Runabc.tcl

Updates of this text

If you have ghostscript installed on your system, runabc has a new editor called **live editor** which updates the music score immediately after you make any changes. This editor automatically pops up when you start runabc; however, you can turn it off by from the Options menu. The **options menu/abc executables** now has a separate entry for **ghostview** and **ghostscript**. Ghostview specifies a path to any PostScript file viewer, for example on Linux I use evince and on Windows I use SumatraPDF. Ghostscript refers to the ghostscript package which is still needed on Windows if you are using SumatraPDF.

Runabc can now be installed in a central location and used by different users. When you start runabc for the first time, it will create a folder called runabc_home in your home directory. This folder will contain runabc.ini and other temporary files used for playing and displaying tunes. This folder will be the current directory used by runabc and other applications. If you have abcm2ps format files, you may wish to save copies here too. (If you wish to place the runabc_home folder elsewhere you need to specify the location using the environmental variable called RUNABC path. The program requires read/write access in that location.)

On Windows the runabc executable could be installed in the Program Files (x86) folder. On unix systems, it could be installed in /usr/bin/ or /usr/local/bin/.

The TclAbcEditor guitar chord interface has been modified to accomodate the new functions 'main' and 'auto' - 2015/12/24.

The section 'Options Menu' was expanded 2015/09/03.

The section 'Getting Started' was rewritten 2014/10/20.

The section 'Play Options/ Arrangement' was rewritten 2014/06/10.

new Options/character encoding and Options/load runabc extension 2014-02-05. Fixed missing install.html link.

Ability to save a histogram as a PostScript File (2013-11-04).

New drum event viewer in Midi menu (2013-09-13).

The most significant change is that provided you use abcm2ps to view the music in common music notation, you no longer need to use ghostscript. You have the option to create either a xhtml or svg formatted file which can be displayed by your internet browser. If you wish, you can still continue creating postscript (ps) output files and use ghostscript instead.

To use this feature, select **style** in the abcm2ps configuration menu and then select either **svg** or **xhtml** radiobutton. When you click on the **Display** button (printer icon), the selected internet browser should be invoked and the selected music should be displayed.

Other additions include **Pitch Histogram** , **Histogram Matcher**, and **Grouper**. The section **find bars** has been rewritten. Note that you need the latest version of abcmatch in the abcMIDI package in order for this to work.

To download runabc.tcl go to: top level

Introduction

Runabc is a graphic user interface to the abcMIDI package. This means that instead of running these programs in a command line window, using long commands such as

```
abcm2ps sample.abc -P -X -O out.ps
```

and then calling another program to view the postscript file out.ps, you merely click one button.

The abcmidi package consists of 7 modules; abc2abc, abc2midi, abcmatch, mftext, midi2abc, midicopy, and yaps. Runabc provides a graphic user interface to all 7 modules and contains many additional features. There are several programs which provide user interfaces to the abcmidi page, but this is the only one which supports all 7 modules.

Besides providing the basic functions for editing an abc file, the program contains many other features. You can play the tune at any tempo or key or assign different musical instruments without modifying the original file. You can easily add drum accompaniment. The built in editor has functions for adding harmony, adding guitar chords or grace notes, removing redundant guitar chords, and aligning the bars. You can search your entire collection of abc tunes for a tune containing a specific word or words in the title. You can perform the search on a fragment of the melody. Given a specific tune, you can search for other tunes which share similar motifs. You can expand a single voiced file with guitar chords and drum accompaniment into a multivoiced file.

Many abc tunes are grouped together into a single file. Runabc allows you to order the tunes by name, key signature, time signature, or X: reference number.

Runabc also provides many analysis tools for MIDI files. You can view the MIDI file in piano roll form and clip out

a particular section of the MIDI file. You can view the MIDI commands in textual form and filter out the commands which are of lesser interest. There is a graphical user interface to midi2abc a program used to convert a MIDI file to an abc file. Midi2abc has many runtime parameters and is rather complicated to use without a user interface.

Runabc provides context help. This means that when you click the help button, the button with a "?", the help text displayed contains information for the particular functions you are using.

Runabc has been expanding over the past 12 years that it has been available. This guide alone when formatted as a pdf file is over 60 pages long. In fact runabc could and should be split into 4 separate programs and each program would address a particular type of user. For example the midi analysis section of runabc has nothing to do with abc notation and is probably unknown to the midi user community. By making it a separate program, this tool would be indexed by Google and would be discovered by more users.

If runabc were split into several programs here is how it could be done.

abccore: this would consist of a program for editing, converting a selected abc tune to MIDI or PostScript format, listening to the tune and rearranging the instruments, displaying the tune in common music notation and controling the format. The editor is very powerful and contains modules for adding guitar chord accompaniment, adding harmony, aligning bar lines in the abc representation, removing redundant guitar chords, removing all guitar chords, removing grace notes and etc.

midianalyzer: this would consist of a program to display the midi file in piano roll format, to display the midi file in

text format, to convert the midi file to abc format, to analyze the drum channel, and to extract some statistical patterns.

abcutilities: this would consist of a program for transposing the tune to another key signature, to extract a particular voice, to expand the guitar chords into a separate music line or abc voice, to add a separate voice for the drum channel, to reformat or reorganize the abc representation, and to create a file of incipits.

abcanalyzer: this would consist of a program for searching a large collection for tunes containing certain key words in the title, for certain musical bars or measures, for identifying groups of tunes containing common features, for matching a tune to other similar tunes, and for analyzing the tonality of the tune (minor, major, dorian, pentatonic, and etc.).

Unfortunately, breaking up the program would entail more work for me. Now I would have four instead of one application to maintain, document and distribute. Furthermore this would be less efficient in terms of memory space utilization. The size of each program as an executable would still be almost the same as runabc.exe. Most of the code in the executable consists of the tcl/tk interpreter and support function.

Runabc is a script written in tcl/tk 8.5. This is a scripting language like Java, Perl, Ruby, Python, Basic and many more. To run this script, you need to install the Tcl/Tk interpreter on your computer; however, fortunately for the PC and some other systems, the Tcl/Tk interpreter and runabc.tcl script can be packaged together into one executable less than two megabytes. The Tcl/Tk interpreter, is available for many systems including the Mac. This means that the program runs on the PC, on the Mac, on Linux, and many Unix based operating systems. Runabc does not run alone but also requires

the abcMIDI executables, a MIDI player and a PostScript or PDF file viewer.

Runabc.tcl no longer works properly with older versions like Tcl/Tk 8.3. To tell which version you are running, type in the command **info tclversion** while you are in the **wish** or **tclsh** command console.)

The installation of all the package components is not a trivial matter, (see install.html for more details).

Note the appearance of the windows shown here may differ depend on operating system you are using as well as the font thay you select.

Runabc saves its state in a initialization file called **runabc.ini**. Thus when the program is restarted, it opens the last abc file that you were viewing and all the user preferences. Runabc.ini is updated each time you exit runabc. Runabc.ini is a regular text file that can be viewed and edited using any text editor; however, with few exceptions (which are noted in this documentation) all the parameters can be modified using the runabc.tcl user interface. If you delete runabc.ini, then runabc will start off with its factory setting as if you are running the program for the first time.

Main Menu

The main menu consists of a row of 13 buttons shown above. These buttons are listed here

- TOC -- table of contents
- Edit menu
- Utilities
- Play selection
- Play option menu

- Abc to PS options
- Display music
- Console
- Search menu
- Midi menu
- Options menu
- Help
- Quit

The rest of the document, describes the functions associated with the menu buttons; but here is a short overview.

The key functions of runabc are displaying the music notation of a tune, converting the tune to a MIDI file and playing it, and editing the tune. Runabc does not perform these functions by itself. When you click the Display music button, runabc finds the tune in the collection and creates a temporary file of just this tune. Next it calls a abc to PostScript converter like abcm2ps to convert this temporary file to a PostScript file (usually called Out.ps). Finally, runabc calls a PostScript file viewer to show this file on the screen. The Play Selection button behaves similarly. A temporary file with the selected tune is produced. That file is converted to a MIDI file by calling abc2midi. A MIDI player is called to play this MIDI file. These three functions are basic to many abc graphic user interface programs.

One of the key features of runabc is the ability, to modify how the tune is played. Few abc files have tempo markings or indications or MIDI declarations which indicate how the melody and accompaniment are to be played. As a result the MIDI files do not play at the right tempo and they are all played on an acoustic piano, the default MIDI instrument. Runabc contains configuration menu buttons which allow you to change these defaults. So without modifying the original files, you can hear the tunes the way they should sound like. Similarly, there are

configuration menus allowing you to change how the sheet music is printed.

Other top menu buttons provide access to many other useful utilities. The MIDI button is designed specifically for decoding MIDI files using the program midi2abc. The MIDI file can be converted to an abc file, it can be viewed in text mode, or it can be viewed graphically.

The search menu, is designed for handling a large collection of music. You can search for all the tunes having a specific word in the title. You can search for all the tunes containing musical pattern in a specific bar or group of bars. You can group tunes which have common patterns in the melody line.

The utilities menu contains a random set of functions. These include the ability to transpose the music using abc2abc and the ability to expand the guitar chords into a separate voice in the abc file.

Getting Started for the First Time

If you use the runabc_setup.exe to install runabc on Windows it should do most of the work automatically including the installation of the abcmidi and abcm2ps executables. The program can now be installed in the 'Program Files (x86)' folder. Runabc will now create a folder runabc_home in your home directory which will be used for storing the runabc.ini file and other temporary files that are needed.

If the runabc executable was installed using runabc_setup then runabc and its uninstall program should be on your 'start' button.

