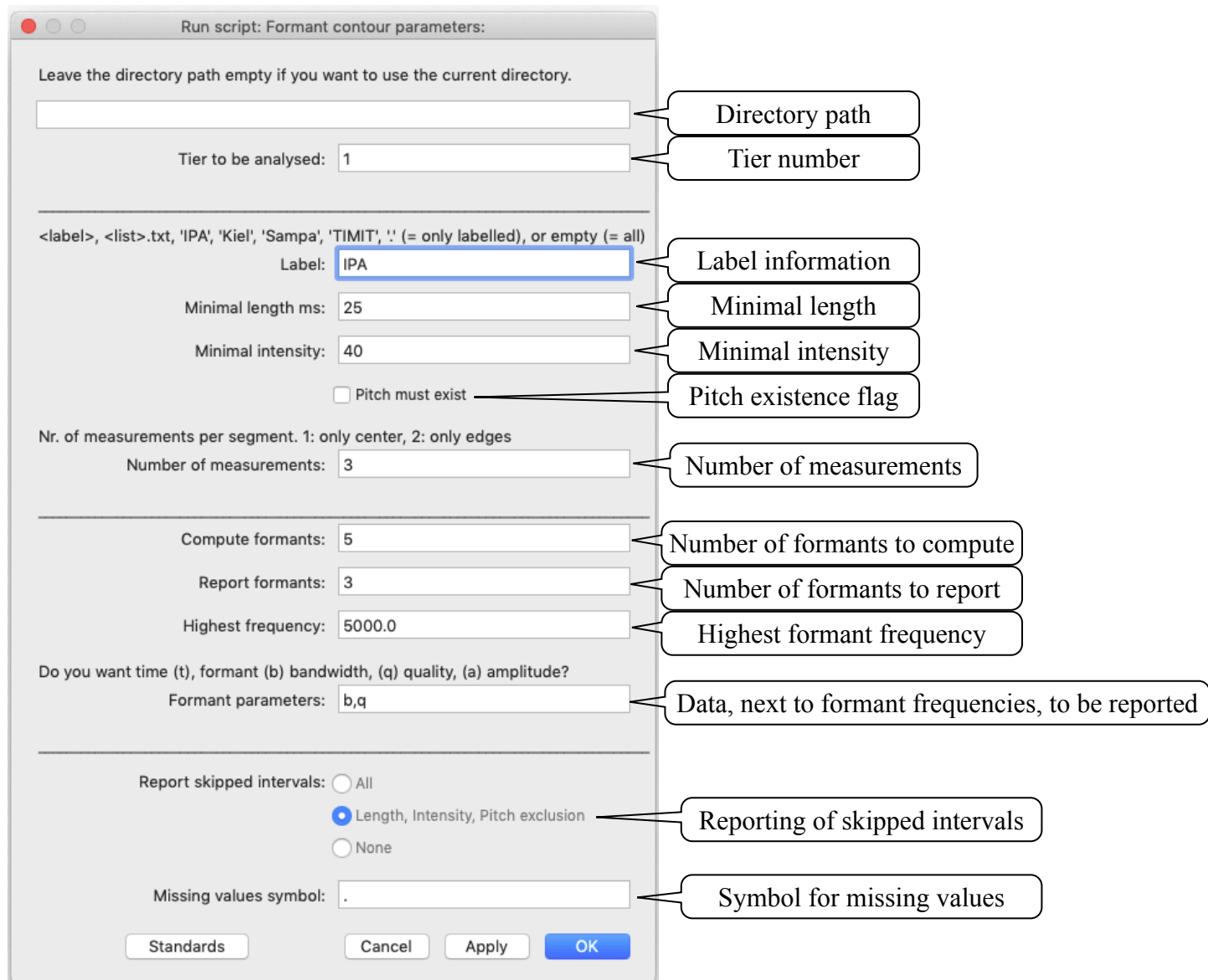


## Formant\_contour\_4\_2.praat

### Task:

This script opens all sound files in a directory and associated TextGrids (if they exist), computes formants, bandwidths, amplitudes and Q-values of all segments, by stepping through each segment, and writes the results as a percentage of the time of a segment to a text file with the name “formant\_contour\_results\_<date>\_<time>.txt”. If no TextGrid exists, the whole file as taken as one segment. The length of the segment, and the pitch and intensity values are reported along with the formant data.

