The PRAAT script 'Pitch_contour_<version>_<revision>.praat' can be used to compare (normalised) pitch contours of many segments.

The script computes the pitch of all .wav files in one directory/folder. For each file it reports the pitch data of each labelled segment in equidistant intervals (i.e. at data points in time). The data can be reported in Hertz, ERB,[1] or semitones.[2] The data can be the arithmetic mean (average) or median around the data point or at the data point. Additionally, the data can be transformed into z-scores to normalise the pitch values and allow comparisons between speakers with different pitch ranges. The data is stored in a tab-delimited text file with the name 'pitch_contour_results.txt'. Any pre-existing file of this name is erased at the beginning of the script.

The script cuts the pitch contour of each labelled segment into a (user-specified) fixed number of equidistant time points. That is, independent of the actual length of a segment in milliseconds each segment has a length of '100%' and by cutting it into e.g. 10 segments leads to 9 time points (at 10%, 20%,…90%; see Figure 1); cutting it into e.g. 4 segments leads to 3 time points (25%, 50%, 75%). The pitch values are taken at theses time points, or as a mean or median centred around this point in time (see Figure 1). Note, however, that the pitch algorithm of PRAAT moves with a fixed window size (= frame) with a fixed step rate (default: 5 ms) across the signal; i.e., there is actually not a pitch value for every point in time but rather for a certain stretch of time the same pitch value is used. Taking the value 'at a point in time' is done in PRAAT by interpolating (i.e. averaging) the value from the neighbouring frames. As a consequence, taking the median or mean will often lead to the same pitch value as taking it at a point in time. Be also aware that the first and last part of a segment is never taken into account, since even the centred mean or median ranges will only span half of the first or last range (see Figure 1).

Using semitones or ERB values allows the comparison of speaker with very different pitch ranges and is the preferred method. Using z-scores additionally normalises each segment by transforming the pitch values to a distribution around the a mean of '0' by the formula:

$$z = \frac{F_0(\text{at time point}) - F_0 mean(\text{of segment})}{F_0 st.dev.(\text{of segment})} .$$

Using z-score transformed semitone values to compare pitch contours is the preferred method (##add ref##).

[1] Equivalent Rectangular Bandwidth

[2] With respect to 1 Hertz. The absolute semitone values depend on this reference frequency (1 Hertz), but relations between values are independent of the reference frequency and give identical contours / relations.

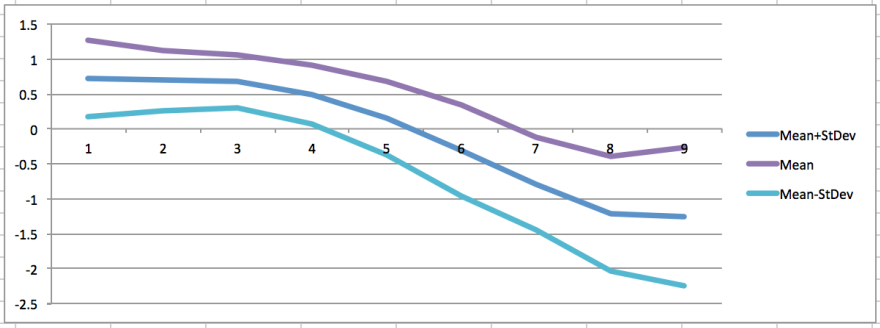
The tab-delimited result file has the form of:

File	Label	Beginning[s]	Duration[ms]	25%	50%	75%	(at position in semitones re 1 Hz)
SA2	don	0.8267	167.500	-0.87	0.02	0.75	
SA2	ask	0.9942	255.187	-0.38	1.66	.	
SA2	me	1.3250	120.000	0.81	0.23	-0.98	

File: Name of the .wav file of which the pitch was computed.
Label: Label of the analysed segment.
Beginning: Beginning of the segment in seconds (helpful to locate a segment in a file, especially if there are more than one identical label per file).
Duration: Duration of the segment in milliseconds.
25%: Data at 25% of the duration of the segment.
50%: Data at the middle of the segment.
75%: Data at 75% of the duration of the segment.
(at position in semitones re 1 Hz): Information about the selected method and units (z-scoring is not reported since it is obvious from the data: mean at 0).
A data value '.' (dot) indicates a missing value.

