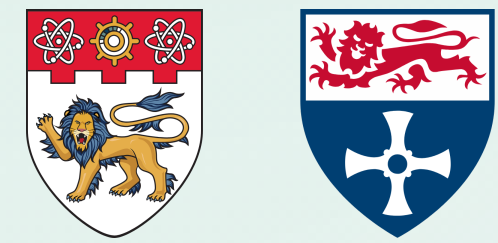


A **free, end-to-end web application and R package** for the whole citation tone analysis workflow: f0 extraction, f0 artefact screening, f0 correction, by-speaker normalisation, f0 visualisation, contour clustering, contour modelling, and Chao tone numeral conversion.

-  Free & open source
-  Runs in browser
-  Reproducible
-  Interactive & versatile

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MOTIVATION

Why this matters

A review of **136** citation-tone studies across **129** tonal varieties of China found that methodological choices **diverge at almost every step** (Xu & Zhang 2024, *JASA*), limiting how well tone inventories compare.

-  **Inconsistent f0 handling**
f0, the main acoustic correlate of tone, is measured and reported differently.
-  **Low transparency**
Procedures are often under-documented, so studies are hard to reproduce.
-  **Small speaker samples**
Many descriptions rest on very few speakers.
-  **Limited comparability**
Divergences make tone inventories hard to compare across languages.

