

Pitch_6_2_0.praat**Task:**

This script opens all sound files in a directory and associated TextGrids (if they exist) and computes

- pitch mean, standard deviation and/or percentiles (e.g. minimum, maximum, 2.5% percentile) of intervals or whole files
- amount of voicing of these intervals or files
- pitch data at the center, edges, or of several time points (to provide data for pitch contours)
- contour data can additionally reported with mean subtracted, median subtracted or as z-scores
- and data can be in Hertz, semitones, ERB,¹ semitones,² mel or logHertz.

Results are written into a tab-delimited text file (the delimiter can be changed in the script) with the name “pitch_results_<date>_<time>.txt”.

The script reports missing values (“- undefined -“ in PRAAT) with a “NA” or any other symbol that can be set inside the script (e.g. to “.”). Additionally, there is the possibility to generate a dummy header line of data to force automatic data-type detection in JMP (or any other spreadsheet or statistics program) to set the correct data type for each column.

There are more parameters that control the behaviour of the script than displayed in the form window (the size of the form window fits into a screen with 640 points vertical resolution). These parameters can be set below the form statement in the script (see the **Programming**) section.

Note, that the pitch algorithm of PRAAT moves with a fixed step rate (default in this script: 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 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. For details on the computation of pitch values for intervals, and why it might be different from your interactive measurements, see the file **Pitch_notes.pdf**.

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.

Parameters:

The default form window at the beginning of the script shows only some of the parameters that control the behaviour of the script (the form window is designed to be able to be displayed on a screen with 1024 vertical pixels). The other parameters can be set inside the script, or put into the form window (or parameters in the form window that are not changed can be put inside the script). Please read the **Programming** section for more internal parameters that can easily be changed.

The screenshot shows the 'Run script: Pitch parameters (Vers. 6.1):' dialog box. It contains several input fields and options, each with a callout explaining its function:

- Tier:** 1 (Callout: Tier number to be analysed)
- <label>, <list>.txt, '!' (= only labelled), or empty (= all)**
- Label:** . (Callout: Specification of labels)
- low F0:** 75.0 (Callout: Lowest pitch values)
- high F0:** 500.0 (Callout: Highest pitch values)
- Units: either (H)ertz, (s)emitones, (m)el, (E)RB or (l)ogHertz**
- Units:** H,e (Callout: Units to report pitch)
- (i)ntensity, (m)ean, <list of quantiles in %> of intervals**
- Interval parameters:** i,0,50,m (Callout: Reports for interval data)
- Nr. of measurements per interval (for a contour) 1: only center, 2: only edges**
- Number of measurements:** 10 (Callout: Data points for contour data)
- (t)ime of measurement, mean (s)ubtraction, (med)ian subtraction, (z)-scores?**
- Contour parameters:** t,s (Callout: Additional reports for contour data)
- Report skipped intervals:** ☐ All, ☒ Length or Intensity exclusion, ☐ None (Callout: Reporting of skipped intervals)

At the bottom are buttons: Standards, Cancel, Apply, and OK.

Tier number to be analysed:

The number of the interval tier to be analysed. If this is set to “0” the whole file will be taken as one interval.

Specification of labels:

The intervals that should be analysed can be specified in several ways (in case the whole file is taken as one interval, this field is ignored):

<label>:

Giving a label (e.g. a:) or a list of labels separated by commas or spaces (e.g. i:,I u:,U) will only report intervals that have this label. This function is case sensitive. Note that labels may not include spaces or underlines in the present version.

<list>.txt:

Giving a text file (e.g. label_list.txt) will report all intervals that are listed on a line-by-line basis in a raw text file (not a Word or Pages file). Note that the extension .txt must be given in this field. Example of such a text file:

```
a
a:
ae
O
good
```

‘.’:

Using a dot (.) will report values for every labelled interval.

empty:

Leaving this field empty will report values for all labelled and unlabelled intervals.

Units to report pitch:

Units which should be used to report pitch values (more than one can be specified as single lower case or upper case letters, separated by commas):

‘H’ (Hertz)

‘s’ (semitones re 1 Hz)

‘m’ (mel)

‘E’ (ERB)

‘l’ (logHertz)

Reports for interval data:

Pitch data which should be reported for intervals (as single lower case or upper case letters, separated by commas):

‘i’ (Report mean intensity of intervals):

The intensity mean of the analysed intervals can be reported in the result file. Additionally, a minimal intensity (by default 40dB, c.f. **Programming**) criterion must be met.