By choosing only one step per segment, the script will report the formant, bandwidth and Q-values at the center of the segment, choosing two steps will cause the reporting of the values at the edges of a segment.



### Parameter:

Please read the **Programming** section for more internal parameters that can easily be changed.

**Directory path:**

The script handles all sound files in a directory specified in this field. If this field is left empty, 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).

**Tier number:**

The number of the interval tier to be analysed.

**Label information:**

The segments (= intervals in PRAAT terminology) that should be analysed can be specified in several ways (in case no TextGrid file is found, 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 segments that have this label. This function is case sensitive.

**<list>.txt:**

Giving a text file (e.g. label\_list.txt ) will report all segments 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
```

**'ipa':**

Writing ipa in this field will use the IPA notation for vowel segments.

List of IPA vowels (additional marks : : ' h ~ ¨ x are possible):

```
a, ɑ, æ, e, ɐ, ə, e, ε, ɛ, ɜ, u, ʊ, ɨ, ɪ, ɛ̃, ɪ̃, ɔ̃, ɒ, ø
```

**'kiel':**

Writing kiel in this field will use the Kiel-Corpus notation for vowel segments.

List of Kiel-Corpus vowels:

```
ə, 2:, ɐ, ɜ, a, a:, E, e:, E:, I, i:, O, o:, U, u:, Y, y:
```

**'sampa':**

Writing sampa in this field will use the SAMPA notation for vowel segments.

List of SAMPA vowels (additional marks : ' ` ~ % are possible)

```
A, {, ɐ, Q, E, @, 3, I, O, 2, 9, &, U, }, V, Y
```

**'timit':**

Writing timit in this field will use the TIMIT-Corpus notation for vowel segments.

List of TIMIT vowels (upper and lower case are handled):