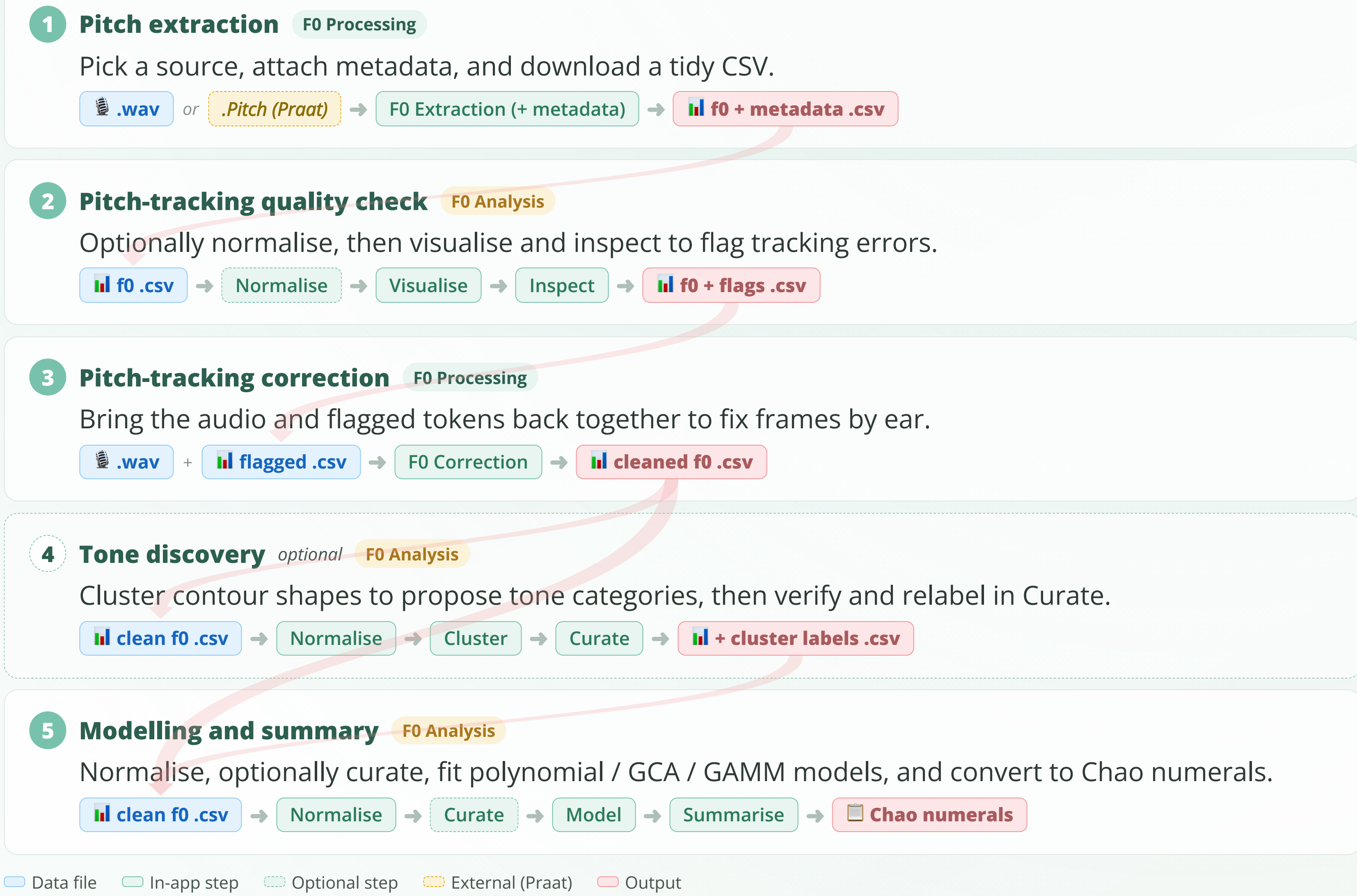
HIGHLIGHTS

What makes it different

-  **Whole pipeline, one tool**
From extraction to Chao numerals, no juggling separate programs and scripts.
-  **Correction by ear and eye**
Repair frames against the audio and waveform; every edit is logged.
-  **Tone discovery**
Cluster contour shapes and normalised heights to propose tones.
-  **A new screen for f0 irregularities**
Three-tier inspection flags octave errors, stray frames, and shifted contours.
-  **Three modelling routes**
Polynomials, growth-curve analysis (lme4), and GAMMs (mgcv).
-  **Comparative Chao numerals**
Reference-line and interval methods shown side by side.

