

# Prosodic variability in marking remote past in African American English

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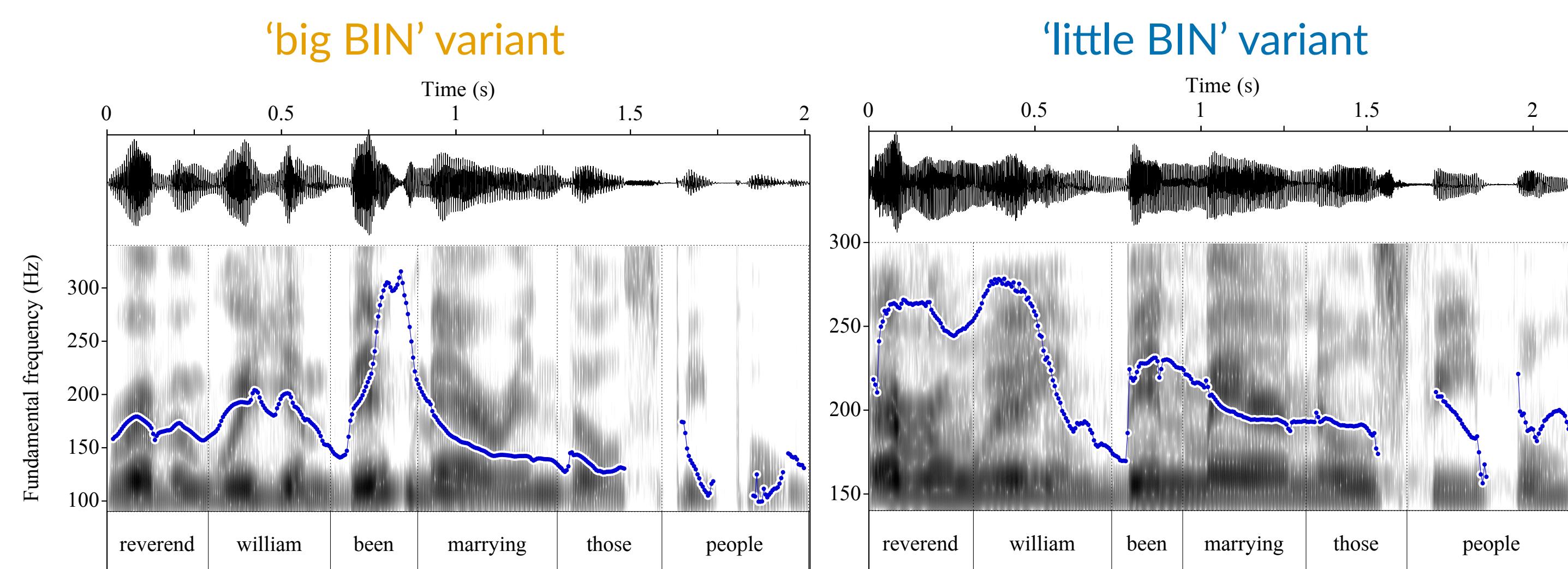
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## Intro: Remote Past BIN in African American English

- Remote past BIN ('stressed BIN'): African American English (AAE) aspectual marker for events that started in distant past and continue into present [1,2]
- Past work (including Green et al. (2022) [3]) focuses on contrast of BIN realization with past participle/perfect *been* (also in Mainstream American English), little work on variation within BIN

## Two motivating observations from Green et al. (2022)

- Aspects of f0 contour shape signalling BIN extend over the entire utterance
- Some speakers seemed to produce more '**big BIN**'-like utterances (f0 global max on BIN, post-BIN compression); other more '**little BINs**' (BIN peak, but lower than pre-BIN region)



## Research questions

- **Empirical:** What structure can we uncover in the phonetic space of BIN realizations, i.e., (i) how can we potentially group the diversity of BIN topline realizations, and (ii) can we uncover by-speaker differences in BIN realization choices?
- **Methodological:** How can/should we extend shape-based methods (e.g., time series clustering, FPCA, GAMMs) to more naturalistic data and f0 shape patterns extending over much longer windows than a syllable?

