic uniformity in how the natural class of sibilants behave in these retracting environments?

Methods

Data collection

- Simultaneous:

ultrasound tongue imaging of the midsagittal plane

+

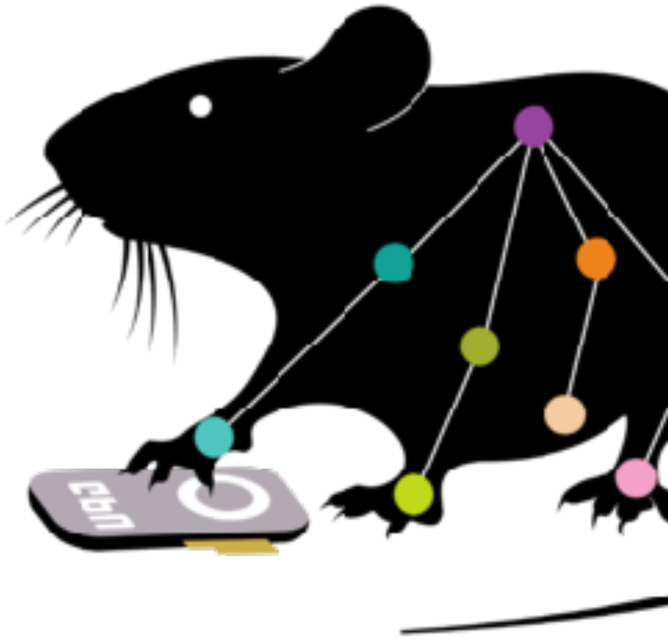
side-profile **lip camera recording**

+

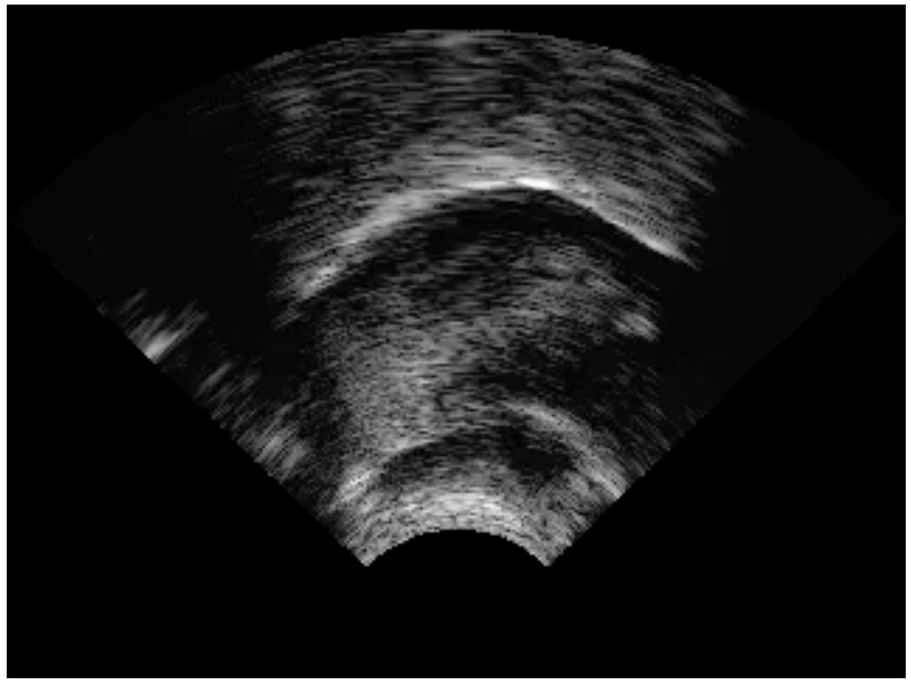
audio recording

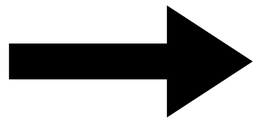
Methods

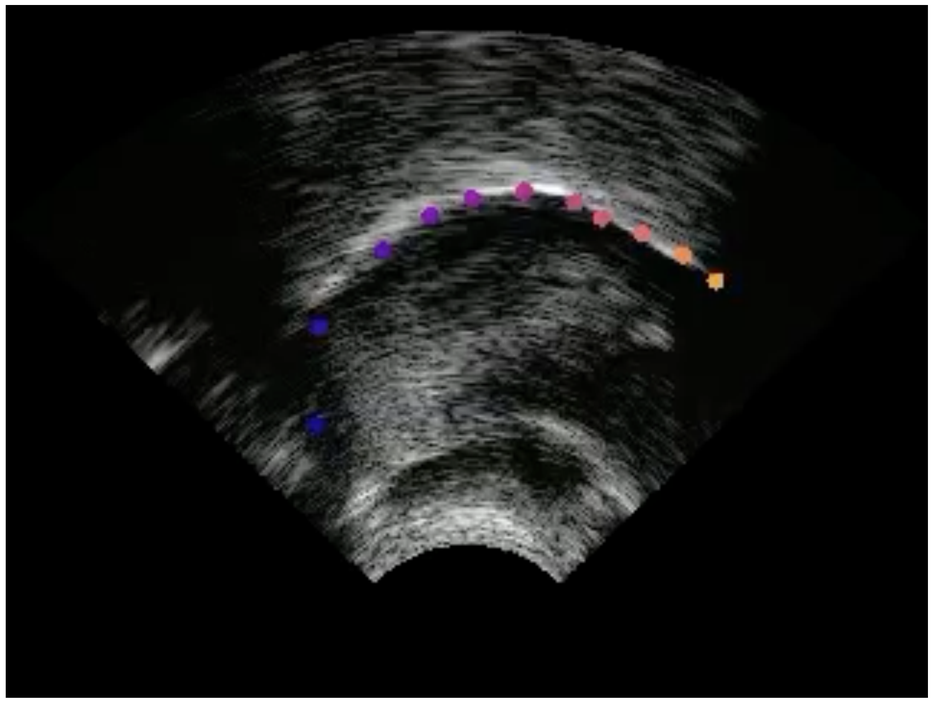
Data processing