```
aa, ae, ah, ao, aw, ax, axr, ay, eh, er, ey, ih, ix, iy, ow, oy, uh, uw, ux
```

**':':**

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

**empty:**

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

**Minimal length:**

The minimal length of a segment (in milliseconds) to be analysed. Setting this value to '0' will analyse all selected (by the **Label information**) segments.

**Minimal intensity:**

The minimal RMS-intensity (in dB or as quantile of the whole file) of a segment to be analysed. A value greater equal 1 is interpreted as an absolute dB value (e.g. '50' means a minimal average RMS-amplitude of 50 dB for a segment). A value between 0 and 1 is interpreted as a quantile of the whole file (e.g. '0.1' will use the 10% quantile of all RMS values of the whole file as lower boundary for a segment). Setting the **Minimal intensity** to '0' will analyse all segments that are selected by the **Label information**.

**Pitch existence flag:**

If this field is checked, only intervals where PRAAT can compute a mean pitch will be reported.

**Number of measurements:**

Number of measurements per segment. Setting this value to '1' will report only the formant data from the center of the segment. Setting it to '2' will report the data from the edges of the segment. Note that this value is the number of points to be reported, not the number of intervals within a segment (e.g. setting this value to '10' will report data at 0%, 11%, 22%, ... 89%, 100% of a segment).

**Number of formants to compute:**

Number of formants that should be used for the LPC-analysis. '5' is a usual value when the highest frequency for analysis is set to 5,000 Hz.

**Number of formants to report:**

Number of formants that should be reported in the output. Often, only the first two formants are used for further investigation and there is no need to report, for example, all five computed formants. It is advisable to report at least one more formant than are needed for an investigation to be able to spot 'shifted' formants (e.g., if the analysis added an additional formant between F1 and F2; in that case, the values for F3 are the real F2 values).

**Highest formant frequency:**

Upper bound for the formant computation. Usually, this is set to 5,000 Hz (PRAAT recommends 5,500 Hz for female voices, but I do not know of any documented investigation supporting that – my own research (to be published) shows a disadvantage for 5,500 Hz).

**Data, next to formant frequencies, to be reported:**

By default, the script reports (see **Result file** below) the file name, name of the segment, starting time of the segment, duration of the segment. Up to 6 additional data can be reported by specifying letter separated by commas or spaces in this field (e.g. b,q) to report data for the particular point in time where a measurement takes place:

- a Amplitude of the formant in dB. This value is normalised by the intensity of the signal at the selected time point. (The intensity is subtracted from the computed formant intensity and an arbitrary value of 80 dB is added. This will provide values that are reasonably compatible between different amplitude levels of a signal, although the values should not be treated with

care. The arbitrary value of 80 dB was chosen to shift the dB values into a comfortable range (a 16-bit quantised recording would be at 92 dB, but by experience, most recordings are about 12 dB below that on the average; furthermore).

- b** (3 dB) Bandwidth of a formant. A smaller bandwidth indicates a ‘sharper’ formant peak.
- i** Intensity of the signal.
- p** pitch of the signal.
- q** Quality (= formant frequency divided by formant bandwidth:  $Q = F/B$ ) of a formant. A smaller Q-value indicates a ‘sharper’ formant peak independent of frequency.
- t** Time the center of the analysis window in seconds (absolute time in the sound file). Note that inspecting the same time point in PRAAT interactively usually gives slightly different results (and might change with the exact position and size of the signal window) since PRAAT computes the data on the fly and the positions of the (25 ms) analysis windows change. Consequently, different parts of the signal go into one analysis window depending on where the left edge of the signal display window (*Edit window* in PRAAT terms) is. Reporting of skipped intervals:

### Reporting of skipped intervals:

Handling of segments which are either excluded by the **Label information** or because they do not fulfil the **Minimal length**, **Minimal intensity** or **Pitch existence** criteria:

#### All:

All segments 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 segment analysed, e.g. the listing will show the data for a vowel, but also the labels of the segments before and after it, which are not vowels.