HOW IT WORKS

One app, five workflows



THE APP IN ACTION

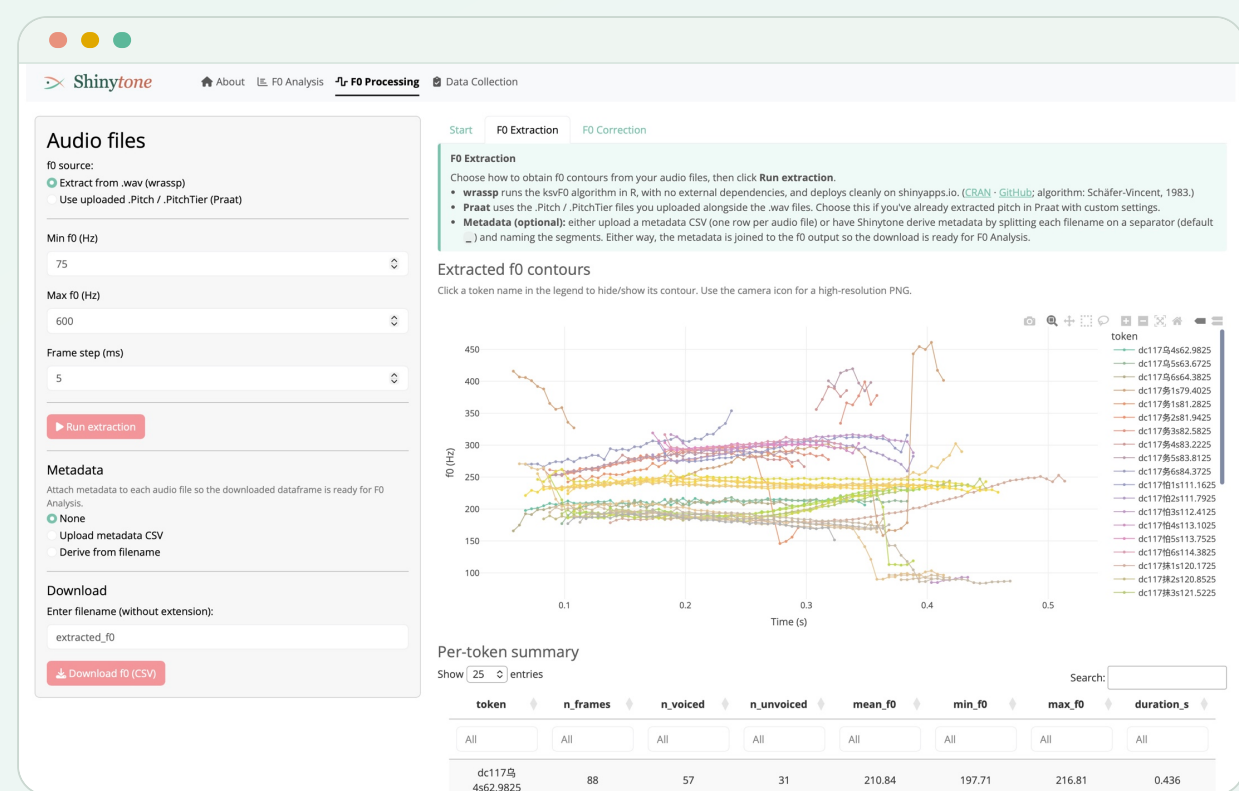
App demo

Two linked workspaces, from raw audio to publication-ready Chao tone numerals.

- Audio and tabular data workspaces
- Compatible with Praat output
- Downloadable output at every step: figures, models, CSVs
- R code at every step, for learning and teaching
- Run locally for offline use and large datasets
- Private by design: data is never stored or shared