- **DeepLabCut** - new method of processing ultrasound recordings using machine learning and markerless pose estimation (Wrench & Balch-Tomes 2022)





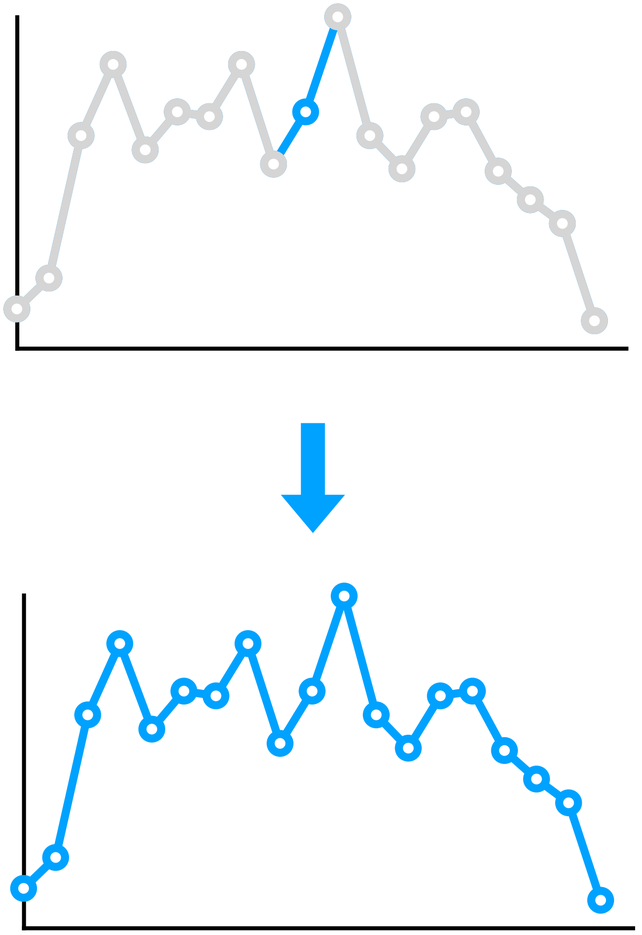


Methods

Data processing

Dynamic analysis across the sibilant duration rather than focusing on the more commonly analysed midpoint

- distinguish between gradient phonetic effects vs. categorical/phonological implementation



Methods

Stimuli design

			/s/	/stɹ/	/stj/	/ʃ/
I said…	th/ə/	/uː/	soup	stroop test	student	chute
		/iː/	seat	street	—	sheet
		/ɒ/	sock	strop	—	shot