If you wish to run the source code runabc.tcl on Windows then you will need to install the tcl/tk 8.5 package. Put runabc.tcl and runabc.ico, in any folder. I usually put it in a folder called something like **abc** and add the various

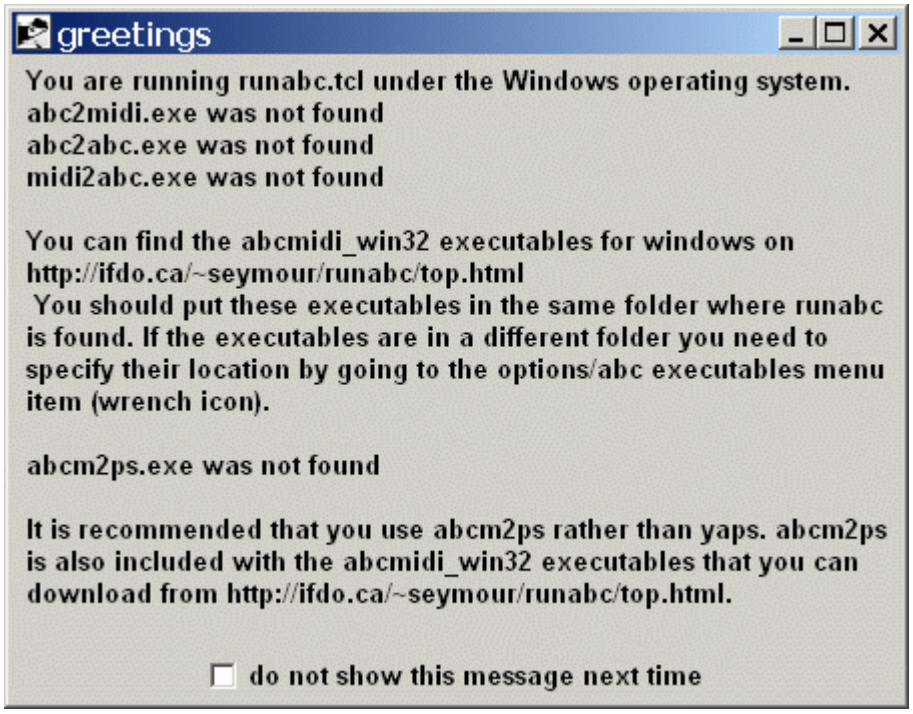
other executables that are needed like abc2midi.exe, abc2ps, etc into the same folder.

You start runabc.tcl on Windows by clicking on the file runabc.tcl. Assuming Tcl/Tk is installed on your system, the Tcl/Tk interpreter will start and automatically run runabc.tcl. On other systems such as Unix, Linux and etc. it may be necessary to start runabc.tcl using a command line such as "wish runabc.tcl".

For Unix, you have the same flexibility however the folder must have execution/read/write access for all users. Runabc will also create a runabc_home folder in your home folder where it will place and modify the runabc.ini file. For Linux, there is a runabcexe executable which has tcl/tk built-in. You can put runabcexe in one of the system folders (eg. /usr/bin or /usr/local/bin) and the program will be available to all users. Each user will have their own copy of runabc.ini in their own runabc_home folder.

The first time runabc.tcl starts it checks whether it can find the abcMIDI package and other helper executables. The results are reported in a window which may look like

this.

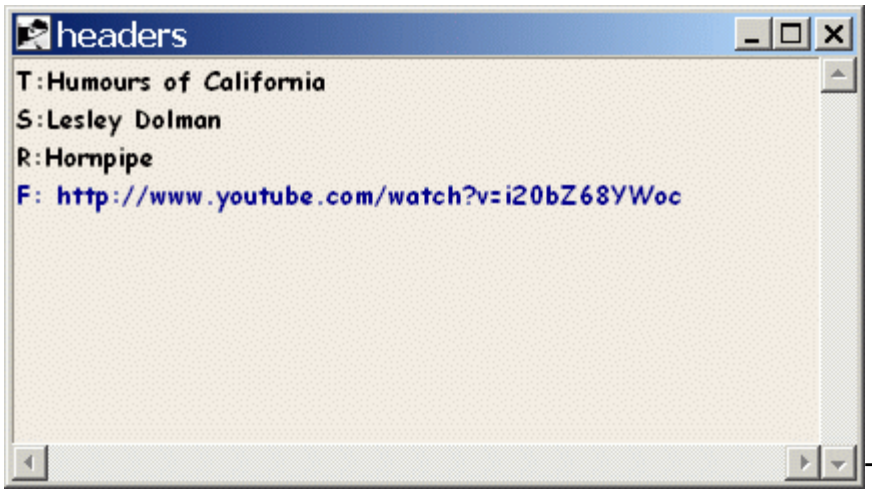


You should address any of the problems reported since the program cannot operate properly. To repeat this check, exit and restart the program. Alternatively, you can click on the options/greetings menu item (under the wrench icon).

The main screen to runabc.tcl consists of a series of buttons and a list of tunes contained in an a specific abc file.

Initially the tunes are ordered as they appear in the file; however, by clicking on the header buttons (which appear in a small font) you can order the tunes by X: reference number, key signature, meter, or title. Clicking on the same button will toggle the order from ascending to descending.

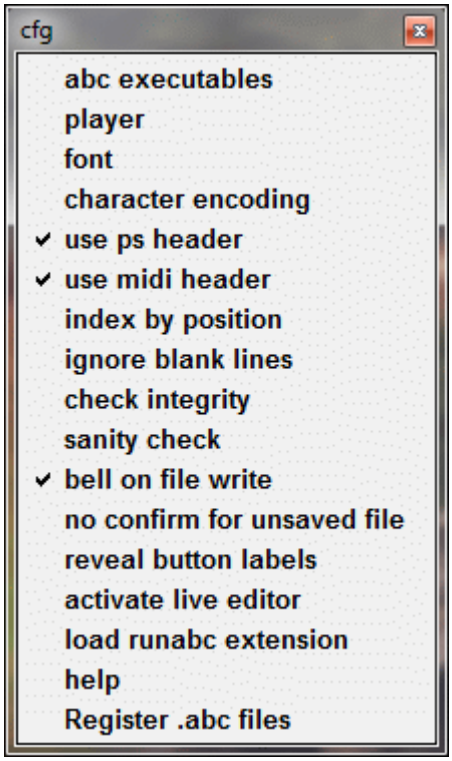
A light yellow box just above the table of contents list some of the header fields for the selected tune. The symbol gs: indicates the tune may contain guitar chords. The symbol %%MIDI indicates that MIDI directives are present in the selected tune. Clicking on this box will display the fields in more detail in a new window called **header**. A sample window is shown here.



The items highlighted in blue are web links. If you click on one of the items, it will open an internet browser for that site. Recent abc tunes, may contain a F: field which contain a link appropriate to this tune. For example it may direct you to a YouTube video.

Options Menu

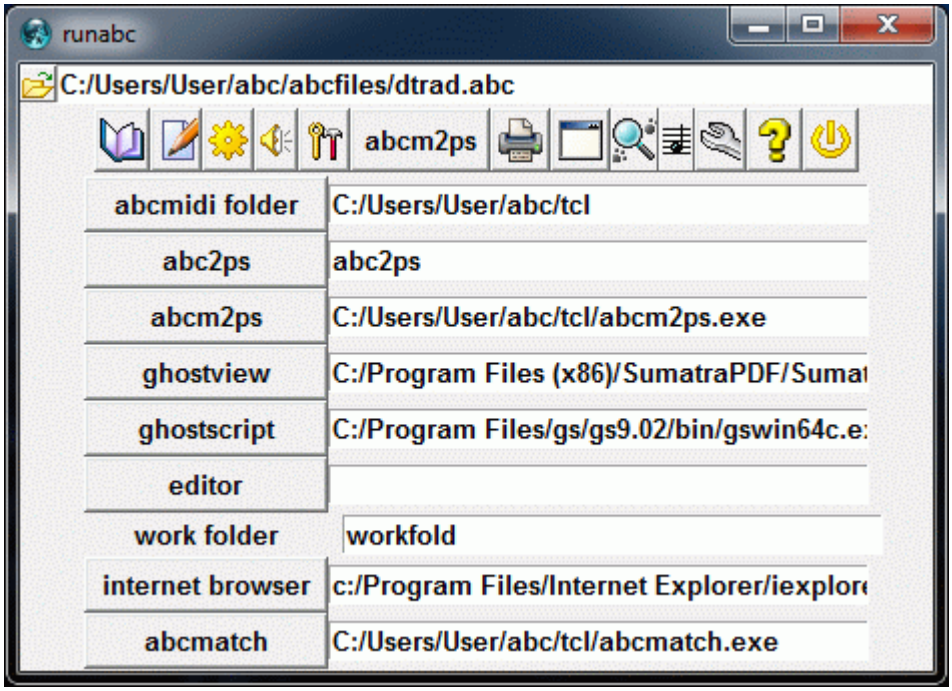
If you are running the program for the first time, you should first click the **Options** menubutton. This is the button showing a wrench. The following menu will be displayed. shown below.



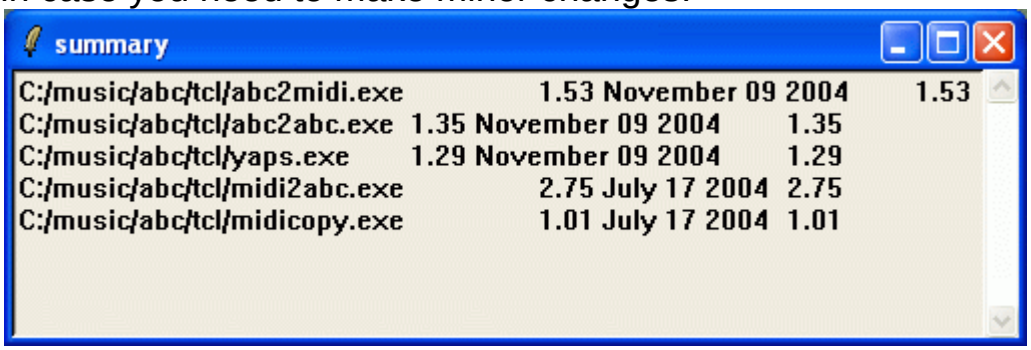
All of these menu items shall be explained here, however, there is also a context help for most of the menu items if you click the 'help' menu item. If you are running runabc for the first time you should look at 'abc executables', 'player', 'font', 'check integrity', and 'sanity check'. The other menu items will make more sense after you have had more experience using runabc.