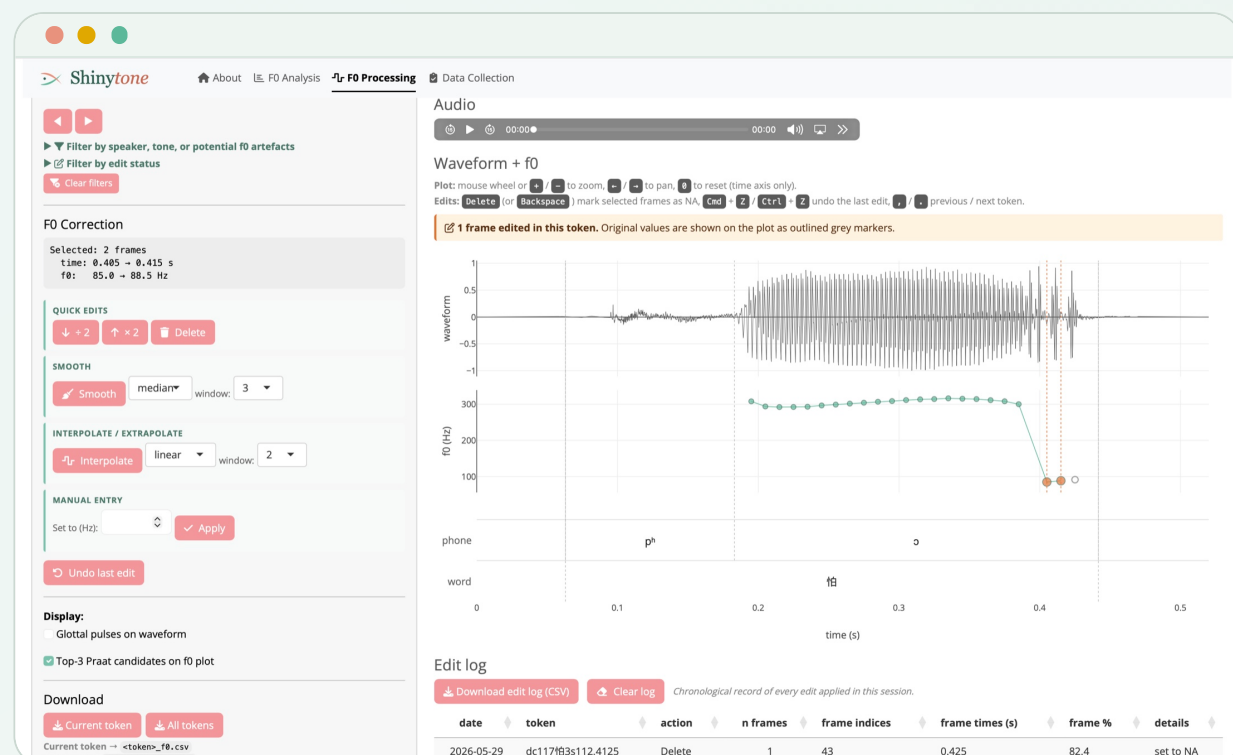
1 F0 Processing

From raw recordings to clean, analysis-ready f0 contours.



Extract

- Extract f0 from .wav (wrassp or Praat)
- Import existing Praat .Pitch files
- Attach speaker, tone, and item metadata
- Annotate temporal landmarks

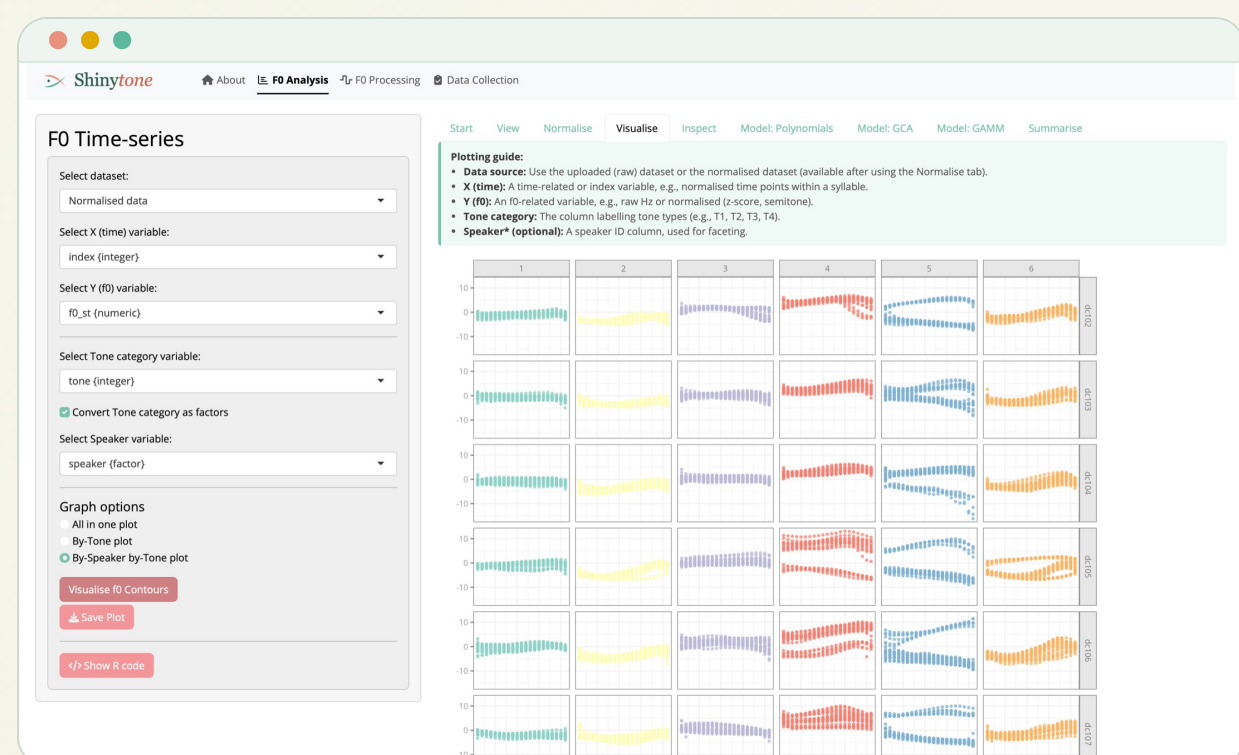


Correct NEW

- Play audio alongside the waveform
- Correct octave errors; smooth, interpolate
- All edits recorded in a downloadable log