Methods

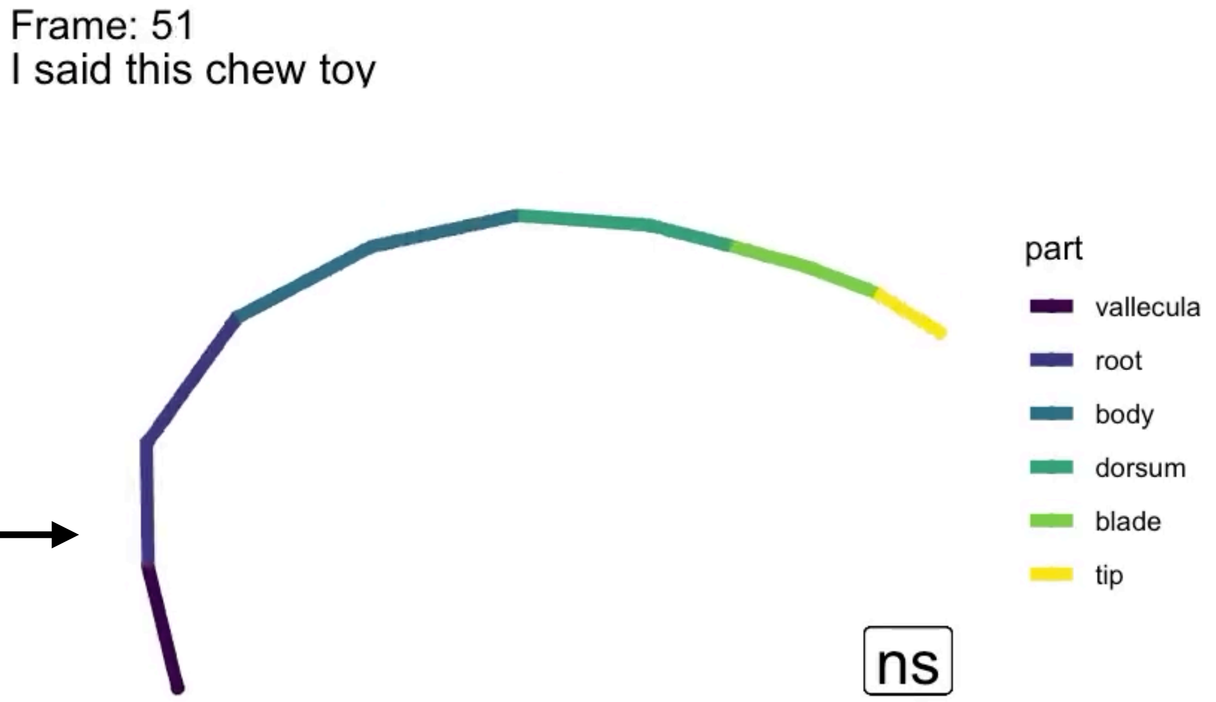
Stimuli design

I said...

		/ʃ, ʒ/	/tʃ, dʒ/	/tɹ, dɹ/	/tj, dj/	/ɹ/	/j/
thi/s/	/uː/	shoe	chew toy	trooper	tube	room	youth
	/iː/	sheep	cheese	tree	—	reed	yeast / year
	/ɒ/	shop	chopper	trolley	—	rock	yacht
the/z/e	/uː/	—	jewels	druids	dunes		
	/iː/	gilets	jeeps	dreams	—		
	/ɒ/	genres	jobs	drops	—		

Preliminary results

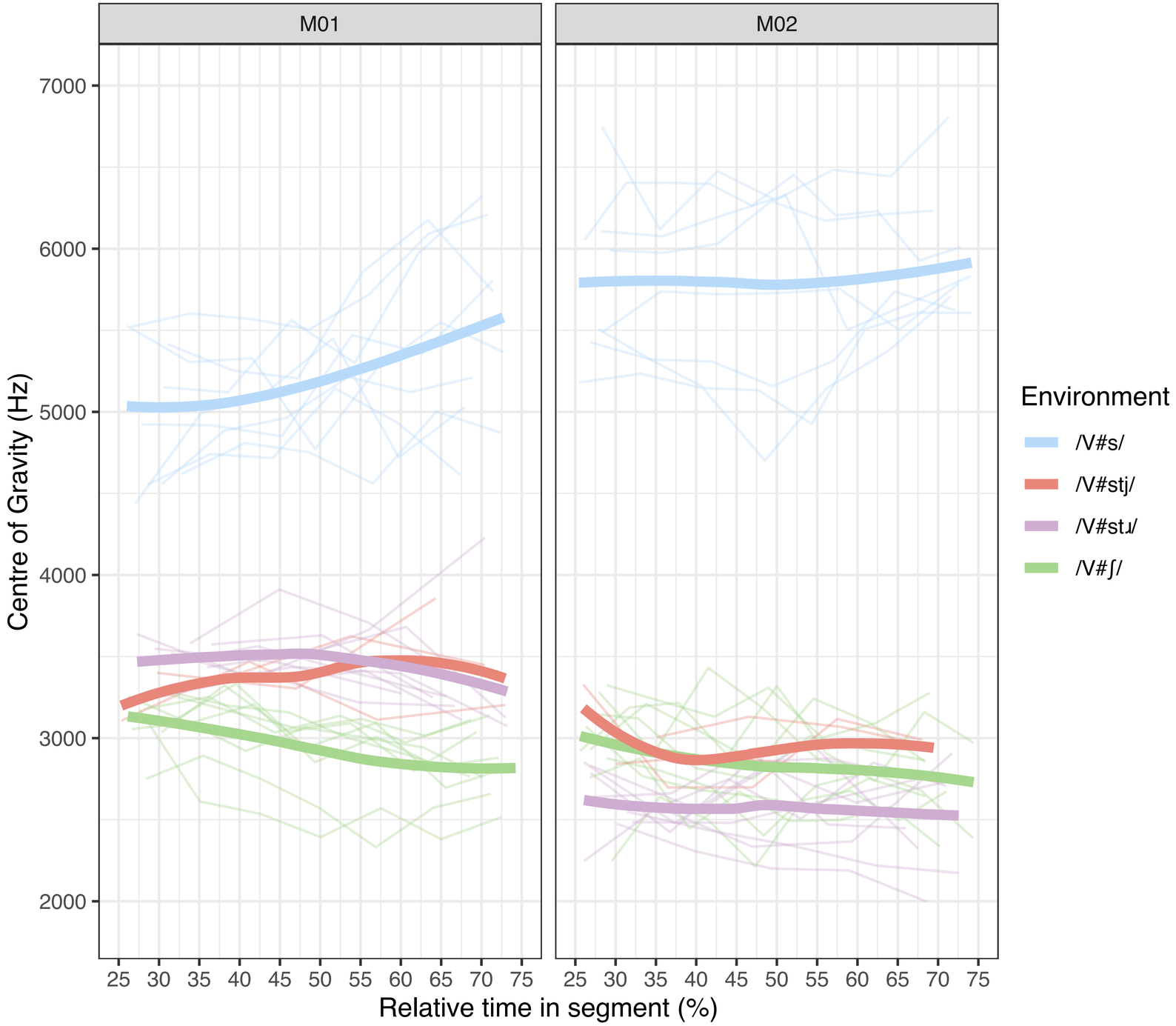
- Pilot data for two speakers:
  - both 30-year-old males from Greater Manchester
- Three weeks ago: *cool animated plots* 😎
- As of about 17 hours ago: some actual (preliminary) results!