## Data

- Reanalysis of Green et al. (2022) data [3]: 8 adult members of an AAE-speaking community in southwest Louisiana
- Written prompts with auditory/visual situational context to elicit BIN
- Included 311 tokens unambiguously classified as BIN and judged acceptable by linguistically-trained native speaker from community (tiny  $N$  so exploratory study)

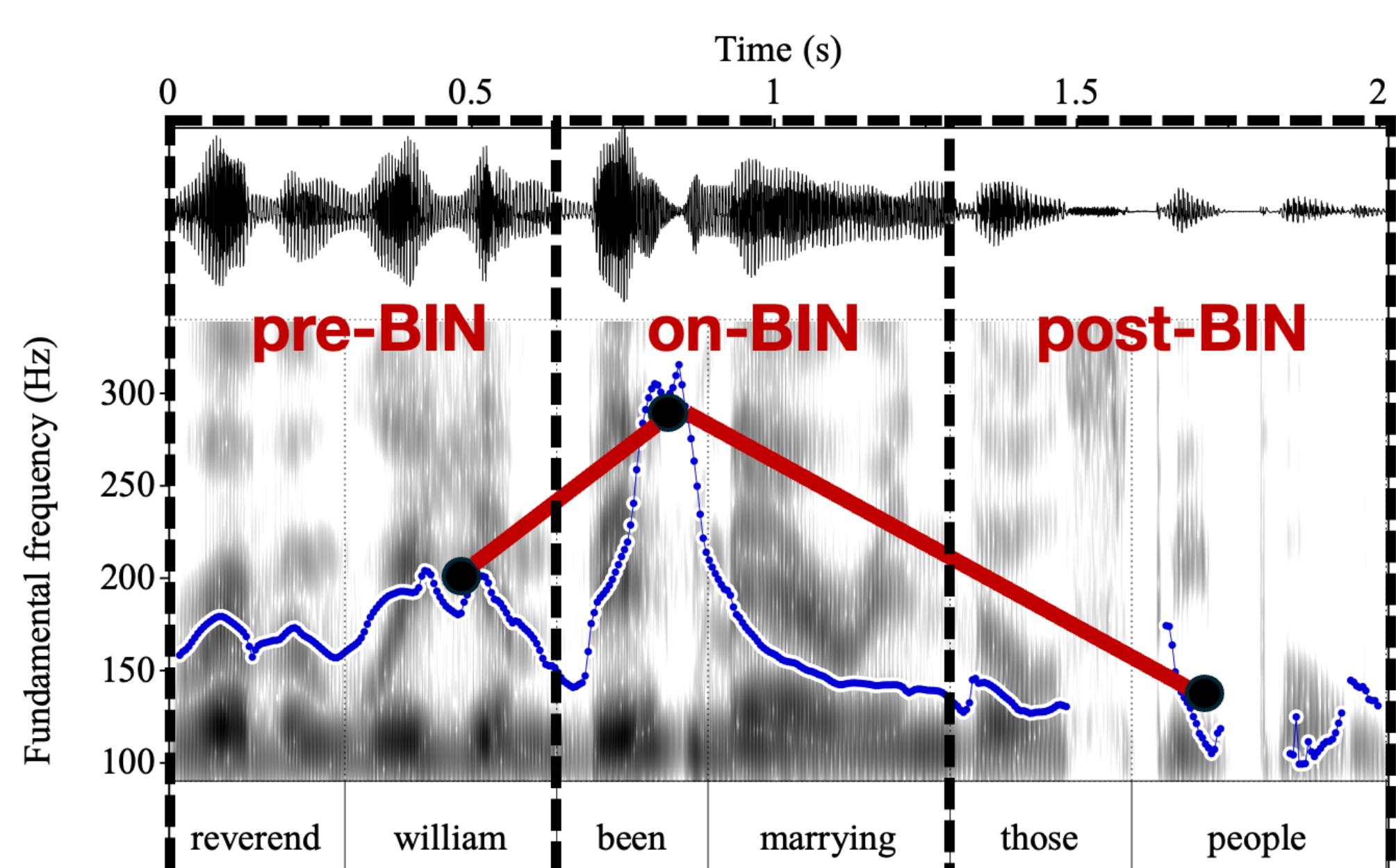
## Methods: f0 contour parameterization and analysis

### Full f0 contour

- F0 extracted at 10ms interval with Praat's autocorrelation, settings from [3]; log-transformed, by-token mean-centered
- Missing values (NAs) trimmed if at f0 contour edges, otherwise replaced by estimates imputed from cubic spline interpolation using `imputeTS` R package (used by [5], too)