Assuming the character font is readable on your computer, you should first select menu item **Options/abc executables**. Otherwise you should choose **Options/font** and read the appropriate section in this documentation right away.

abc executables



All your abcmidi applications (abc2midi.exe, abc2abc.exe, yaps.exe, midi2abc.exe and midicopy.exe) should be in the same folder. Either enter the path name of this folder in the abcmidi folder entry box or start the browser by clicking the button labeled **abcmidi folder**. Note that you should separate directories with a forward slash "/" even when you are running on a Windows operating system. Tcl/Tk treats backslashes differently. Once you have selected the folder, runabc will list the version numbers and expected version numbers in a summary window shown below. If any of the files were not found, they will be indicated. The the runabc/cfg window will be expanded to include all the abcmidi paths, in case you need to make minor changes.



Either one of the applications abc2ps, abcm2ps, and yaps convert abc files to PostScript files which represent the music graphically in common musical notation. Set the path names to the other applications that you may use such as abc2ps.exe, abcm2ps. If you wish to use a particular abc to postscript converter such as jcabc2ps or jaabc2ps, you may substitute its path for abc2ps. It is good idea to have a choice of several abc to postscript converters since some applications work better on some abc files. I find that the yaps converter can handle certain abc files which would cause abc2ps or abcm2ps to crash. You can change the default converter by going to the menu button which labeled as one of the following (yaps options, abcm2ps, abc2ps or other ps) in the second row of buttons and selecting ps converter cascade menu.

In order to be able to display postscript files on your screen, you will need to specify the path to a postscript viewer program besides the label ghostscript. This involves installing other packages on your system as PostScript viewers are rarely used except for some old public domain software. Unfortunately these packages are fairly big and does not come with this program or installation. For Linux I use gv or evince. For Windows I use Sumatrapdf. Sites where you download these viewers are indicated in the install.html web page. The postscript viewer program is called automatically when ever you click on the **Display** button. This is the button showing an icon of a printer. It is now possible to display the music without PostScript viewers if you are satisified in using only abcm2ps (which is sufficient). Abcm2ps can be configured to produce an XML *.svg (scaler vector graphics) file or an *.xhtml file which can both be viewed using an internet browser like **Firefox** or **Microsoft Internet Explorer**. Thus you can now manage fairly well without installing one of the PostScript viewers, provided that you configure runabc to produce an svg or xhtml file as described below. If you decide to go this way, you may skip the following note in italics but note it is

important to specify a path to your web browser in the above configuration window.

If you are using gsview on windows, you may wish to pass the -e argument so that a new gsview window does not appear each time you display another file. Unfortunately, you cannot pass program arguments in the entry box since tcl/tk assumes this is just part of the file or folder name. A simple way around this is to call gsview32.exe indirectly through a batch file. You can also use this batch file to convert the PostScript file to a Acrobat PDF file. For example, here is gsview.bat

```
REM execute gsview32.exe with the -e option
"C:\Program Files\Ghostgum\gsview\gsview32.exe" -e
Out.ps

REM convert Out.ps to out.pdf using gswin32.exe
"C:\Program Files\gs\gs8.53\bin\gswin32.exe" -dBATCH
-dNOPAUSE -sDEVICE=pdfwrite -q -sOutputFile=out.pdf
Out.ps
```

You would now specify the path to gsview.bat in the ghostview entry box. Note you may need to edit gsview.bat if gsview32.exe and gswin32.exe are not in the same locations on your system.

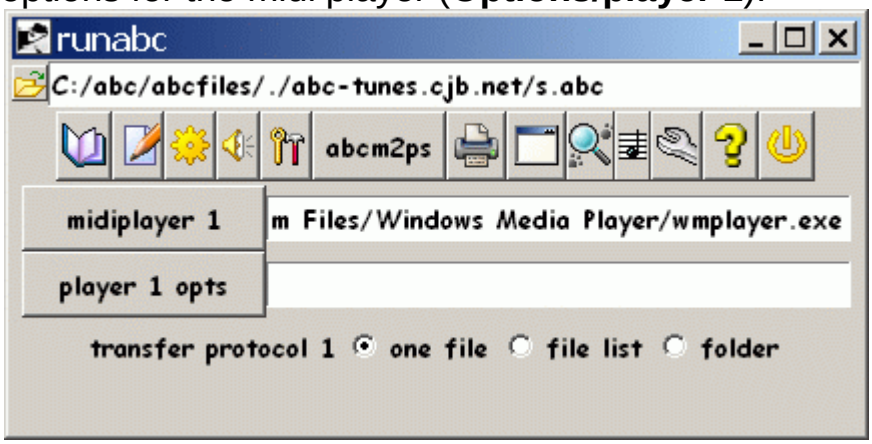
Though the script has its own editor for creating and editing abc files (with many special features), you may prefer to use your own editor (like vi, emacs, notepad...) for everyday work. You specify the path to the editor in the adjoining entry box.

When you edit a particular tune included in a compilation of tunes in a abc file, runabc extracts this particular tune and saves it to a abc file with a name derived from the title into a specified directory. The name of the directory is specified in the entry box besides work folder. You should specify the name of a folder to keep everything organized. If the folder does not exist, it will be created automatically. It is necessary to do things this way to remain compatible with the other editors.

Abcmatch is a program for performing searches on abc databases on your hard drive. You will need it when you use the **find** utility on the menu screen.

player 1

Now return to the Options menu button and configure the options for the midi player (**Options/player 1**).



You have the choice of specifying two midi players with their options. If you only have one midi player available then ignore player 2 configuration menu item. The selected midi player is chosen from the abc2midi options (second row of buttons).

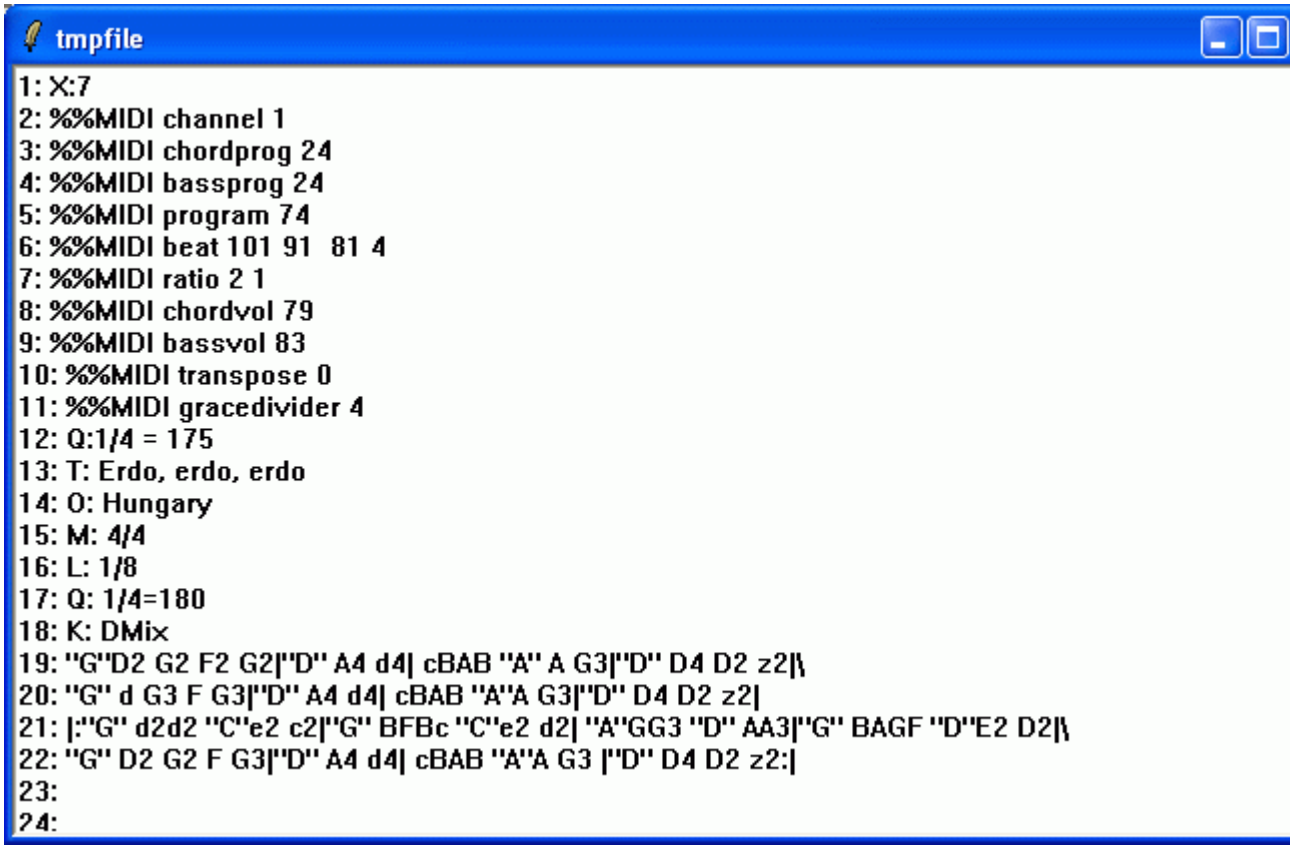
This configuration page is used to specify the path name to the midi player, any required run time options and the protocol for passing the midi files to the midi player. All midi players handle single files. Others can accommodate a list of midi files, while some will even accept a folder of midi files. The manner of passing the midi file(s) to the player is specified by the protocol. You may use any of the three protocols even if you are only passing one midi file to the player, provided the player supports this method. If you are passing a folder then the folder name should be given in the options entry box and the 'folder' radio button should be selected. It is necessary to do this manually since some midi players require the folder name to be preceded by a flag. Note

that in some operating systems there may be a limit in the length of the string containing the list of midi files.