Acoustic results

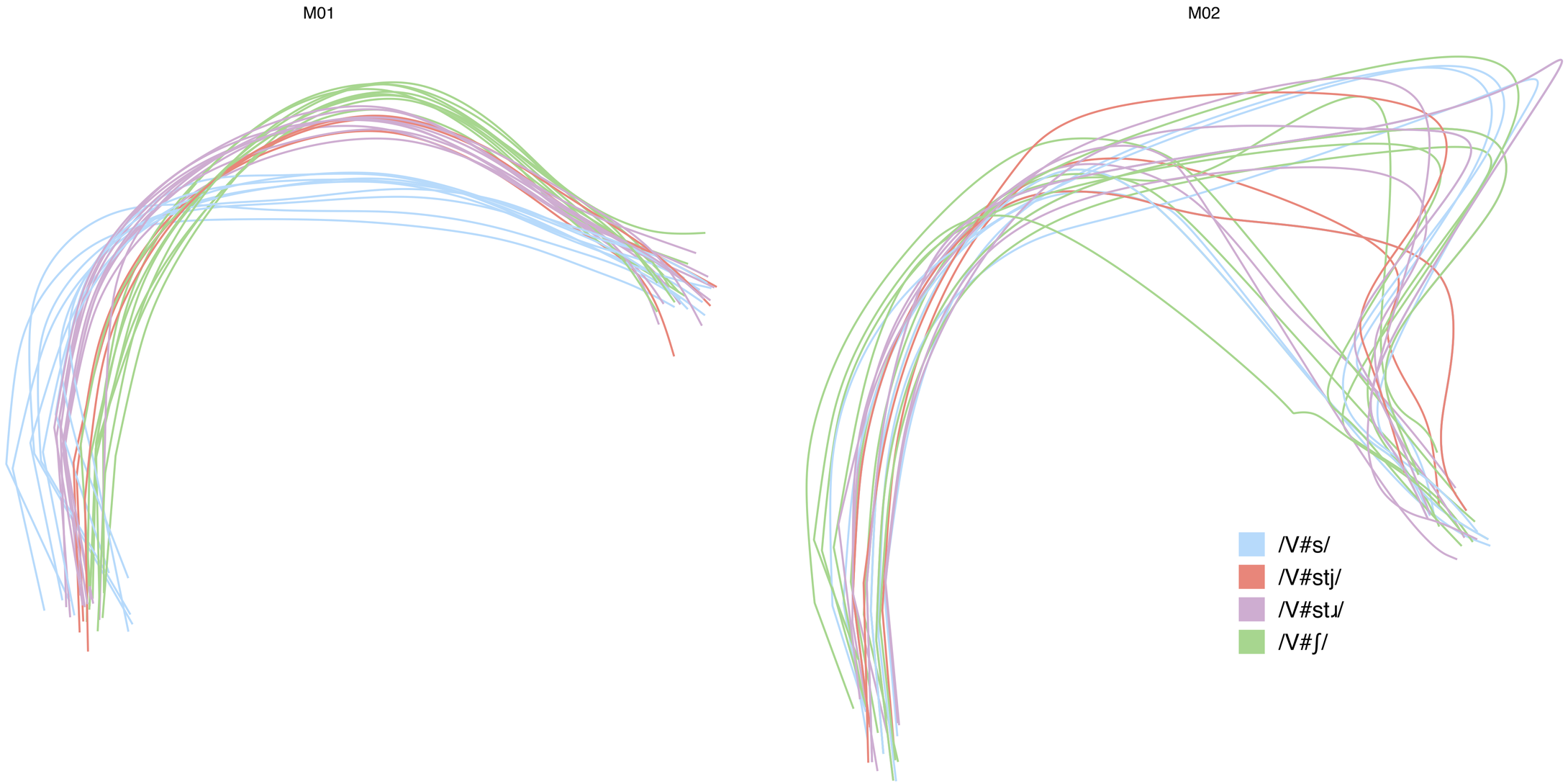
Word-initial /s/ contexts

- Both speakers show clear acoustic retraction in terms of CoG
- Clustering of **/stɹ/** and **/stj/** for both speakers
- Quite stable across the segment durations