#### Length, Intensity, Pitch exclusion:

All segments that fulfil the **Label information** are reported, but fail either the length, intensity or pitch criteria. Only File, Label, Start[s] and Duration[ms] are reported (see **Result file** below), all other values are set to the missing value symbol (see below).

#### None:

No segments that are excluded because of any criteria are reported.

### Symbol for missing values:

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.

### Result file:

The script generates a raw text file with tab-delimited data and a header line. The file name is of the form “formant\_contour\_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 “formant\_contour\_results\_190322\_150110.txt” was created on the 22nd of March 2019 at 3pm, 1 minute and 10 seconds. The parameters controlling the computation are listed at the end of every result file.

The result file for a parameter setting to report 2 formants with their bandwidths and the time of measurement (i.e. center of analysis window), 5 measurements per segment and reporting excluded segments (here: i: 1t 2.8991 s because it was shorter than 25 ms):

File	Label	Start(s)	Duration(ms)	Intensity(dB)	Pitch(Hz)	%	timepoint(s)	F1(Hz)	B1(Hz)	F2(Hz)	B2(Hz)
g071a000	u:	1.0139	31.6	72.7	127.6	0	1.0267	321	265	1083	122
g071a000	u:	1.0139	31.6	72.7	127.6	25	1.0282	321	281	1096	127
g071a000	u:	1.0139	31.6	72.7	127.6	50	1.0297	321	296	1108	132
g071a000	u:	1.0139	31.6	72.7	127.6	75	1.0312	320	312	1120	138
g071a000	u:	1.0139	31.6	72.7	127.6	100	1.0327	318	326	1131	140
g071a000	a	1.1676	60.3	74.7	134.1	0	1.1804	466	380	1476	292
g071a000	a	1.1676	60.3	74.7	134.1	25	1.1891	538	272	1475	357
g071a000	a	1.1676	60.3	74.7	134.1	50	1.1977	585	224	1407	210
g071a000	a	1.1676	60.3	74.7	134.1	75	1.2064	619	227	1385	244
g071a000	a	1.1676	60.3	74.7	134.1	100	1.2151	631	232	1382	248
g071a000	i:	2.8991	18.9	69.1	147.6	.	.	.	.	.	.
g071a000	a:	2.9907	57.9	73.3	143.9	0	3.0035	531	249	1198	184
g071a000	a:	2.9907	57.9	73.3	143.9	25	3.0116	571	262	1240	169
g071a000	a:	2.9907	57.9	73.3	143.9	50	3.0197	557	285	1229	169
g071a000	a:	2.9907	57.9	73.3	143.9	75	3.0278	489	324	1214	169
g071a000	a:	2.9907	57.9	73.3	143.9	100	3.0359	408	343	1184	166
g071a000	a:	3.1648	120.4	75.6	142.4	0	3.1776	588	228	1165	127
g071a000	a:	3.1648	120.4	75.6	142.4	25	3.2013	646	171	1221	190
g071a000	a:	3.1648	120.4	75.6	142.4	50	3.2250	657	161	1245	141
g071a000	a:	3.1648	120.4	75.6	142.4	75	3.2487	684	193	1268	125
g071a000	a:	3.1648	120.4	75.6	142.4	100	3.2725	539	299	1252	176
g071a000	i:	3.4601	48.1	72.7	142.5	0	3.4729	314	79	1848	399
g071a000	i:	3.4601	48.1	72.7	142.5	25	3.4785	316	72	1945	335

Analysis started: 19-May-20 12:19:55

Tier: 4

Labels: kiel

Minimal length: 25 ms

Minimal intensity: 40 dB

Pitch must exist: No

Formants computed: 5

Highest formants frequency: 5000 Hz

Window size: 25.6 ms

Pre-emphasis: 50

**Information for programming:**

Some parameters can be set underneath the ‘form’ section in the script. these are:

**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 (or put them into PRAATs ‘form’ window).

**Sound file names:** The default extension for sound files is “.wav”. This parameter can be changed in the script.

**Positioning of analysis window at the edge of a segment:**

do\_not\_cross\_segment\_boundary = 0    The window is centred on the boundary  
do\_not\_cross\_segment\_boundary = 1    The window stays within the segment (i.e., the left or right edge of the analysis window is on the edge)

**Frequency unit:**

The units that should be used for the analysis. ‘Hertz’ and ‘Bark’ units can be selected.

unit = 1            “Hertz”  
unit = 2            “Bark”

**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 = 0    Gives user feedback  
user\_feedback = 1    No user feedback

**Noprogress string:**

PRAAT itself reports its activity when computing pitch, intensity and formants. All these outputs can take substantial processing time, sometimes longer than the actual computation time. (This string is actually positioned where in PRAAT the `noprogress` is written.)

np\_string\$ = ""                    (= empty string) normal PRAAT feedback  
np\_string\$ = “noprogress”    No PRAAT feedback

**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 reporting:**

duration\_in\_ms = 1    Duration is reported in milliseconds  
duration\_in\_ms = 0    Duration is reported in seconds

**Formant computing parameters:**

pre\_emphasis = 50.0  
time\_step = 0.0  
window\_length\_ms = 25.6

**Pitch computing parameters:**

low\_pitch = 75

high\_pitch = 600

**Current version and date:**

4.2, 19-may-2020

**Known problems:**

None

**Planned extension:**

None

**Contact:**

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