
NAME

key — estimate the key (tonic and mode) of a passage

SYNOPSIS

key [-af] [*inputfile* ...]

DESCRIPTION

The **key** command estimates the key of a given musical passage using Krumhansl's tonal hierarchy method. The command is restricted to identifying only those keys within the common major/minor tonal system. Modes outside the major/minor system are not recognized.

The input may be either ****semit**s or ****kern** representations. The program adapts to input having varying numbers of staves each with a different interpretation.

The non-optional output consists of three items of information:

1. the *estimated key* for the passage,
2. a *coefficient of correlation* (Pearson's "r") that measures how well the pitch organization of the musical passage conforms to an idealized major or minor key template, and
3. a *confidence score* that indicates how distinctive the key-match is compared with other competing keys. A confidence score of 100% indicates a very strong confidence in the key estimate; low confidence scores indicate that there is at least one other key that is a good alternative candidate.

The algorithm is based on Krumhansl's perceptually-based key-finding method (see reference). This method compares a given pitch-class frequency profile with two perceptually-determined prototypes (one each for major and minor modes). The coefficients used for these prototypes are those determined by Krumhansl & Kessler (1982). In order for the algorithm to work properly, durational information ought to be provided. When using ****semit**s format input, best results are achieved when the input has a *time-base* format. (See the **timebase** (4) command.)

The **key** command is poor at distinguishing less common enharmonic keys. For example, it is unable to distinguish the following enharmonic spellings for tonic pitches: C-flat, B-sharp, E-sharp, F-flat. Also, **key** is unable to distinguish enharmonic spellings involving double- or triple- sharps or flats. That is, G double-sharp major is identified as A major. **KEY** is able to distinguish the more common enharmonic spellings (such as E-flat versus D-sharp).

There is no special output file-type designation.

OPTIONS

The **key** command provides the following options:

- a** output correlation values for all keys
- f** output frequencies for all pitch-classes
- h** displays a help screen summarizing the command syntax

Options are specified in the command line.

The **-a** option will show all of the correlation coefficients for all 24 of the (enharmonic) major and minor keys.

The **-f** option will output the relative frequencies for each of the twelve chromatic pitch classes (in quarter-note durations).

SAMPLE OUTPUT

Without any options, typical outputs are of the following form:

```
Estimated key: B minor      (r=0.8442)      confidence: 51.3%
```

With both the **-f** and **-a** options invoked, a typical output is given below. The **-f** option causes 12 pitch-class tallies to be outputted. These values are given in accumulated whole-note durations. For example, the output: "PC[5]: 4.25" means that the enharmonic pitch-class "F" appears in the passage for the equivalent of 4 whole-notes plus a quarter-note duration. If inputs do not include durational information (such as in ****semit**s input), each note is assigned the nominal duration of a quarter-note.

```

PC[0]: 5.50617
PC[1]: 0.375
PC[2]: 6.1875
PC[3]: 0
PC[4]: 5.625
PC[5]: 4.25
PC[6]: 1.25
PC[7]: 5.6875
PC[8]: 0.5
PC[9]: 4.625
PC[10]: 0.625
PC[11]: 4.40625
Tonic[0]      major 0.791744      minor 0.0962456
Tonic[1]      major -0.747033     minor -0.337397
Tonic[2]      major 0.506935      minor 0.535771
Tonic[3]      major -0.404982     minor -0.720203
Tonic[4]      major 0.0308014     minor 0.64007
Tonic[5]      major 0.475928      minor -0.13113
Tonic[6]      major -0.735928     minor -0.157988
Tonic[7]      major 0.772586      minor 0.205276
Tonic[8]      major -0.574103     minor -0.487743
Tonic[9]      major 0.232566      minor 0.66303
Tonic[10]     major -0.014411     minor -0.625767
Tonic[11]     major -0.334105     minor 0.319835
Estimated key: C major      (r=0.7917)      confidence: 5.7%

```

The **-a** option causes the tonic major and minor correlations to be printed for each pitch-class. Good key matches have a high positive correlation; the maximum value is 1.0.

In the above sample output, notice that the confidence score for the predicted key of C major (Tonic[0]) is quite low. The reason for this is that the correlation coefficient for A minor (Tonic[9]) is rather close to that for C major (0.791744 versus 0.66303) Note that confidence scores may be used as a simple index for estimating the tonal ambiguity or degree of chromaticism for a passage.

PORTABILITY

DOS 2.0 and up, with the MKS Toolkit. OS/2 with the MKS Toolkit. UNIX systems supporting the *Korn* shell or *Bourne* shell command interpreters, and revised *awk* (1985).

SEE ALSO

****kern** (2), **kern** (4), ****semit**s (2), **semit**s (4), **timebase** (4)

WARNINGS

As noted, **key** is very limited. When used to find “the key” of a particular work, it frequently produces incorrect results. In particular, for much tonal music, **key** has a tendency to

mistakenly identify the dominant of the key rather than the tonic. See also the discussion under “proposed modifications.”

BUGS

The current version does not handle multiple stops in ****kern** spines.

NOTES

Currently the program is sensitive to ****semit**s and ****kern** interpretations. If no recognizable interpretation is given in the input stream, **key** assumes ****kern** compatible input. This may lead to erroneous results.

REFERENCES

Krumhansl, C. *Cognitive Foundations of Musical Pitch*, Oxford: Oxford University Press, 1990, Chapter 4.

Krumhansl, C. L. & Kessler, E. J. “Tracing the dynamic changes in perceived tonal organization in a spatial representation of musical keys,” *Psychological Review*, Vol. 89 (1982) pp.334-368.

PROPOSED MODIFICATIONS

The **key** command is likely to appeal to two types of uses: (1) those who are interested in knowing the key of a musical work without having to examine the work manually, or (2) those who are interested in a perceptual characterization of the tonality of a passage. These goals are quite different. The current **key** command implements the second approach; **key** is not very good at consistently and correctly identifying “The Key” of typical tonal works. Another command (or variant of the **key** command) might use contextual heuristics (such as looking at the final chord of a work, or examining cadences) in order to better identify “the key” of a work.