Articulatory results

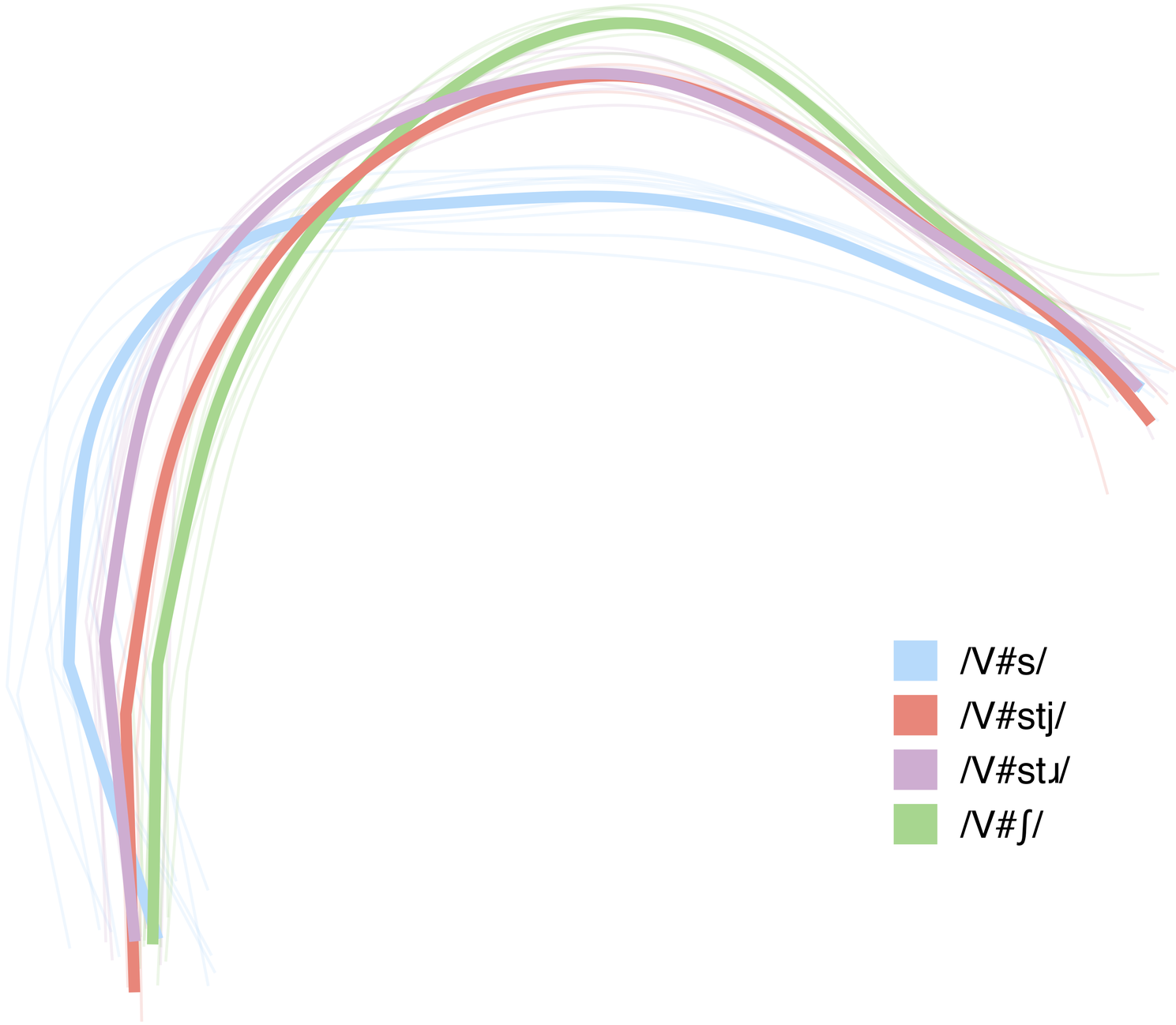
Word-initial /s/ contexts



Articulatory results

Word-initial /s/ contexts

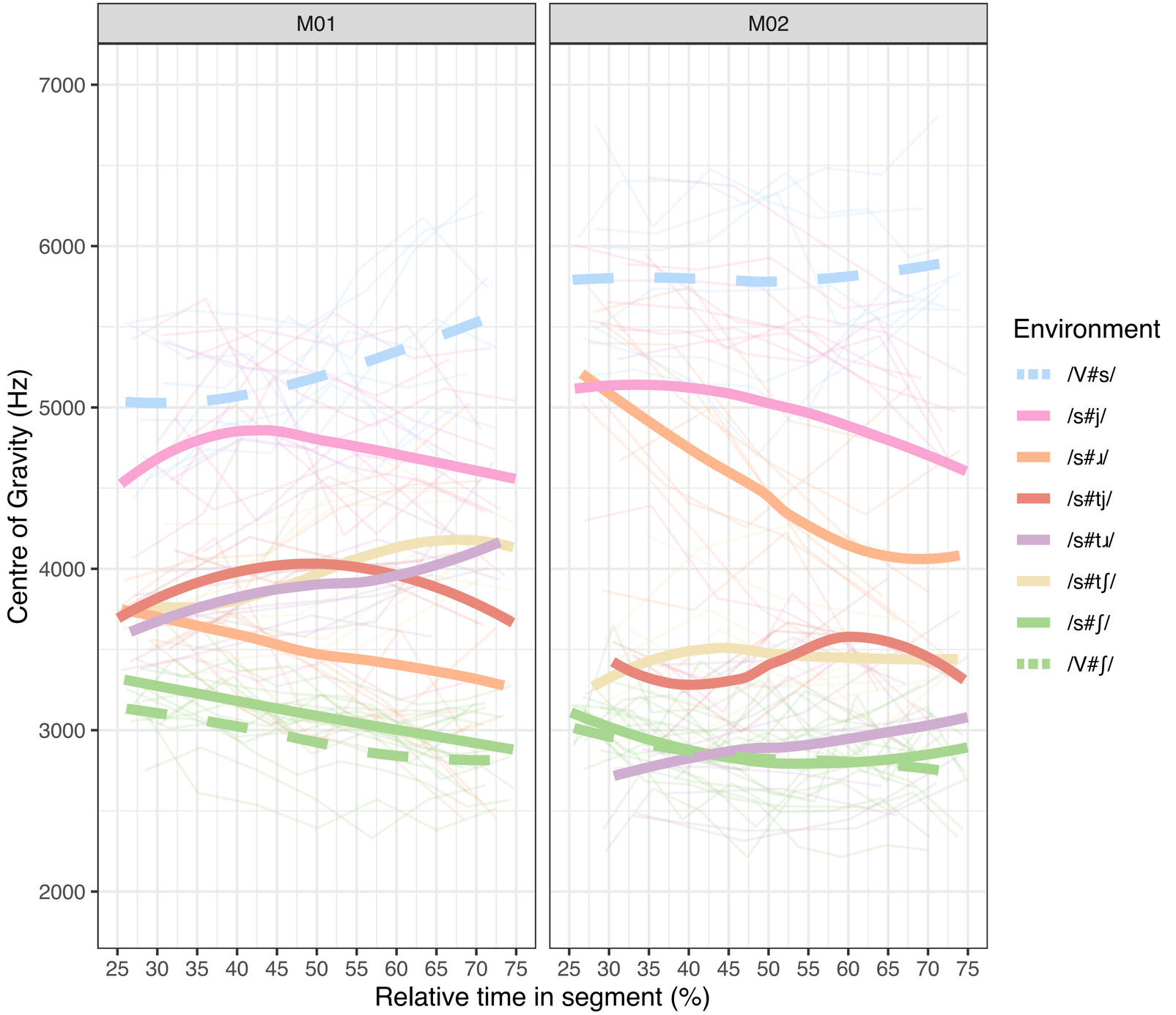
- Similar pattern in lingual articulation, reflecting acoustics
- **/stɹ/** and **/stj/** close to **/ʃ/** in the tongue body, though somewhat more intermediate in root