### Topline (inspired by Cooper & Sorenson (1981) [4], i.a.)

- 3-point sequence of max 90th percentile f0 value over all words in each of the pre-BIN, on-BIN, and post-BIN regions
- Word immediately following BIN included in on-BIN region due to peak delay
- F0 data from function words could be and were excluded: subject to missing values, impacted by segmental perturbations



### Exploratory data analysis of toplines and full contours in R

- Time series clustering with `dtwclust` (partitional, Euclidean distance); 2-4 clusters tested, with 2 selected as optimal number by cluster validity indices
- Principal components analysis (PCA) of toplines using `prcomp`, `factoextra` (excluded from poster for space but in paper)

## References

[1] Rickford, J. R. (1975). Carrying the new wave into syntax. [2] Green, L. J. (1998). Remote past and states in African-American English. *Am. Speech*. [3] Green, L. et al. (2022). Range in the Use and Realization of BIN in African American English. *Lang. and Speech*. [4] Cooper, W.E & J.M. Sorenson (1981) Fundamental frequency in sentence production. [5] Gryllia, S. et al. (2022). The many shapes of H\*. *Speech Prosody 2022*.

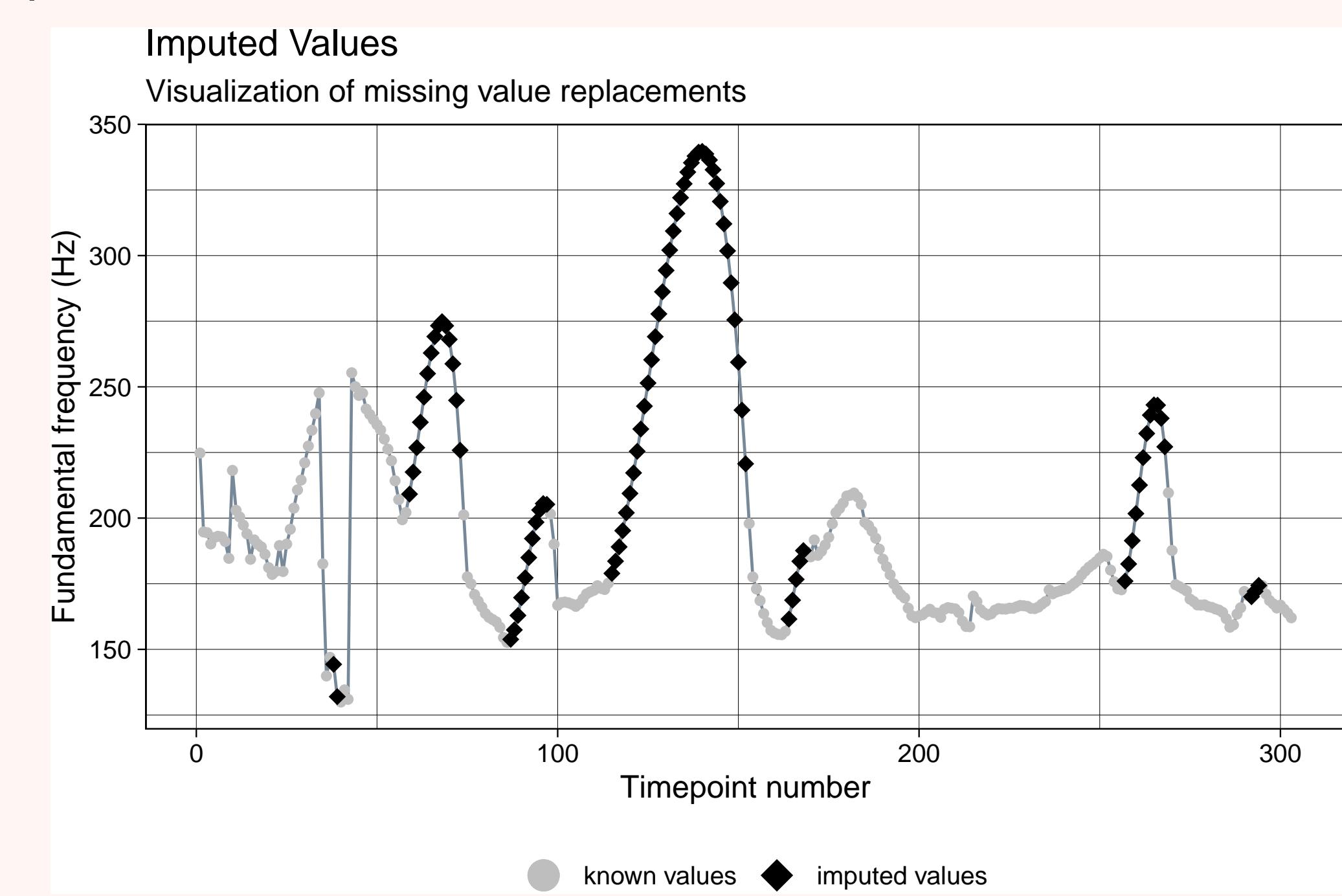
## Results: distribution and handling of missing values