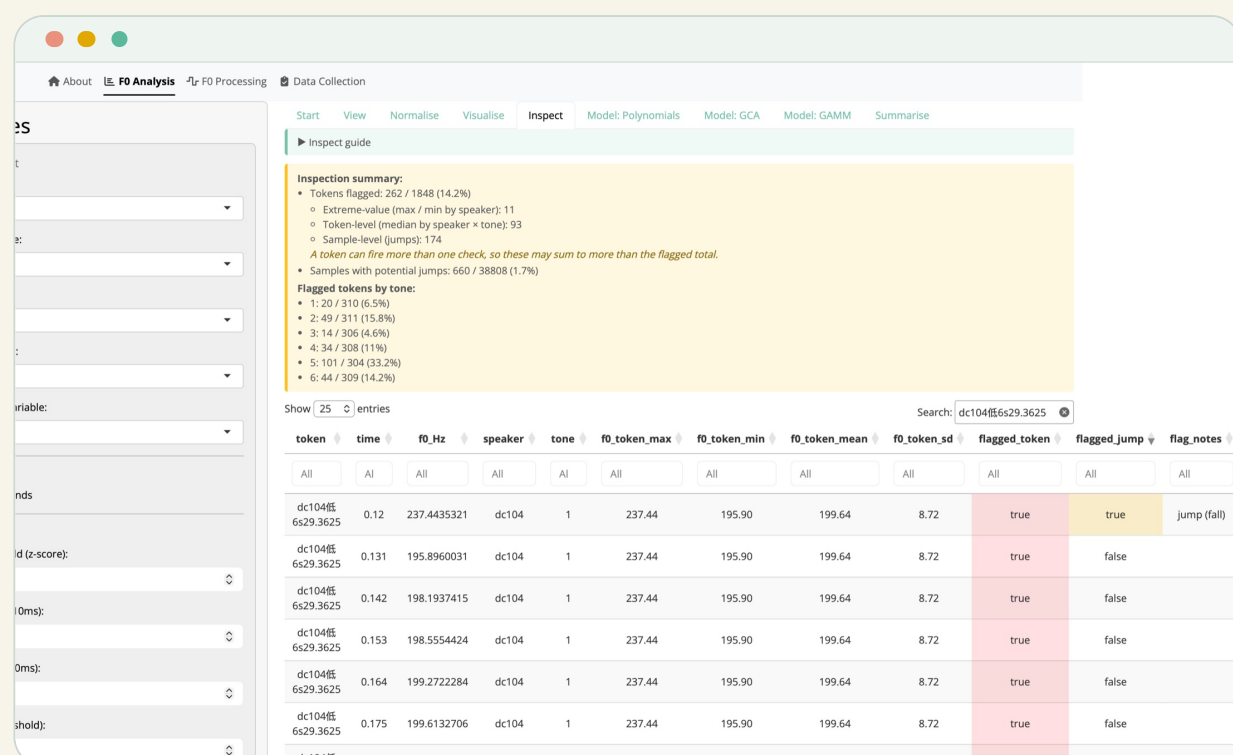
2 F0 Analysis

From f0 measurements to publication-ready contours, models, and Chao tone numerals.