X.tmp

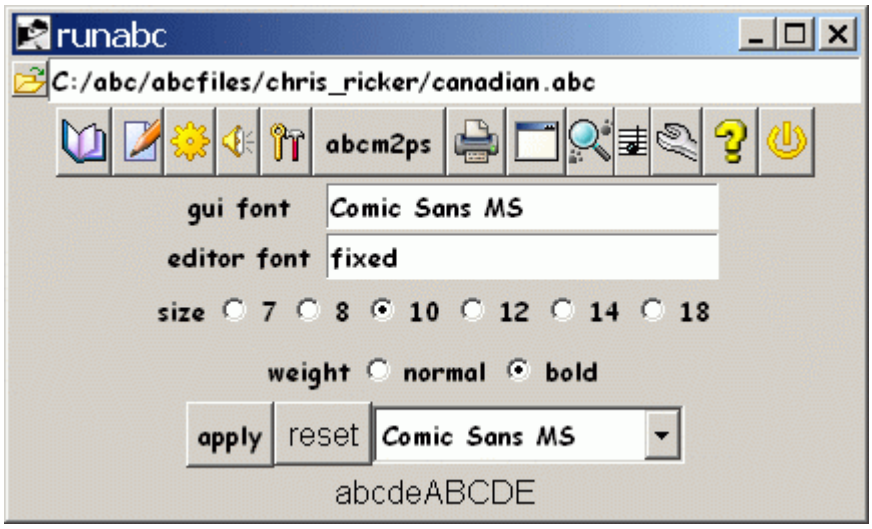
When you click the **Play selection** button (shows a picture of a speaker), runabc creates a file called X.tmp containing the selected abc tunes and puts it in a tmp folder in the same folder from which runabc.tcl is invoked. (If you wish to use a different subdirectory name instead of tmp, you should edit the contents of the midi_dir parameter in the runabc.ini file.) Prior to running abc2midi, any midi files beginning with the letter X are removed from the tmp directory. Then abc2midi is executed with the file X.tmp and it creates a new set of midi files. These midi files are sent to a designated midi player using one of three protocols. You are allowed to designate up to two possible midi players which have their own option entry box and protocol. A convenient way for viewing the X.tmp file is to click the edit/view X.tmp menu item. Line numbers are added so it is easy to review the error messages from abc2midi. A sample of

such file is shown here.



font

Go to the menu item **Options/font** and select the font size and weight ideal for your display.



The font size, is very useful for adjusting the size of all windows and buttons to match the resolution settings of your screen. The program uses two different fonts, one for all the buttons and controls and the other to display the table of contents and the editor. Any font is suitable for the former, but you should use an equally spaced font (eg fixed) editor. You enter the names of the fonts in the entry box followed by a carriage return. For tcl/tk 8.5 and higher a combobox at the bottom allows you to browse through the fonts available on your system. Samples characters of the font "abcdefg" are shown at the bottom right. You can get the list of available fonts by typing "font families" while running the Tcl/Tk interpreter (usually called wish). On my system (Windows 98) the list includes Courier, Arial, Century, Comic and many others.

If the font that you choose results in an unreadable screen when you run the script runabc.tcl, you can press the button labeled Reset. Alternatively, you can edit the runabc.ini file and changing the entries for font_family. In the worst case you can delete the entire line and tcl/tk and runabc will try to restore it to something reasonable. If the font you choose does not exist, Tcl/Tk chooses a standard font.

character encoding

It is unlikely that you will need to change the character encoding unless the abc files have European characters. If the characters in your abc file, look like

```
T: ~B~_Ä±k-Ä± Ger
C: HÃ¼seyin Fahreddin Dede
O: Turkey
```

it may be necessary to use a different character encoder. The trick is knowing which encoder to use. As a safe bet, you should try utf-8. Abcm2ps handles utf-8 so if the file uses this scheme, the lyrics and annotation should appear correctly. Click **apply** to activate this selection. If

you click the **reset** button, the program would revert to the system set on your computer. You may need to reload the table of contents (TOC) by doing an enter in the input file name entry box in order to see the effect.

use ps header

Most tune collections in abc files do not have a header of PostScript commands, so it will not make any difference whether you tick 'use ps header'. A few of these collections may have such a header which may look something like this.

```
%%pageheight  11.00in
%%pagewidth    8.50in
%%leftmargin   0.35in
%%rightmargin  0.35in
%%topmargin    0.35in
%%botmargin    0.25in
%%staffwidth   7.80in
etc.
```

before the first tune in the file. If you tick this checkbutton, then runabc will transfer the PostScript header information to abcm2ps when it tries to display the selected tune. In some cases the this header may contain important information so there is no harm including this data; however, in some cases this header may cause some unwanted information when you want to view a particular tune in the collection. In such situations you may want to uncheck this option.

use midi header

A midi header contains a collection of %%MIDI commands which occur before the first tune. Most tune collections do not contain such headers so again it will not make any difference whether you check or uncheck this option. However, for some collections you may need to check this option in order that the abc tune is converted correctly to the MIDI file.

ignore blank lines

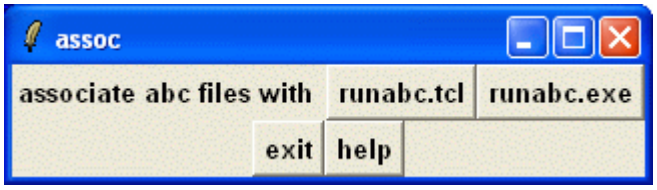
The abc standard uses a blank line to separate abc tunes in a compilation of tunes in a file. Unfortunately, different computer platforms use different **end of line** conventions, (eg. carriage/return linefeed, carriage/return, or linefeed) which get in the way of this convention. On unix, there are programs called dos2unix, unix2dos, mac2unix, etc. which convert a text file to the appropriate convention. If runabc has difficulty detecting the blank line or sees blank lines every where, it is suggested that you tell runabc to ignore this convention by ticking the check box ignore blank lines. Since each tune is supposed to start with an X: reference number, runabc will use this as an indication to separate tunes. Runabc requires that every tune has an X: reference number, T: title, and K: key signature.

sanity check

If you do not succeed in getting runabc working properly, you can do a sanity check and send me the runabc.out file by e-mail to me. The runabc.out file is a text file that you can view with any editor.

Register abc files

If you are running on Windows, operating system, you will see the button **Register abc files**. Clicking this button will display the following window which will allow you to associate abc files with runabc. I have not figured out how to use this feature on Windows 7 and higher.



Associating the abc files with runabc means that whenever you double click on an abc file it will automatically start up runabc with that file loaded. If runabc was already running, then double clicking on the file will load that file into the current process. The

association is set up through the Windows registry system.

Normally it is only necessary to create this association once. The association remains permanent (unless changed by another abc application). If you later decide to move runabc to a new directory, then it is necessary to reestablish the association the same way. If at sometime you wish to destroy or change this association, you can do this by going to 'Folder Options' which is accessed from the file manager under the menu item view or toolbar or somthing else (depending on which version of Windows you are running -- 95,98,ME,etc.); then select 'File Types' find ABC, select it and take the appropriate action (eg remove).

When you double click on abc file, windows starts up runabc and loads up the selected abc file. However, the current directory is the same directory where the abc file was found. This poses a problem, since the runabc.ini and tmp directory is normally in the same directory as where runabc was installed. To fix this problem, this function also stores the path name to the runabc install directory in the registry. Runabc determines whether runabc.tcl or runabc.exe are found in the current directory. If they are not found, then runabc looks in the registry to find out where they are located and changes the current directory to this location. Now it is possible to load and store the correct runabc.ini file.

Note if you use runabc.exe or runabc.kit, you should associate the abc files with runabc.exe or runabc.kit.

If you want a similar feature on other operating systems, it will be necessary for you to set it up yourself. You can put a link a runabc link in your ~/bin directory (i.e. in your home directory), so that it points to the location of runabc.tcl. For example, you would create the link by typing.
ln -s ~/abc/runabc.tcl runabc

Now you can start up runabc from any current directory. Furthermore, if you enter
runabc sample.abc
where sample.abc is some abc file in your current directory, then runabc will start up with this file preloaded. However, in order for this to work properly, you also need to create a new environment variable called RUNABCPATH which points to the folder where runabc.tcl is stored. On my system, I added the following to my .bashrc file.

export RUNABCPATH=~/abc/

If this is not done, runabc will create a folder called .runabc in your home folder (if such a folder does not exist) and cd to this folder. The runabc.ini file will be accessed from this folder and a tmp folder will also be created here.

Load runabc extension

It is unlikely that you will want to use this function. Occasionally, there is a need to modify the behaviour of runabc for a particular application. For example, you may want to record some of the results in a form so that some othe package like scikit-learn could use them. This feature is very specialized so it not something for general distribution. Clicking on this menu item will start a file browser where you can choose the tcl file that you wish to "source in". You must restart runabc.tcl to get back to the standard version. I have included a couple of such extensions in runabc/extensions/ folder which come with runabc.zip. There is some internal documentation in those files.

Main Features

At this point you are ready to start using the program. Click the file button at the top left, and use the file browser to select the desired abc file. Alternatively, you may enter the full file pathname in the entry box and

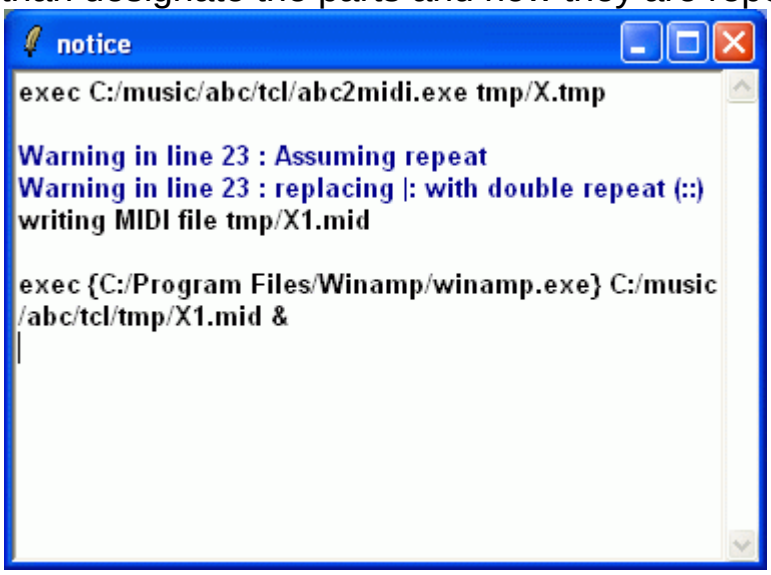
press 'return'. (The return key can be used to remove the focus, i.e. flashing cursor from many of the entry boxes you will see.) A list of all the tunes in that file should appear below. (If no index appears on the screen, it may be necessary to convert abc text file to unix, dos format or whatever is appropriate for your machine using utilities like dos2unix, see readme file for more discussion.) If you do not have those utilities, you may be able to accomplish this using the edit/copy to file command on the runabc console and create a new copy of the tunes in the abc file. This is discussed later.