Acoustic results

Post-lexical /s/ contexts

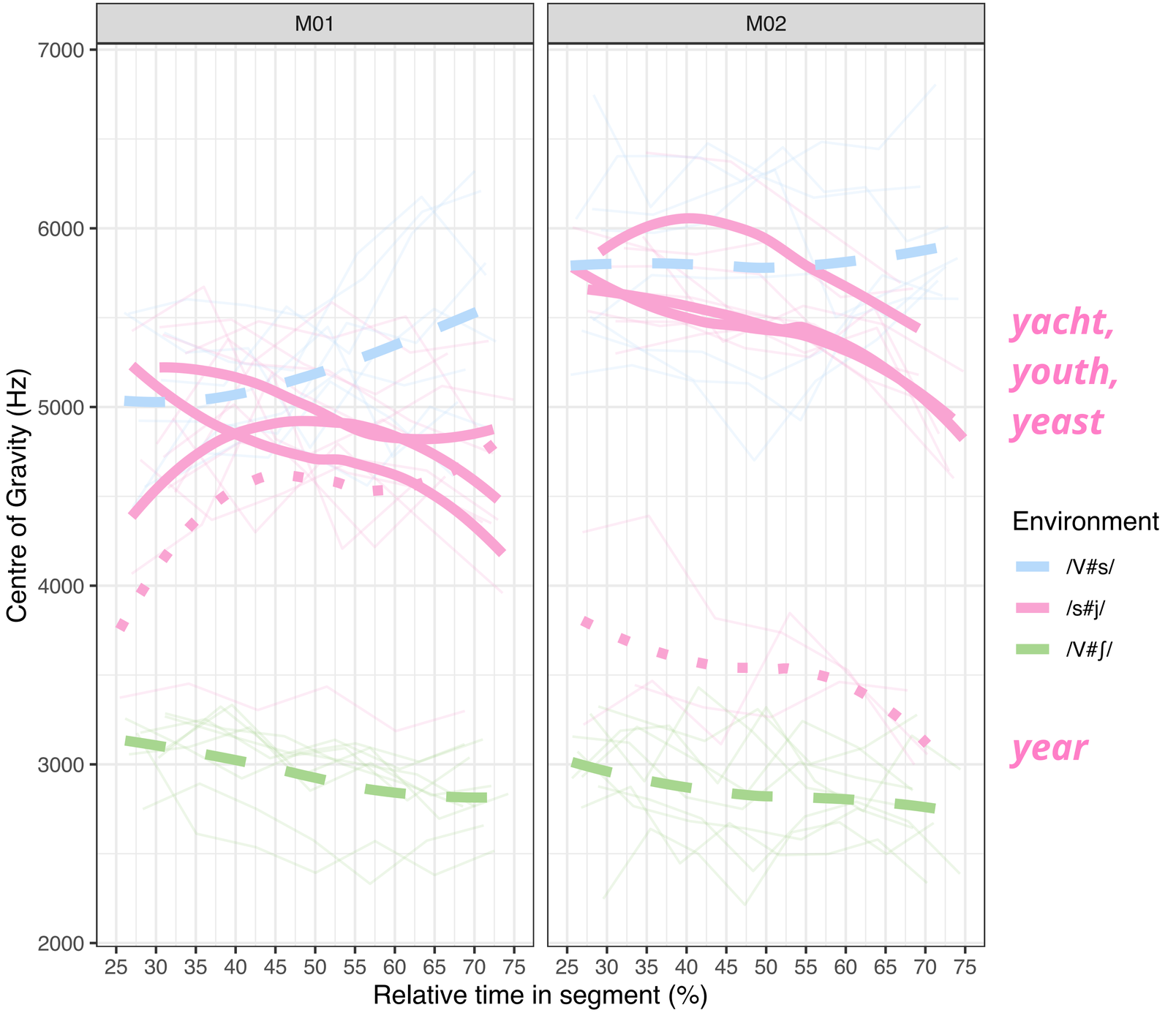
- Retraction less advanced before /tɹ/ and /tj/ when a word boundary intervenes
- Word-initial /tʃ/ has the exact same effect as the other affricating contexts
- Highest degree of inter-speaker variation found in /s#ɹ/