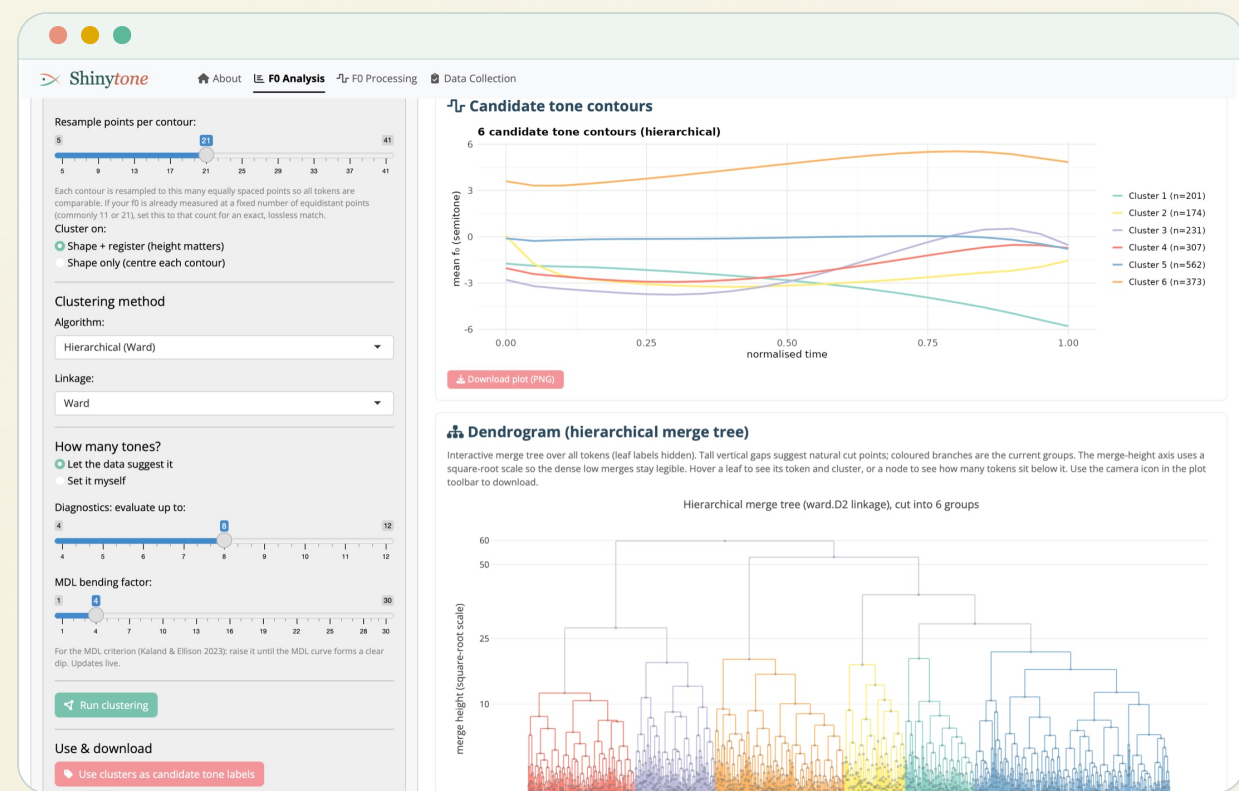
Visualise

- f0 contours coloured by tone category
- Facet by speaker; export figures
- Semitone, ERB, or z-score normalisation