Select a tune, using the mouse pointer. If you right click a particular tune, a short summary will pop up in a separate window. Then click the play button, to hear it on your speakers or the display button to view the tune in musical notation. You can select several tunes by dragging the mouse pointer, or clicking with the shift key (or control key) depressed. When you click the play or display button, all the selected tunes will be converted to midi files or a postscript file.

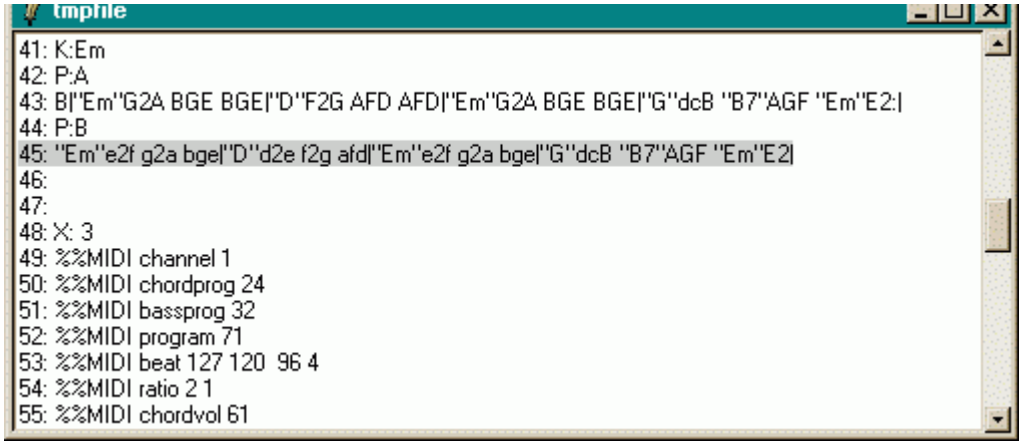
Other bindings: the arrow, page up/down, allow you to scroll up and down the table of contents. In addition the p key or space will play the current selection and the d key will display this selection.

When you right click any tune in the table of contents list box, a short menu (play, display, summary) will pop up. Clicking on play is equivalent to clicking on the speaker icon in the top menu array. A MIDI file of that tune will be created and played. Clicking on the display menu item, is equivalent to clicking on the printer icon in the top menu array. A postscript file will be created for the particular tune and this file will be displayed on the screen. Clicking on the summary menu item, will display the header items of that tune in a separate window called summary. If you want the entire tune shown then set 'summary_enabled' to 2 in runabc.ini.

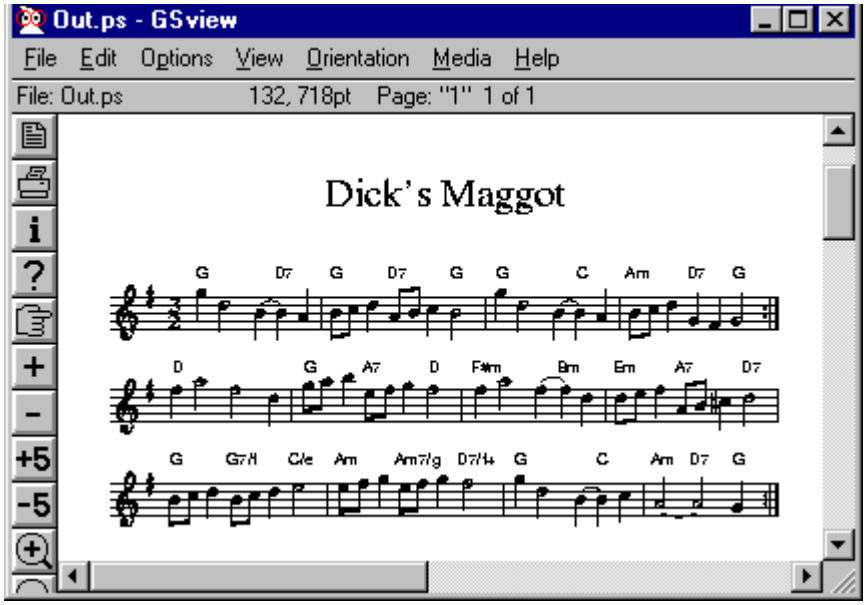
If you click the **Play selection** button (which has a speaker icon), the program will convert the specific tunes to a midi files, store them in a specific directory (by default tmp in your current directory) and then attempt to play these midi files using the midi player that you had designated in the configuration property sheet. Any error or warning messages reported by abc2midi can be viewed by clicking the button labeled **Console**. (The Console button appears as a rectangular box with a blue bar at the top.) Note abc2midi is more stringent than abc2ps in the use of the P: field. The P: field has sometimes been used to put additional annotation rather than designate the parts and how they are repeated.



The error and warning messages produced by abc2midi and yaps may appear in blue print. If you click on one of those messages, runabc will display the input file (X.tmp) in a separate window and the line associated with this error message will be highlighted with a grey background. Do not attempt to edit the contents of this window since you cannot save the results.



If you click the button labeled **Display**, the program will create a postscript file (Out.ps) of the abc file by calling the program abc2ps or whatever with the appropriate parameters and then display this file by running ghostview. A sample view of the postscript file is shown below. Again you can view any messages reported by abc2ps by clicking on the button labeled console. Abc2ps depends on the X: reference number to find the selected tune so be sure there are no duplicate numbers or the wrong tune could be selected. Note abc2ps and its variant may not handle all forms of line/end conventions even though runabc, yaps and abc2midi can handle them.



Play Option Menu

Runabc has many advanced features to control how the midi file or postscript file is created. You get to these features by clicking the menu button abc2midi or abc2ps (may also be labeled yaps or abcm2ps).

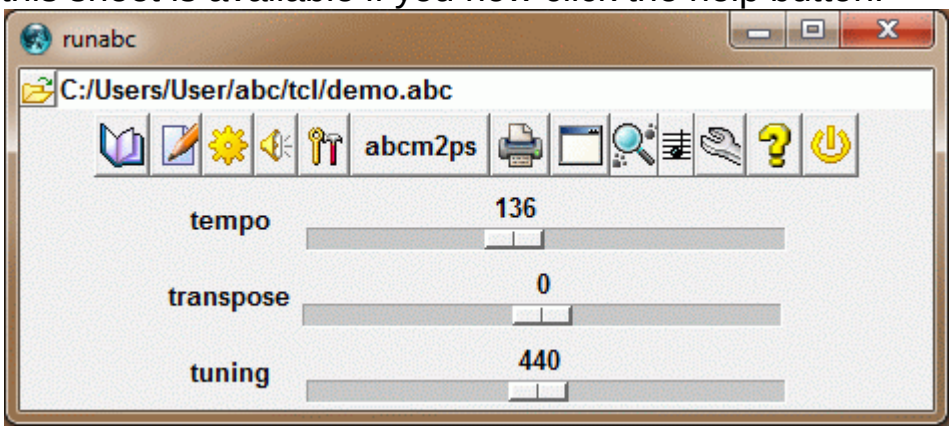
Few abc notated tunes contain details on how to play the music. Tempo information is often lacking and the music is always played on the MIDI Acoustic Piano. Runabc allows you to change these defaults without altering the input file. Runabc can enliven the tune using additional MIDI directives which are inserted into a copy of the tune. These options are controlled using the menu items described here.

When you are creating and playing the midi file, the **Play options** menu button provides options for changing the tempo, transposition, assignment of voices to melody and accompaniment, turning off chordal/bass accompaniment, turning off the melody line. (This button shows a picture of a hammer and a pin, standing vertically.) Most of this information is rarely included in the midi file, so it is necessary to automatically insert it before sending it to abc2midi.

Prior to calling abc2midi, runabc creates a copy of the tunes you wish to play with this added information in the file called **X.tmp** which is stored in the tmp subdirectory. Abc2midi then processes the file X.tmp producing the desired midi files. You can view, but not edit the X.tmp file using the menu button **edit/view X.tmp**. (The edit button shows an icon of a pencil writing on a sheet of paper.) This is often useful, since the error messages reported by abc2midi (viewed when the console button is clicked), refer to lines in the X.tmp file. Line numbers are automatically inserted by the runabc viewer for your convenience.

Tempo/pitch

If you wish to change the tempo or choice of instruments in the midi file, you should click the button labeled **Play options** and select **tempo/pitch**. A new property sheet will appear as shown below. On line help appropriate to this sheet is available if you now click the help button.



Most abc files do not have any tempo or midi program indications, so it does not matter whether this program ignores or uses these indications. This also provides complete freedom to change the tempo or instrumentation. However, there are a few abc files (in particular the multivoice files generated by midi2abc) which preserve these indications. If you wish to ignore these indications, check the appropriate boxes in this property page.