Example of post-processing the data (here: z-scores of semitones):
After selecting one segment form all files and putting the data into Excel, computing the mean and standard deviation and displaying differences between mean and st.dev. in a graph, the average pitch contour of (in this case: 191 items) can be displayed (with st.dev. range):

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	File	Label	Beginning[s]	Duration[ms	10%	20%	30%	40%	50%	60%	70%	80%	90%
2	TEST_DR1_F	year	3.4663	321.188	0.35	0.42	0.52	0.55	0.45	0.23	0.02	-2.48	-2.47
3	TEST_DR1_F	year	4.6837	425.562	0.89	0.93	0.97	0.71	0.41	-0.09	-0.45	-1.17	-1.96
4	TEST_DR1_F	year	3.0035	325.063	1.31	1.19	0.82	0.31	-0.38	-0.93	-1.11	-1.16	-0.92
5	TEST_DR1_F	year	3.2545	313	0.59	0.43	0.46	0.73	1.01	0.81	-0.27	-1.25	-1.85
6	TEST_DR2_F	year	3.0175	435	1.29	1.06	1.13	0.71	0.1	-0.53	-0.9	-1.38	-1.33
7	TEST_DR2_F	year	3.0125	347.25	0.77	0.67	0.71	0.65	0.47	0.36	-0.45	-1.6	-1.63
188	TRAIN_DR8_	year	2.4961	264.625	1.43	0.83	0.51	0.1	-0.82	-1.52	-0.91	-0.33	
189	TRAIN_DR8_	year	2.8733	355.063	0.07	0.19	0.27	0.39	0.56	0.52	0.23	-0.44	-3.36
190	TRAIN_DR8_	year	2.6125	365	0.53	0.61	0.95	1.05	0.7	0.21	-0.61	-1.49	-1.67
191	TRAIN_DR8_	year	2.6928	239.75	1.37	1.31	0.84	0.22	-0.34	-0.74	-1.2	-1.3	-0.78
192	TRAIN_DR8_	year	2.4949	274.625	0.77	0.78	0.99	0.89	0.01	-0.66	-1.09	-1.52	-0.95
193													
194	Mean				0.72082418	0.68967568	0.67805263	0.49879581	0.15696789	-0.3044278	-0.7906648	-1.2161932	-1.2597911
195	StDev				0.55704417	0.43435597	0.38577744	0.4206325	0.52268601	0.65180658	0.66224273	0.81354655	0.99590327
196													
197	Mean+StDev				1.27786835	1.12403165	1.06383007	0.91942831	0.6796539	0.34737877	-0.1284221	-0.4026466	-0.2638879
198	Mean-StDev				0.16378	0.2553197	0.2922752	0.07816331	-0.3657181	-0.9562344	-1.4529076	-2.0297397	-2.2556944