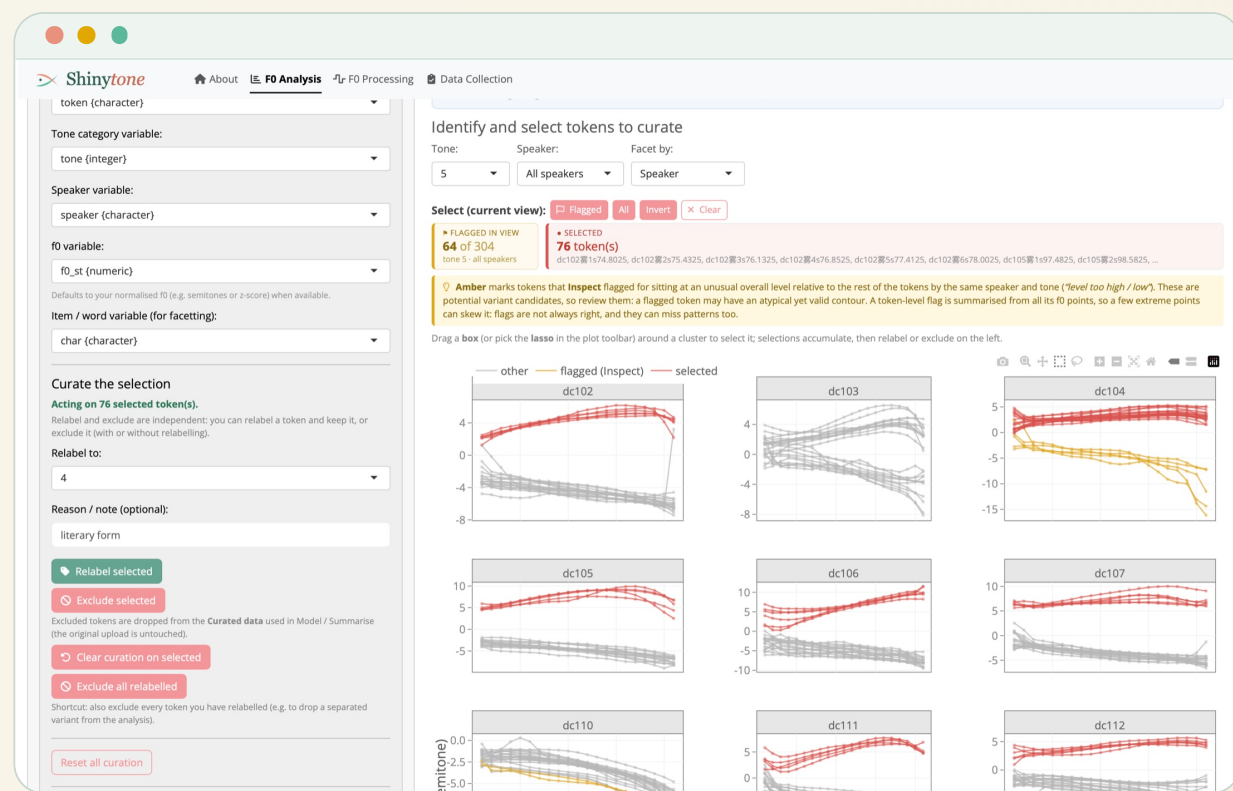
Inspect

- Speaker-, token-, and frame-level checks
- Detect octave errors, stray frames, shifts
- Flag and annotate potential f0 artefacts