Acoustic results

Post-lexical /s/ contexts

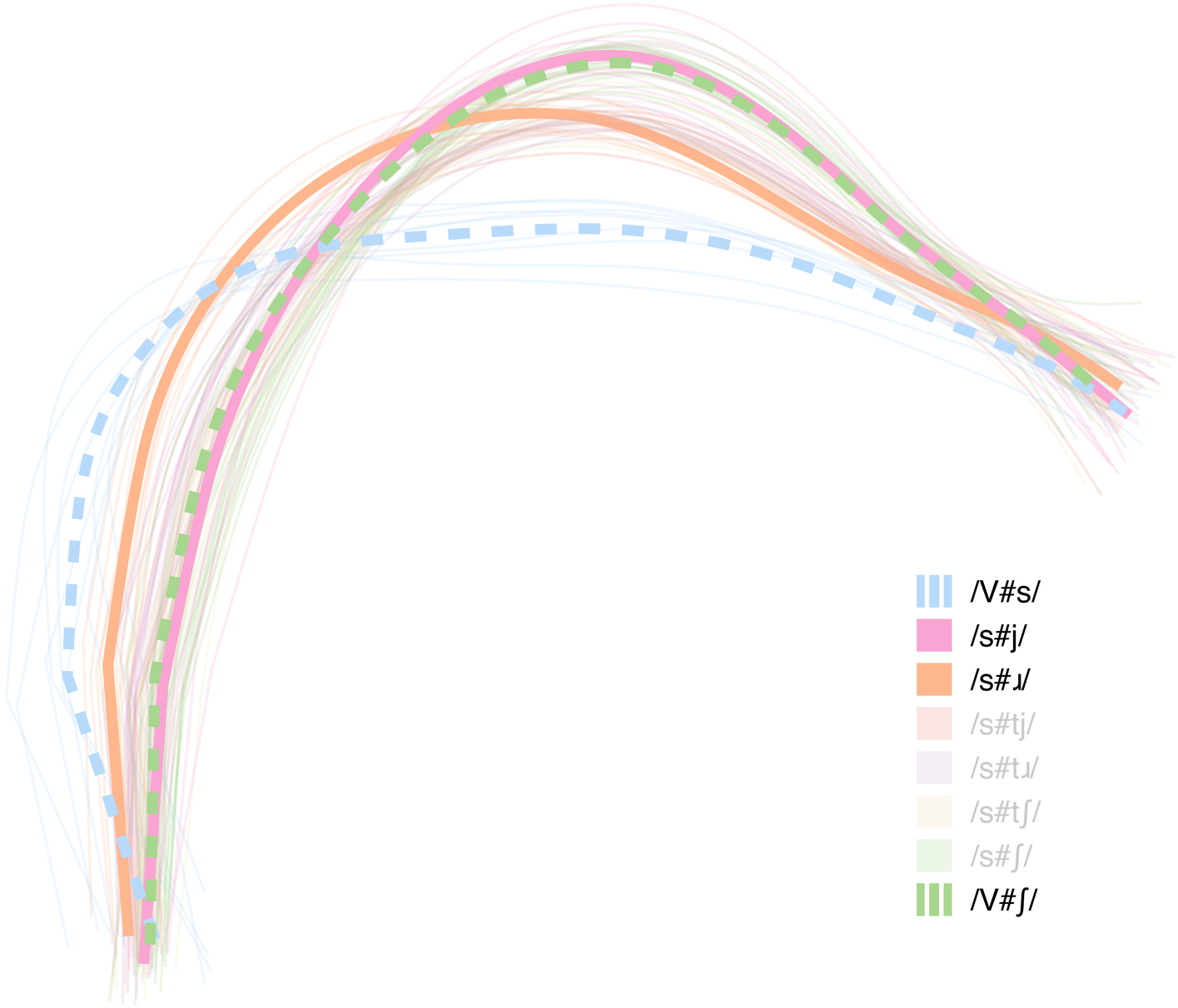
- Evidence of lexically-specific behaviour in **/s#j/**
- Hardly any retraction before words like *yacht, youth, yeast*
- But much more advanced in high-frequency collocation *this year* for M02