‘m’ (Report pitch mean and standard deviation of an interval):

Setting this switch will report the mean and standard deviation of each interval selected by **Specification of labels**.

<numerical values> (Specification of quantiles to be reported):

Quantiles (actually percentiles) of an interval will be reported by specifying values separated by commas or spaces. Values must be given as percentages between 0 and 100. The program will always makes the reporting symmetrical to the lower and upper quantile range. For example, a specification like. 0, 2.5, 10, 50 will report the Minimum (0%), 2.5%, 10%, Median (50%), 90%, 97.5%, and Maximum (100%) quantiles.

Data points for contour data:

The number of data points along an interval/file. If '0' is given, only the means and/or quantiles are reported. '1' will report the pitch at the center of the interval/file, '2' will report data at the left and right edges, '3' at edges and center. Higher numbers will report data at more points. Note that this is the number of data points, not intervals: '10' will report data at 0%, 11.11%, 22.22%, ...77.78, 88.89%, 100% of the length of the interval/file. Pitch data will always be reported for the number given in this field, even when the **Additional reports for contour data** field below is left empty.

Additional reports for contour data:

The data is always reported at the time point of measurement, by default with linear interpolation (see **Programming** → **interpolation**). Additionally, the data can be reported with the actual (absolute) time point of the measurement, values with subtracted mean of the interval/file or as z-scores. (Cf. <<https://sites.google.com/site/tonemodelling/anaposts/z-transformdoesnotworkforpitchcontoursflat>> why z-scores are not always appropriate.)

t:

The (absolute) time of a measurement is reported.

s:

The mean of an interval/file is subtracted from the pitch data to normalise the data to the deviation from a mean during an interval in dB:

$$s [\text{unit}] = \text{Pitch at time point} [\text{unit}] - \text{Pitch mean of segment} [\text{unit}]$$

med:

The median of an interval/file is subtracted from the pitch data to normalise the data to the deviation from a median during an interval in dB:

$$\text{med} [\text{unit}] = \text{Pitch at time point} [\text{unit}] - \text{Pitch median of segment} [\text{unit}]$$

z:

The mean of an interval/file is subtracted from the pitch data and divided by its standard deviation to normalise the data as z-scores:

$$z = \frac{\text{Pitch at a time point} - \text{Pitch mean of a segment}}{\text{Pitch stdev of a segment}}$$

Reporting of skipped intervals:

Handling of intervals which are excluded by the **Specification of labels**:

All:

All intervals excluded from the computations are reported with File, Label, Start(s) and Duration(ms) only (see **Result file** below), all other values are set to the missing value symbol (see below). This function can be helpful to see the context of a particular interval analysed.

Length of intensity exclusion:

By default, the minimal length of an interval to be analysed must be 25 ms (see **Programming** to change this criterion). Additionally, the **intensity** setting (see above) can lead to intervals not being analysed.

None:

No intervals that are excluded are reported.

Result file:

The script generates a raw text file with tab-delimited data and a header line. The file name is of the form “pitch_results_<date>_<time>.txt” with <date> of the form ‘yymmdd’ (i.e. 2-digit year, 2-digit month, 2-digit day) and <time> of the form ‘hhmmss’ (i.e. 2-digit hour in 24 hour format, 2-digit minutes, 2-digit seconds). For example, a file with the name “pitch_results_201124_144519.txt” was created on the 24th of November 2020 at 2pm, 45 minutes and 19 seconds.

The parameters controlling the computation are listed at the end of every result file.

The results will also include the percentage of voicing in an interval (see **Pitch_notes.pdf** for details).

The result file for a parameter setting to report mean, standard deviation, 10% centils and values at the the left and right edges of all intervals in Hertz.

(Note that only missing values (here a dot ‘.’) for the segment [t] at 1.1281 are displayed since it is shorter than 20 ms. The segment [th] at 12.5693 is long enough, but unvoiced, i.e. only missing values can be displayed.)