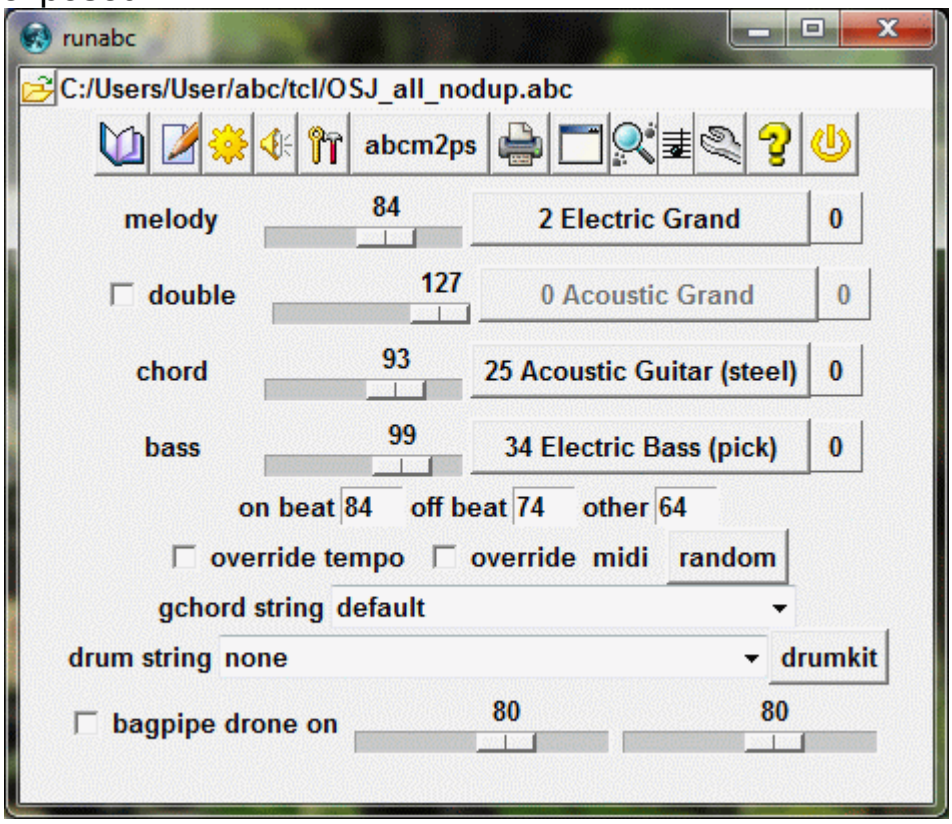
The **tempo slider** allows you to control the tempo in quarter notes per minute. The **transpose slider** allows you to transpose all channels up or down by a number of semitones. If you move the transpose slider, remember to restore it back to zero. Its position is stored in the runabc.ini file until you change it.

By default, the midi file is tuned to A =440 Hz. If you wish to change it adjust the **tuning slider**. You have a margin of plus or minus one semitone.

Play Options menu/ arrangement

By default all MIDI tracks are mapped to the acoustic piano. If you wish abc2midi to map the melody track to

another instrument, you should select **Play options/arrangement** and the following sheet will be exposed.



The first four rows in the window, labeled **melody**, **double**, **chord** and **bass** provide additional controls on how the music is played. Many abc tunes contain guitar chord indications (for example "Dm" or "G7") specified in the music body. If abc2midi recognizes these guitar chords, it will automatically create a chord/bass accompaniment which adds more flavour to the music. Both the chord and bass components can be adjusted using the controls in this window. There are three controls for each of these components (a forth one for **double**). They control the loudness, the musical instrument, and octave shift.

The **double** line with check box is a new feature in runabc. If the box is checked runabc will create another copy of the melody and place it in a separate voice. The way in which this voice is played can be controlled in a the manner discussed below.

If you click on the button labeled Fiddle in the figure, a cascaded menu will allow you to choose a different instrument from a set of 128 General Midi instruments.

A volume slider on the next line adjusts the volume level of the melody. This in effects three numbers labeled **on beat**, **off beat**, and **other** which is used by abc2midi to control the volume level (called note velocity in MIDI terminology) of each note depending on its position in the bar. The velocity for the first beat should be higher than than the offbeat and similarly the velocity of the offbeat should be higher than the other notes. You can edit these in the adjoining entry boxes, or you can adjust them automatically with the volume slider. The volume levels in each entry box should not exceed 127. Though the optional voice labeled **double** also uses three numbers to control the playback, this is not shown.

The **octave** menu button, (here the button labeled 0), permits you to play the part one or more octaves above or below what is written in the score. This is particularly useful when you double the melody line with another instrument. For example, you may choose to double the piano with the flute. The flute will stand out better if it is played an octave higher.

Similarly you can select any instruments for the chordal and bass accompaniment, adjust the volume level and the octave shift.

Most notated abc files do not have MIDI directives; however, if the tune does contain MIDI directives, then none of the settings you make will prevail unless you tick **override midi** check box.

If you click the **random**, the melody,chord and bass will be assigned to random instruments. Sometimes the assignment is terrible but many times the arrangement is quite interesting.

To turn off any one of the components, set the volume level to zero. This may be useful if you wish to practice on your musical instrument by playing along with the accompaniment. There is also an option for drum accompaniment which are described next.

gchord configuration

When guitar chords are present, by default abc2midi generates a track with bass/chordal accompaniment using a set pattern determined by the key signature. The particular pattern can be changed using a %%MIDI gchord command embedded in the abc file. You have the option of choosing your own gchord pattern without modifying the original file using the gchord string combobox. You can either enter the pattern directly in the entry box or select one of the choices in the combobox when you click on the down arrow head. The choices are appropriate for the time signature of the selected tune. As long as you do not restart runabc, the program will remember this choice for all tunes having the same numerator in the time signature.

The gchord pattern is specified using the codes, f (bass fundamental), c (chord) and z (rest). A number after the codes f,c and z specifies the duration. For example the default gchord string or 3/4 time is fzczcz. The duration of the gchord string is always normalized to one measure so that f4c2 and f2c denote the same thing.

Besides the f,c,z codes, new codes g,h,i,j,G,H,I and J were recently introduced for handling broken codes or arpeggios. These codes address the individual notes in the chord starting from the lowest note in the code. The lowest note is not necessarily the root if the chord is an inversion. For example for the C major chord, the ghord string ghih would play the sequence CEGE for every bar. The code GHIJ would play the same notes but at a lower octave.

drums

Though abc2midi can produce drum accompaniment using an embedded %%MIDI drum command, this is very rarely used. For common time signatures, it is easy to add drum accompaniment (without modifying the original tune) using the combobox besides the **drum string** label. Replace the entry **none** with one of the patterns in the combobox. Like the gchord, the program will remember this choice for all tunes sharing this time signature.

The %%MIDI drum command is somewhat more complicated since you need to specify both the drum pattern and the percussion instruments. In addition, if you wish to control the loudness of the drum hits, you will need to specifiy the intensities for each drum hit. Clicking the **drumkit** will display a tool which may make it easier to design a %%MIDI drum command. Further information about the drumkit editor is presented in the section on the TclAbcEditor.

Play options menu/ drumkit

For many folk dances, drum accompaniment may be more appropriate. The MIDI standard assigns one of the channels (usually 10) to be used for drum accompaniment. This means that any MIDI notes indicated in this channel is interpreted as a drum hit. There is a choice of more than 45 percussion instruments which is indicated using the byte normally reserved for the pitch. Since many percussion instruments such as cymbols, triangle, tambourine, ... do not have a pitch associated with the sound this does not pose any problem.

The abcguide.txt indicates how to set up the drum pattern using several of the %%MIDI extensions of abc2midi. The editor assists you with a special tool box for incorporating the drum accompaniment **tools/drum**.

This tools allows you to create a drum pattern and patch it your abc tune. A simple pattern is indicated here.
%%MIDI drum dzdd 36 40 40
It consists of a pattern **dzdd** followed by three numbers which assign a percussion to each of the three d's. These three numbers may also be followed by another set of 3 numbers which specify the loudness of each d. The **z** signifies a rest. The d's may be followed by a number that specify the duration of the hit. For example it is likely that the pattern d2dd would also sound the same as the above.

Please note that the d's do not correspond to eigth notes or any particular length. The duration of the d's is adjusted so that the entire pattern fits into one measure. If the measure is 4/4 then each d of dddd is one quarter note. If the pattern is dddd3d6 then the first 3 d's form a triplet, the d3 is a quarter note and the d6 is a half note. If you write ddddd, then each d is 4/5 of a quarter note or a note of length of duration 4/20. The same convention also applies to the gchord string.

The drumkit entry box at the top is shared with several other windows such as Play Options/Arrangement, so its effect is far reaching. The entry box, is used to input a new drum string. After typing your drum string in the entry box, click on the **enter** button or press the return button on your keyboard. The drum string should now appear in the third row preceded by the **deselect** button.

If you have not entered the percussion instrument numbers, you can do it by clicking one of the buttons in the pallette below. If you click the **enter** button again, the program will add default loudness levels (velocities) for each d.

The **play** button allows you to hear the percussion string. The **paste** button will paste the drumstring in your file being edited in the abcedit window if it is exposed. The %%MIDI drum command will be pasted at the position of the insert cursor. (Don't forget to insert the %%MIDI drumon command in the body of the music.)

At this point you may wish to edit the drum command. To do this you need to select which d's (besides the deselect button) that you want to change. Hovering the mouse pointer on top of one of the drum hits (will) cause a tooltip to appear indicating the current instrument assigned to this hit. If the hit is strong or weak, the **d** will appear in either red or blue. To change the attributes of one or more hits, select them by clicking on them so they are now appear selected. Clicking on a selected hit will deselect it. Clicking on the **deselect** button will deselect all the selected hits. Now clicking on one of the instruments (eg. Side Stick, Closed Hi Hat, etc.) will change the percussion instrument for all the selected hits. Similarly clicking on one of the buttons **strong, medium,** or **weak** will change the intensity of the hit.

The pallette of percussion instruments is only a random selection of the 46 or so percussion instruments that are defined by the General Midi Standard. The **selector** button will allow you to change the pallete of available

percussion instruments using the following window.

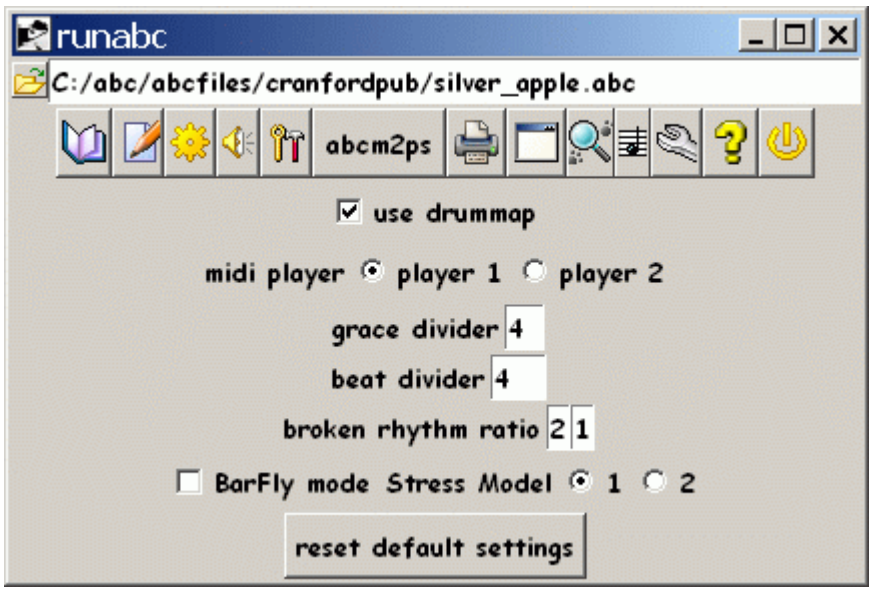
You can see some sample applications of the %%MIDI drum command in the set of dances in the collection of Balkan and Israeli dances that I have transcribed. I have also included the abc files drumdemo.abc and drumpat.abc in the runabc.zip distribution. The drumpat.abc file is helpful for learning to associate the sounds of the MIDI percussion instruments with their names.

drone

Bagpipe music now has some limited support. If the music is written in the K:Hp or K:hp signature, then you can instruct abc2midi to insert a continuous drone which is played in the background. The loudness of the two

instruments generating the drone are configurable using the sliders.