- Every f0 contour contained NAs: 15,442 all together (23% of values)
- If common strategy of omitting contours with missing values followed, no data left
- Note that removing trailing/leading NAs has implications for time normalization

Source	%	Strategy for handling
Utt-final plurals	39.9	Remove trailing NAs
Utt-init. the	6.7	Remove leading NAs, impute NAs
BIN	5.3	Impute NAs
Silence	3.9	Remove trailing/leading, impute
Other	44.2	Impute NAs

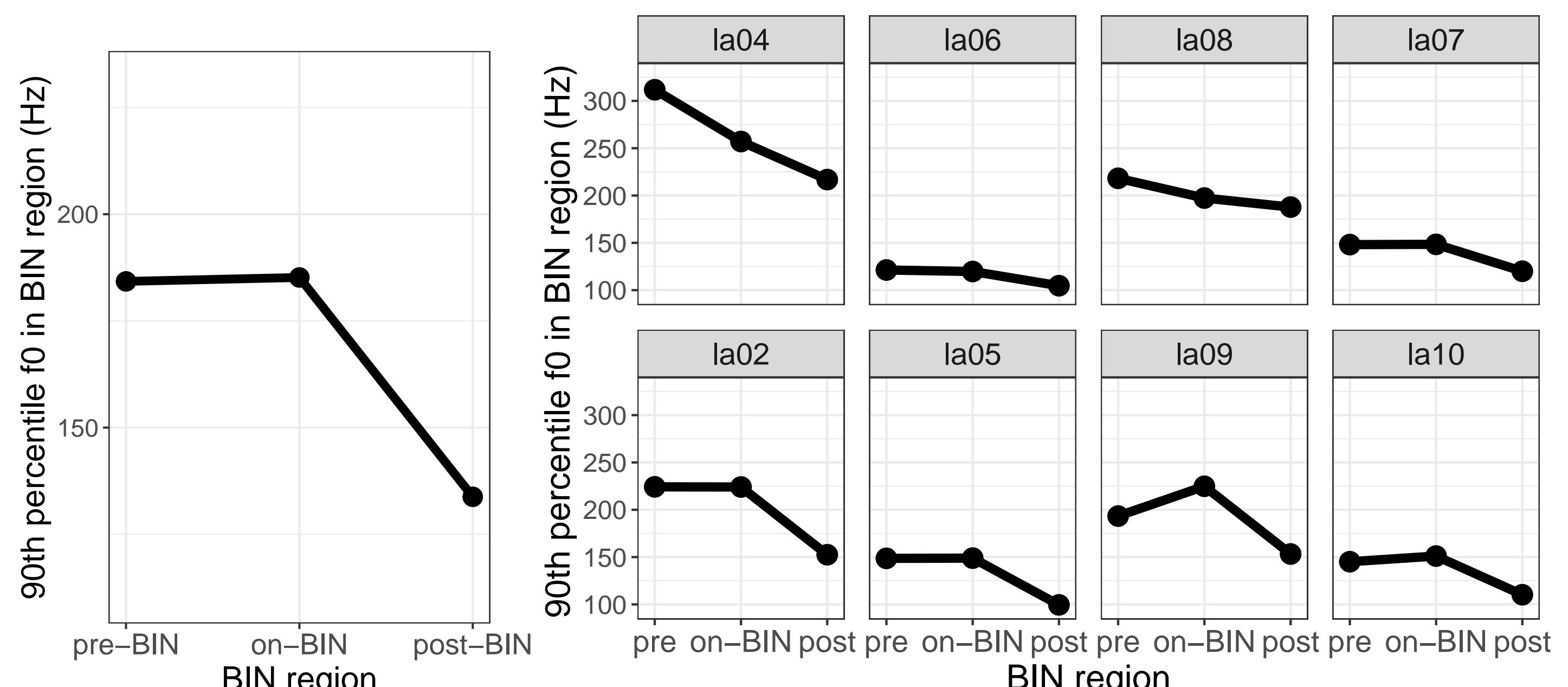
## Example: wild cubic spline imputation over pause

- Missing value source: utterance-medial [s] followed by 230-ms (fluent) pause,  $\approx$  timepoint numbers 100-150.
- No interpolation of f0 values over the silence makes sense: f0 undefined!