Units: either (H)ertz, (s)emitones, (m)el, (E)RB or (l)ogHertz
 Units:

(i)ntensity, (m)ean, <list of quantiles in %> of intervals
 Interval parameters:

Nr. of measurements per interval (for a contour) 1: only center, 2: only edges
 Number of measurements:

(t)ime of measurement, additionally mean (s)ubtraction, (z)-scores?
 Contour parameters:

File	Label	Start(s)	Duration(ms)	Voiced(%)	Mean(Hz)	StDev(Hz)	10.0%(Hz)	90.0%(Hz)	p_left(Hz)	p_right(Hz)
g071	j	0.7934	91.6	75	228.24	10.98	217.34	241.75	.	222.43
g071	ã	0.8851	77.8	61	162.51	43.27	123.78	219.46	222.43	122.18
g071	g	0.9629	50.9	100	119.22	2.86	116.10	123.42	122.16	124.81
g071	u:	1.0139	31.6	100	127.59	1.51	125.42	128.95	124.81	129.45
g071	n	1.0455	82.5	98	134.40	5.79	128.31	142.55	129.45	139.26
g071	t	1.1281	14.5	.	.	.	.	.	.	.
• • •										
g071	th	12.5693	59.4	0	.	.	.	.	.	.

Script: Pitch_6_0_0.praat

Analysis started: 24-Nov-20 14:45:19

Tier: 4

Labels: .

Computation units: Hertz

Step rate: 0.005 s

Low F0: 75 Hz

High F0: 500 Hz

Minimal duration: 20 ms

Minimal intensity: 40 dB

Example of post-processing the data (here: z-scores of ERBs; data in 'Pitch_contour.xlsx'):
After putting the data for the label 'year' into a spreadsheet, computing the mean and standard deviation and displaying differences between mean and st.dev. in a graph, the average pitch contour (measured at 11 points) can be displayed (with st.dev. range).

(Note, that the graph can be very misleading: the 11th data point is often missing and its average is higher than the penultimate. The contour would look like 'clearly falling' if one would have left out this last data point in the graph!)

Run script: Pitch parameters (Vers. 6.0):

Tier: 2

<label>, <list>.txt, '!' (= only labelled), or empty (= all)

Label: year

low F0: 75.0

high F0: 500.0

Units: either (H)ertz, (s)emitones, (m)el, (E)RB or (l)ogHertz

Units: e

(i)ntensity, (m)ean, <list of quantiles in %> of intervals

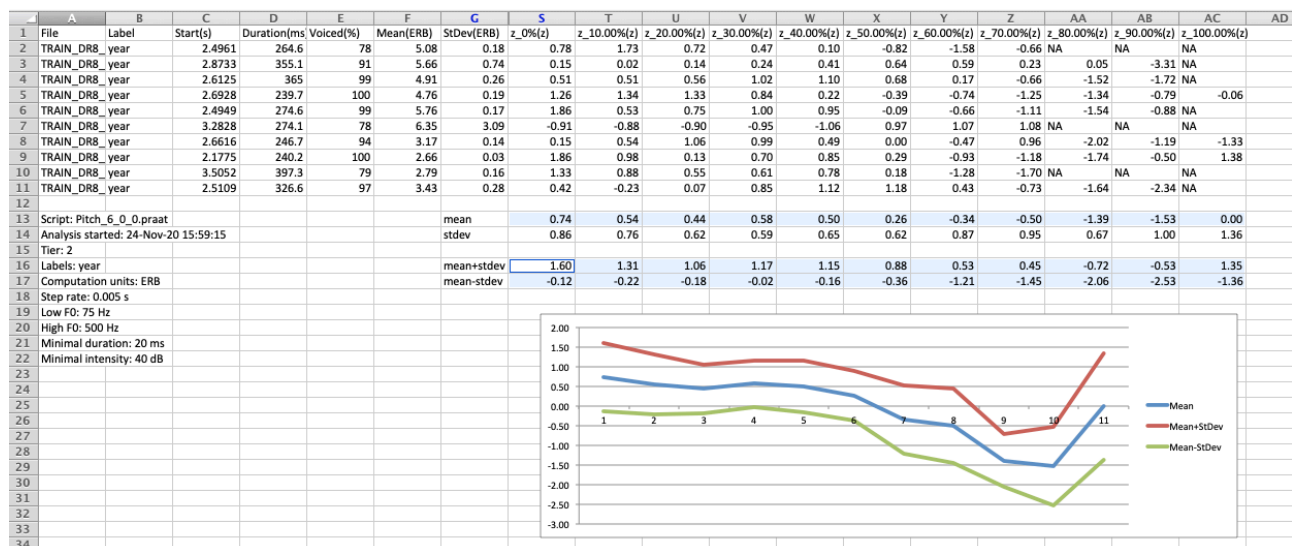
Interval parameters:

Nr. of measurements per interval (for a contour 1: only center, 2: only edges)

Number of measurements: 11

(t)ime of measurement, additionally mean (s)ubtraction, (z)-scores?