Advanced settings



If you have specified an **alternate midi player** in the configuration property page, you can select the desired midi player to use here. Note: for these changes to take effect, the play mode must be aborted and the play button must be clicked again.

The gracedivider is a new feature which replaces the old %%MIDI grace a/b (still available in abc2midi but no longer supported by runabc). In the old method, you would specify would part of the note could be used for expressing a grace and this ratio would remain fixed. Unfortunately, the length of each grace note is now dependent on the complexity of the grace group and the note to which it was applied. In the new method, the grace note always has a fixed duration, eg (1/64 th note) irrespective of where it occurs. The time is still taken from the following note but the ratio of grace notes to the following note is now variable. If the following note is too short to handle the grace, then the grace is ignored. You specify the duration of the grace notes using the new

%%MIDI gracedivider b command. Runabc supports this new command by allowing you to specify the b value. This value specifies the divider applied to the standard note length as specified by the L: field command. For example, for L:1/8 and b=4, all the grace notes would be 1/32nd notes. (Note that in order for this feature to work correctly the version of abc2midi must be 1.44 or higher.)

Broken rhythm ratio adjusts the times for > and < indications in the music body (eg. B > c). The default is 2 to 1, meaning the notes are played as B4/3 c2/3 even though it is printed as B3/2 c1/2. If you want it to be played as written then you should set the ratio to 3.

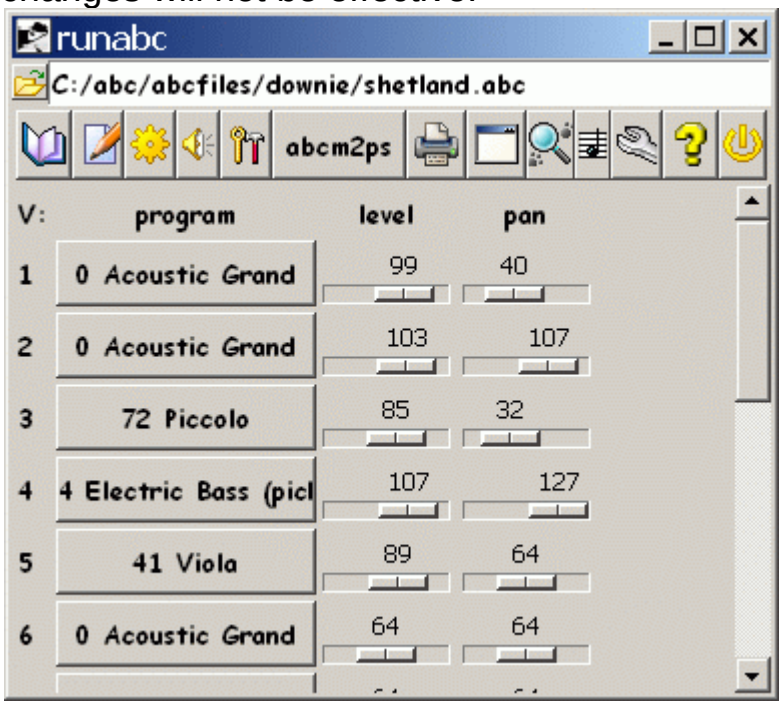
The parameter beat divider is used for determining which notes are to be considered as strong (off beat). If the time signature is x/y then each note is assigned a position 0,1,2,...x-1 depending on its position in the bar. If its position k, is an exact multiple of n, then that note is considered strong and is assigned a level of b. If you need finer control, you should insert the %%MIDI beatstring string into your abc file. This is documented in the abcguide.txt which comes with the abcmidi distribution.

The default button restores all these parameters to factory settings.

Play options menu/ voice

If your abc file uses different voices (V:1, V:2, ...) then you should select **Play options/voices** to control the assignment of the voices to the different MIDI instruments, volume levels and panning parameter. If the tune has already assigned instruments to the voices and you have not requested to override all MIDI indications (in the abc2midi options/tempo-pitch page), then these

changes will not be effective.

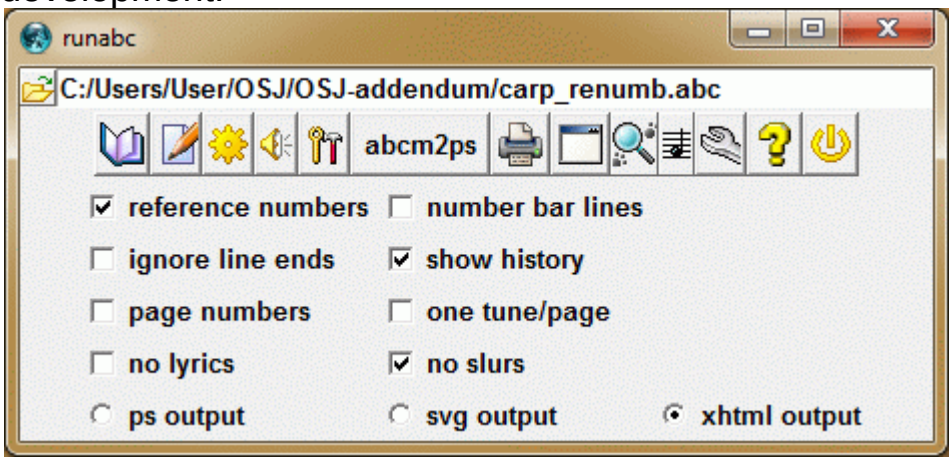


The panning parameter is useful if you have two speakers. You can shift the voice towards the left or right speaker. If you wish to turn a voice off, simply set the volume level to zero. Be sure to return the level back to normal when you are done, since all settings are saved when you exit from runabc. These options were found to be useful when you are trying to track errors in one of the voices or you are playing a long with the computer using your musical instrument.

Abc2ps, Abcm2ps, Yaps Configuration

As mentioned above, these applications are designed to convert an abc tune into a PostScript file containing a graphical representation of the common music notation. Anyone of these programs will suffice, however abcm2ps is the only one maintained and under continual

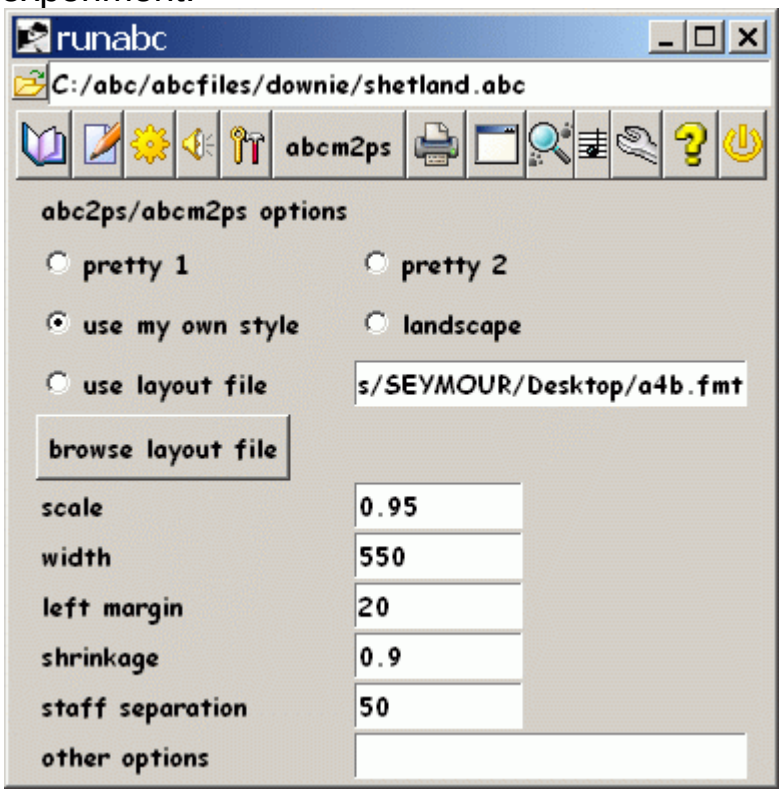
development.



Abcm2ps is the only program which allows you to create an svg or xhtml file instead of a ps file. Since the software for displaying an svg or xhtml file is built-in most browsers, this saves you the trouble of having to install extra software for viewing the music notation. The svg file displays only a single tune so if you wish to create a single file with multiple tunes, you should use the xhtml or ps representation. Once the music is displayed you can change the size of the font by holding the control button down and pressing either + or - on your keyboard. This should not affect the way the music is printed.

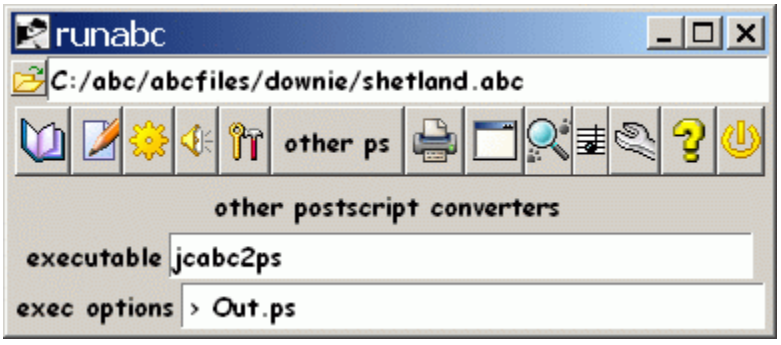
The menubutton allows you to choose the particular application to use as well as configure its operation. The configuration functions are split into two windows **style** and **format**. A detailed description of the features and options of abc2mps would take to much space in this document and only a fraction of these options are accessible in this program. It is suggested that you

experiment.