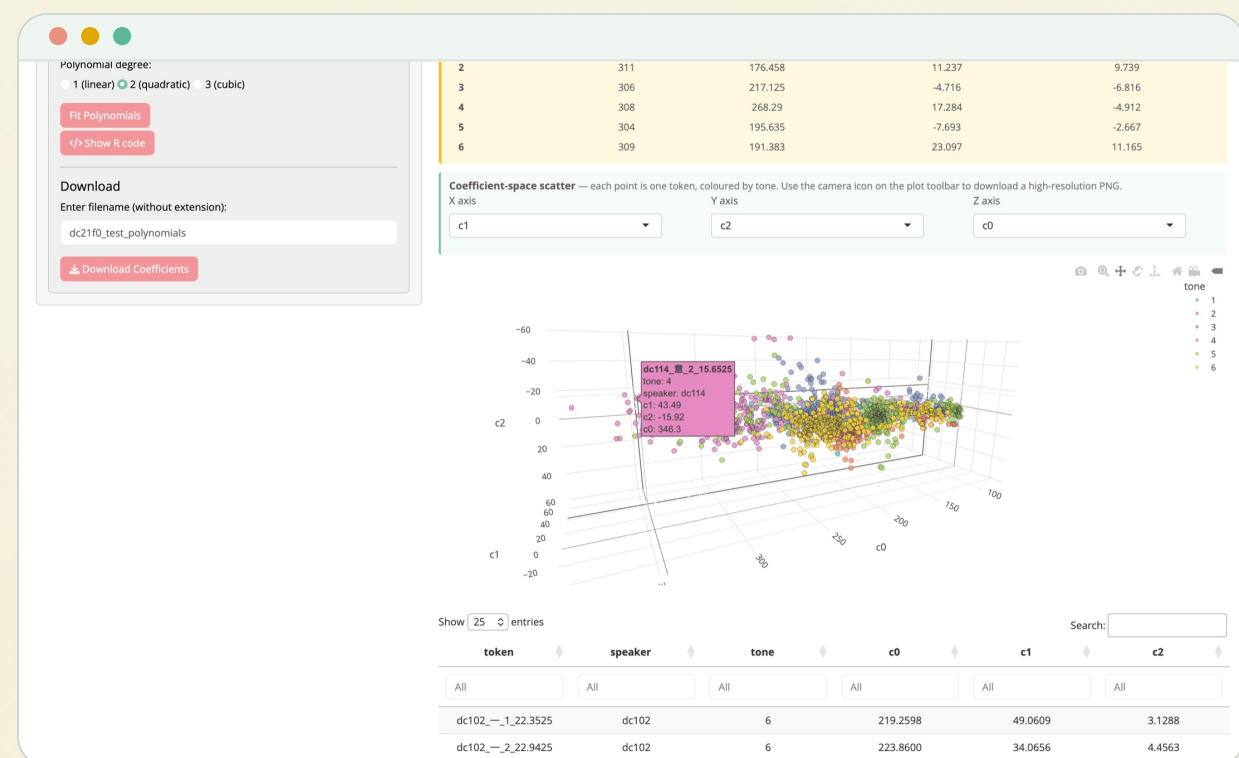
Cluster NEW

- Label-free clustering of contour shapes
- Methods: k-means, hierarchical (Ward), GMM
- Tone count (k): silhouette, gap, BIC, MDL
- Dendrogram, PCA/UMAP, tone plots



Curate NEW

- Literary vs. colloquial readings
- Tone sandhi and sociolinguistic forms
- Merge or split tone categories
- Exclude mis-elicited tokens



Model

- Per-token Legendre polynomials
- Growth-curve analysis (lme4)
- Generalised additive mixed models (mgcv)



Summarise

- Chao 1–5 tone numerals
- Reference-line and interval methods
- Both methods compared side by side

FOR OFFLINE USE & LARGE DATASETS

The R package



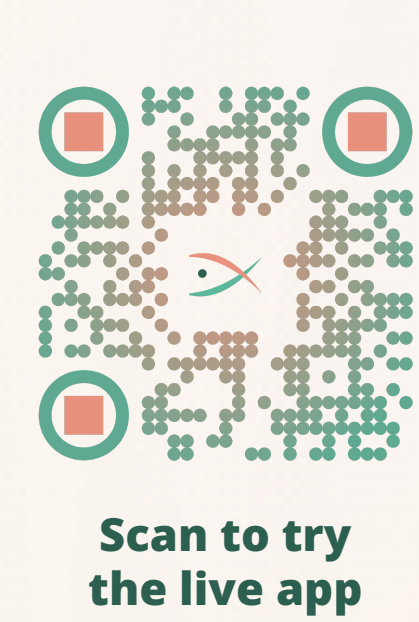
```
# launch the same UI offline
remotes::install_github("chenchenzi/citationtone_hub")
shinytone::run_app()
```

```
# or script the pipeline
cluster_f0(df, method = "hclust")
contour_to_chao(mean_contour)
```

normalise_f0() inspect_f0() cluster_f0() choose_k_f0() contour_to_chao()

TRY IT NOW

Get started



Scan to try the live app

 **Live app**
chenzixu.shinyapps.io/shinytone

 **Docs & function reference**
chenchenzi.github.io/citationtone_hub

 **Get-started vignette**
chenchenzi.github.io/citationtone_hub/articles

 **Source code**
github.com/chenchenzi/citationtone_hub