Articulatory results

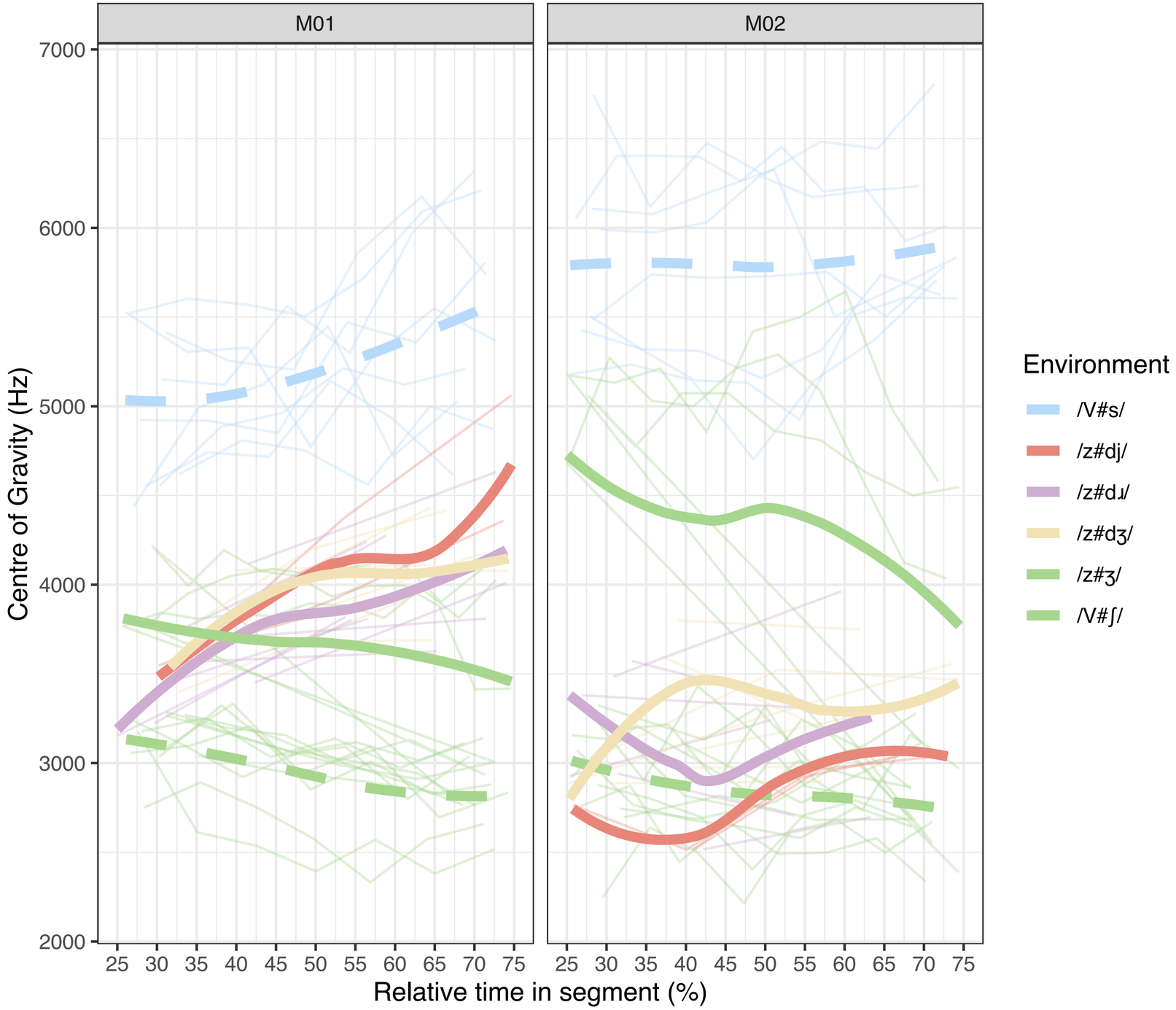
Post-lexical /s/ contexts

- Two key results that jump out:
  - /s#j/ quite /s/-like acoustically but here follows the tongue shape of /ʃ/
  - /s#ɹ/ quite /ʃ/-like acoustically but here closer to the tongue shape of /s/, at least in tongue root



Acoustic results

Post-lexical /z/ contexts



Theoretical significance

Contributing to our understanding of:

- post-lexical vs word-level behaviour in **pathways of sound change** (e.g. Bermúdez-Otero 2015 on the LIFE CYCLE OF PHONOLOGICAL PROCESSES)
  - see Zsiga (1995) on categorical retraction in word-internal *pressure* but gradient in *press you*
- competing accounts over the **triggering mechanisms** behind /s/-retraction
  - non-local assimilation to /ɹ/? (Shapiro 1995; Baker et al. 2011)
  - local assimilation to following /t/-affrication? (Lawrence 2000; Bailey et al. 2022)
- the role of **generalisation** in the spread of a sound change and its targeted environments
  - comparing retraction of /s/ and /z/, which have different positional distributions
  - see also Chodroff & Wilson (2022) on phonetic uniformity in sibilant production

Thanks!

Questions for you!

Email us!

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data collection/ analysis

camera orientation: lip rounding vs protrusion?

other **methods** of analysing acoustics/articulation?

any **additional environments** to include?

expanding from just DET+N constructions? (e.g. varying **prosodic boundaries** between /s/ and trigger)

stimuli design

theoretical significance

any other **connections to literature** that we've overlooked?

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