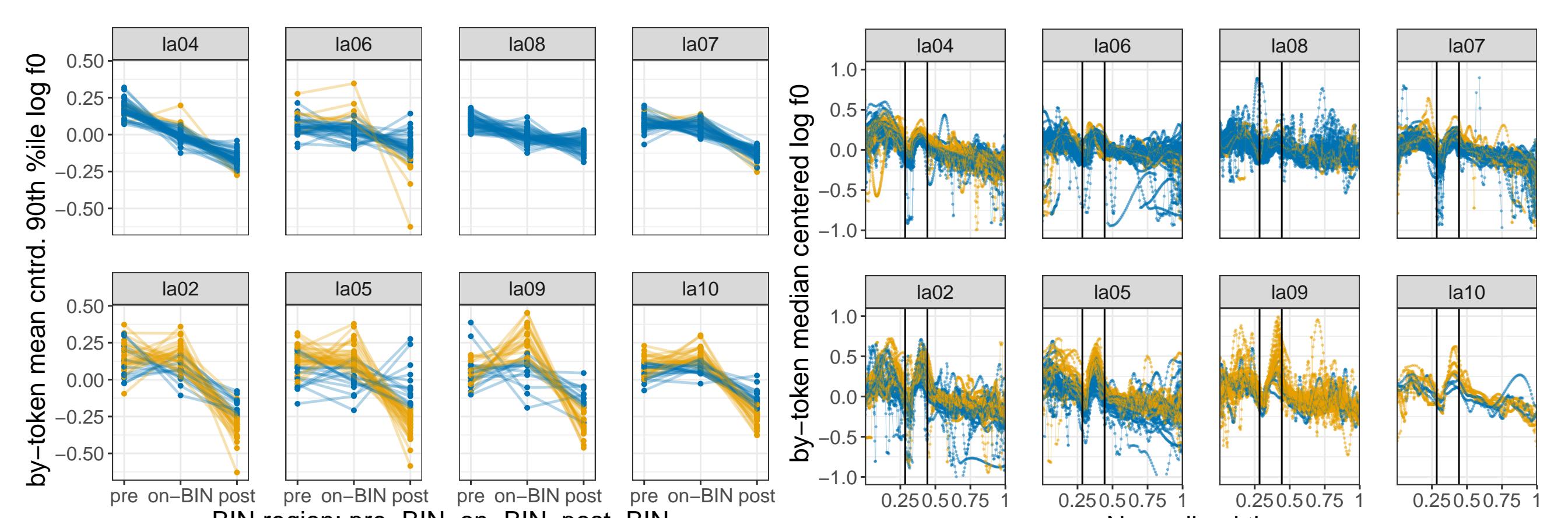


## Results: interspeaker BIN realization patterns

### By-speaker median 90th percentile toplines show variability missed in aggregate



**big BIN/little BIN clusters emerge over toplines, but not over full contour mess: speakers tend to produce realizations from one cluster**



## Conclusions

- Two distinct clusters of BIN realizations emerged from 3-point toplines: (i) **big BIN** (higher BIN peak, lower f0 post-BIN), (ii) **little BIN** (higher post-BIN f0, smaller BIN peak) and speakers tended to produce realizations from mostly just one of the clusters
- Low-temporal resolution 1970s/80s "topline" representation of downtrends easily generalize across different sentences with different lengths, stress positions, etc., due to its sparsity of sampling
- Acoustic methods alone can't provide decision on if little/big BINs might be categorically distinct, but can help with identifying variants
- Substructure in BIN realizations not evident from detailed full f0 contours: more detailed shape analyses (e.g., time series clustering, FPCA, GAMMs) perhaps not always the right tool, especially for more naturalistic data and f0 patterns over large temporal windows
- Important to consider the **sources of missing values** and think about whether it makes sense to impute f0 values when f0 is undefined, e.g., over pauses

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