Contour parameters: 4



Information for programming:

Some parameters can be set underneath the ‘form’ section in the script. The user might put some of these into their form window (as long as it fits into their screen).

step_rate:

The step rate (in seconds) of the pitch analysis (default: 0.005).

minimal_length_ms:

The minimal length (in milliseconds) for an interval to be analysed (default: 25 ms).

minimal_intensity:

The minimal intensity (in dB) for an interval to be analysed if intensity is requested (see **Reports for interval data**) (default: 40 dB).

position_in_percentage:

When more than 3 data points are requested for the contour data (for 1 to 3 the terms ‘left’, ‘center’ ‘right’ are used) the data points can be reported in the header as percentage of the whole interval (e.g. 0%, 25.00%, 50.00%, 75.00%, 100%) or as index number (e.g. 1, 2, 3, 4, 5) (default: %).

maximal_number_of_measurements:

The script warns the user if a large number of data points are selected for contour data (default: 50).

interpolation\$:

Method to interpolate the pitch values at the data points (‘nearest’ or ‘linear’; default: ‘linear’).

directory\$ (Directory path):

The script handles all sound files in a directory specified by this string. If this string is an empty string, the script will handle all sound files in the directory where the script was started (i.e., the script is placed in the same directory as the sound and TextGrid files). If not a single TextGrid can be found, the whole file will be taken as one interval.

Directories:

The script uses internally separate strings for sound, TextGrid, result and support directories. Users who use separate directories for these can adjust these names in the script.

path_name:

By default, only the TextGrid or sound file name is listed. If the full path should be reported, path_name should be set to 1.

path_name = 0 No report of full path name

path_name = 1 Full path name is reported

sound_ext\$ (sound file name extensions):

The default extension for sound files is “.wav”. This parameter can be changed in the script.

method\$ (pitch algorithm):

Pitch extraction method to use:

"ac" = autocorrelation (default)

"cc" = cross-correlation

"shs" = Sub-Harmonic Summation (Hermes, 1988)

"spinet" = Spatial Pitch NETwork (Cohen, Grossberg, and Wyse, 1995)

sep\$ (separator symbol):

In the (columns of) data in the result file are separated by this symbol. The default is tab\$ (tabulator) but users might use e.g. the comma for an csv file.

user_feedback:

The script reports which file is being handled and the percentage of all files in a directory that have been handled. By setting this switch, any output (other than error and warning messages) will be suppressed. This will decrease processing time, but there is no feedback other than an increasing size of the result file.

user_feedback = 1 Gives user feedback (default)

user_feedback = 0 No user feedback

np_string\$ (noprogess string):

PRAAT itself reports its activity when computing intensity and pitch. These outputs can take substantial time. (This string is actually positioned where in PRAAT the `noprogress` is written.)

np_string\$ = "" (= empty string) normal PRAAT feedback

np_string\$ = "noprogess" No PRAAT feedback (default)

dummy_data_header (dummy data header line):

Statistic programs like JMP decide the type of data for each column on basis of the first data line.

To force correct data-type assignment (due to missing data in the first data row) a dummy data line of text, 0 and 0.0 can be generated to force correct data-type assignment.

dummy_data_header = 0 No dummy data line

dummy_data_header = 1 Dummy data line with "Dummy" for strings and "0.0" for numerals

duration_in_ms (duration reporting):

duration_in_ms = 1 Duration is reported in milliseconds (default)

duration_in_ms = 0 Duration is reported in seconds

missing_values_symbol:

When PRAAT cannot compute a value it uses internally the string "- undefined -". This script replaces this string by the string given in this field. For a subsequent analysis of the data with JMP, the dot indicate missing values, for R it would be NA (default: NA).

Current version and date:

6.2.0, 10-aug-2022

Known problems:

Version 5_0_x reported wrong values if the (t)ime display option was selected.

Planned extension:

Handling of point tiers

Allow spaces in labels

Allowing more than one tier for interval/point specification

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