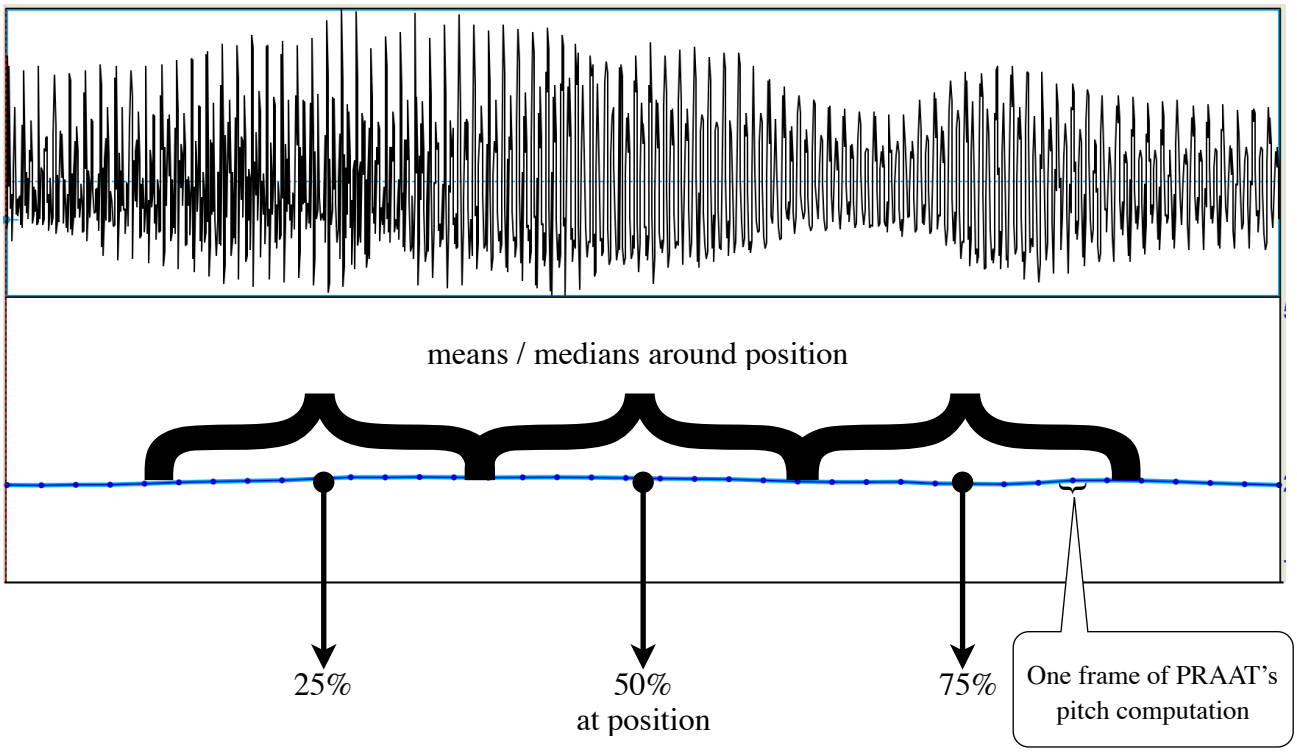
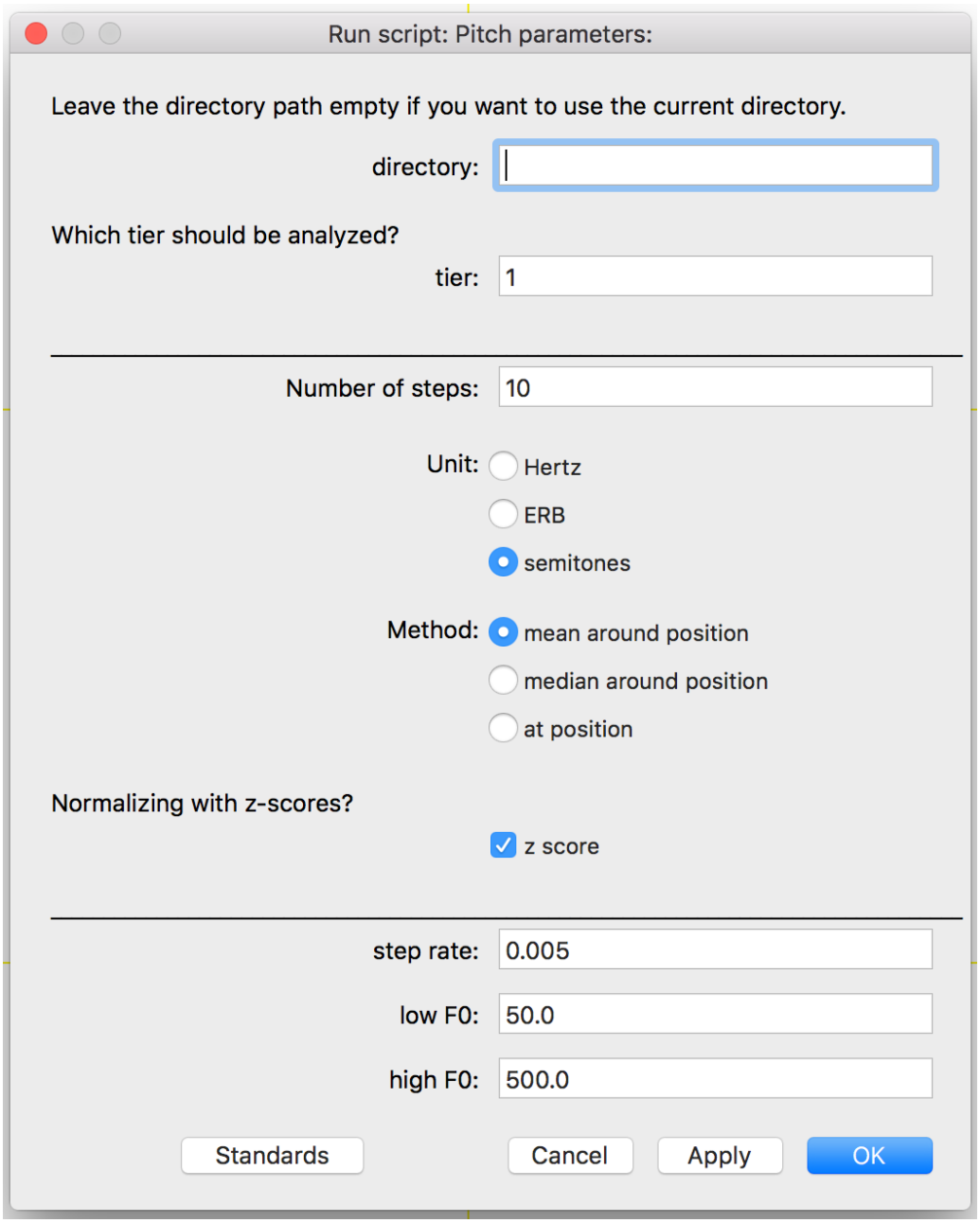


Figure 1: Speech waveform with pitch contour (in blue). The little black dots in the pitch contour mark the centres of PRAAT's pitch frames. The 'contour' was reduced to four segments (i.e. three time points at 25%, 50%, 75%), where data could be taken 'at position' (indicated by arrows) or as 'means / medians around position' (indicated by curly brackets).


Run script: Pitch parameters:
Leave the directory path empty if you want to use the current directory.
directory:
Which tier should be analyzed?
tier:
1
Number of steps:
10
Unit:
Hertz
ERB
semitones
Method:
mean around position
median around position
at position
Normalizing with z-scores?
z score
step rate:
0.005
low F0:
50.0
high F0:
500.0
Standards
Cancel
Apply
OK