Jcabc2ps, Jaabc2ps, Abctab2ps and other abc2ps clones

For the many other postscript file creators, you can select the **other** radio button in the config/abc executables menu page. When you click on the **other ps** button, the following configuration page would be displayed.



You specify the path name to the executable and the program options in the two entry boxes provided. You

may specify as many options as you wish, but you should ensure that the program produces an output file called Out.ps. The input abc file name will be automatically provided by runabc. Unless you are running an old version of runabc (prior to 3.95 April 9 2003) you should no longer specify the selector parameter -e $xsel. Runabc now copies all the selected tunes to a separate file (usually X.tmp) in the tmp folder and the postscript creator processes this file. This avoids several problems (eg. duplicate X: reference numbers). When you click the display button, runabc calls this converter with these options producing an Out.ps file which is then sent to a postscript viewer such as Ghostview. If there are any problems, you should click the **Console** button in order to see any of the error messages.

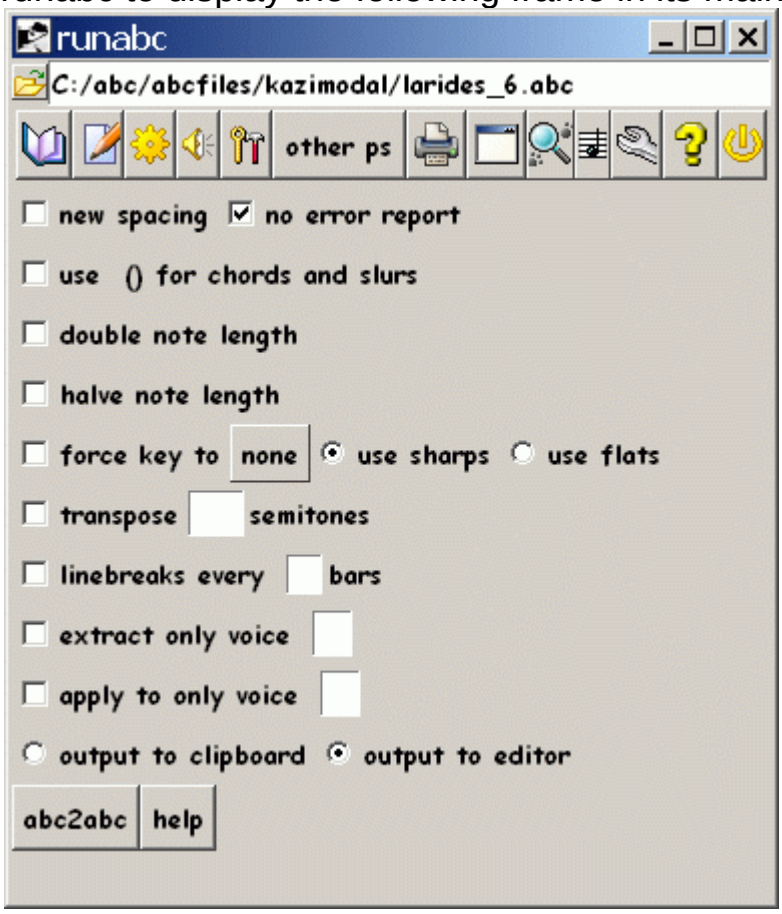
Abcm2ps advanced format options

Abcm2ps is the most advanced program for generating common music notation either as a PostScript or SVG file. The program is continuously improved. The program provides many options to control how the music is printed. Another interface was introduced to make these features more accessible. This interface can can be reached from the abcm2ps menu button. An explanation on how to use the interface is given when you start this program. The interface was developed from the format.txt documentation file which is included with the abcm2ps package.

Edit/Abc2abc interface

The user's interface to abc2abc is hidden away in the **Edit menu** menu button. Selecting this item causes

runabc to display the following frame in its main window.



Abc2abc is one of the programs which comes with the abcmidi package and provides many useful formating and conversion functions. As its name implies, both the input and output are abc files. (If you do not redirect the output to a file, the output will be printed on your command window.) Abc2abc is commonly used to transpose an abc file to a different key signature; however, it provides many other formatting functions. The documentation in the readme.txt file is quite concise and for the benefit of some runabc users, I shall provide a more detailed description below.

The abc2abc interface reflects nearly all the run time options which are listed when you run the program with no options. Thus if you tick the checkbox **halve note lengths**, abc2abc would be run with the parameter -v. The execution string is displayed at the bottom of the

main window after you click the button labeled **abc2abc** near the bottom. If you had selected, the radio button **output to editor**, then the abc2abc would be written in a file edit.abc and displayed in **TclAbcEditor** which will be described in the following section. If you selected the radio button **output to clipboard** the results would be placed in a clipboard where it can be accessed by most textbased editors. (For example, cntl-v will access the clipboard on the Windows operating system.)

To illustrate the effect of various abc2abc options, consider the following simple example adapted from http://www.leeds.ac.uk/music/Info/RRTuneBk/tunebook.html

```
X:17
T:Quick Step 71st. Regt.
M:6/8
L:1/8
K:D
dfdecA|dfagfe|dfdecA|dedd3:|
AFABGB|cBcded|AFABGB|cBcd3:|
```

If the **no error report** checkbox is not ticked, abc2abc will produce the following output

```
X: 17
T:Quick Step 71st. Regt.
Z:rrobinson/Aird1.abc
M:6/8
L:1/8
K:D
dfdecA|dfagfe|dfdecA|dedd3
%Warning : No repeat expected, found :|
:|
AFABGB|cBcded|AFABGB|cBcd3
%Warning : No repeat expected, found :|
:|
```

Unless you are trying to clean up any errors or minor inconsistencies, you would normally have that checkbox ticked so all warnings and error messages are suppressed.

Ticking the box **new spacing** will result in the following output which would produce a cleaner output when converted to a postscript file.

```
X: 17
T:Quick Step 71st. Regt.
Z:rrobinson/Aird1.abc
M:6/8
L:1/8
K:D
dfd ecA|dfa gfe|dfd ecA|ded d3:|
AFA BGB|cBc ded|AFA BGB|cBc d3:|
```

Spaces were placed between beats.

The option **use [] for chords and slurs** is an ancient remnant when abc files indicated chords with +ACE+ instead of [ACE]. Presently, it is fairly difficult to find abc files using the old convention. Abc2abc would convert the old convention to the new standard if this option is selected.

Running abc2abc with the option **double note length** produces the following output.

```
X: 17
T:Quick Step 71st. Regt.
Z:rrobinson/Aird1.abc
M:6/8
L:1/16
K:D
d2f2d2 e2c2A2|d2f2a2 g2f2e2|d2f2d2 e2c2A2|d2e2d2 d6:|
A2F2A2 B2G2B2|c2B2c2 d2e2d2|A2F2A2 B2G2B2|c2B2c2 d6:|
```

The standard unit length specified by the L: field has been halved to 1/16 and all the notes have been doubled in length. Effectively, there has been no change; however, this feature is sometimes handy when you are transcribing a new tune. The option **halve note length** does the opposite as illustrated below.

```
X: 17
T:Quick Step 71st. Regt.
Z:rrobinson/Aird1.abc
```

```
M:6/8
L:1/4
K:D
d/2f/2d/2 e/2c/2A/2|d/2f/2a/2 g/2f/2e/2|d/2f/2d/2
e/2c/2A/2|d/2e/2d/2 d3/2:|
A/2F/2A/2 B/2G/2B/2|c/2B/2c/2 d/2e/2d/2|A/2F/2A/2
B/2G/2B/2|c/2B/2c/2 d3/2:|
```

The option **force key to none** will produce the following output

```
X: 17
T:Quick Step 71st. Regt.
Z:rrobinson/Aird1.abc
M:6/8
L:1/8
K:none
d^fd e^cA|d^fa gfe|d^fd e^cA|ded d3:|
A^FA BGB|^cBc ded|A^FA BGB|^cBc d3:|
```

The key signature is K:none and additional sharps were added to preserve the original music. You can force the key signature to any one of 11 possibilities if you click on the menu item currently labeled **none**. This feature becomes useful for some jazz music which has so many accidentals that it is hard to assign any particular key signature.

Some musical instruments automatically transpose the music a certain interval. For example, when clarinet plays a piece written in C major, the music comes out in Bb. Ticking the transpose button and entering a number -1 in the semitones entry box produces the following output.

```
X: 17
T:Quick Step 71st. Regt.
Z:rrobinson/Aird1.abc
M:6/8
L:1/8
K:Db
dfd ecA|dfa gfe|dfd ecA|ded d3:|
AFA BGB|cBc ded|AFA BGB|cBc d3:|
```

All the notes were shifted down one semitone and the key signature was changed to Db to be consistent. Note it is important to tick the adjoining checkbox for

performing the transposition or else no action will be taken.

The placement of linebreaks affects the clarity of the abc file and the appearance postscript converted file. Ticking the **linebreaks every n bars** allows you to place linebreaks at regular intervals. For example if n is set to 3 the output would look like

```
X: 17
T:Quick Step 71st. Regt.
Z:rrobinson/Aird1.abc
M:6/8
L:1/8
K:D
dfd ecA|dfa gfe|dfd ecA|
ded d3:|AFA BGB|cBc ded|
AFA BGB|cBc d3:|
```

The **extract only voice** is applicable to multivoiced abc files. It will produce an abc file with only the selected voice.

Finally, you can apply any one of these functions to a particular voice in an abc file. For example

```
X:1
T: transpose one voice
M: 2/4
L: 1/8
K: C
V:1
CDEF|GABc|
V:2
K:C
CDEF|GABc|
```

To transpose voice two to Bb major, check the **transpose** button and enter -2 and check the **apply to only voice** and enter 2. Then click the **abc2abc** button. The resulting output will look like.

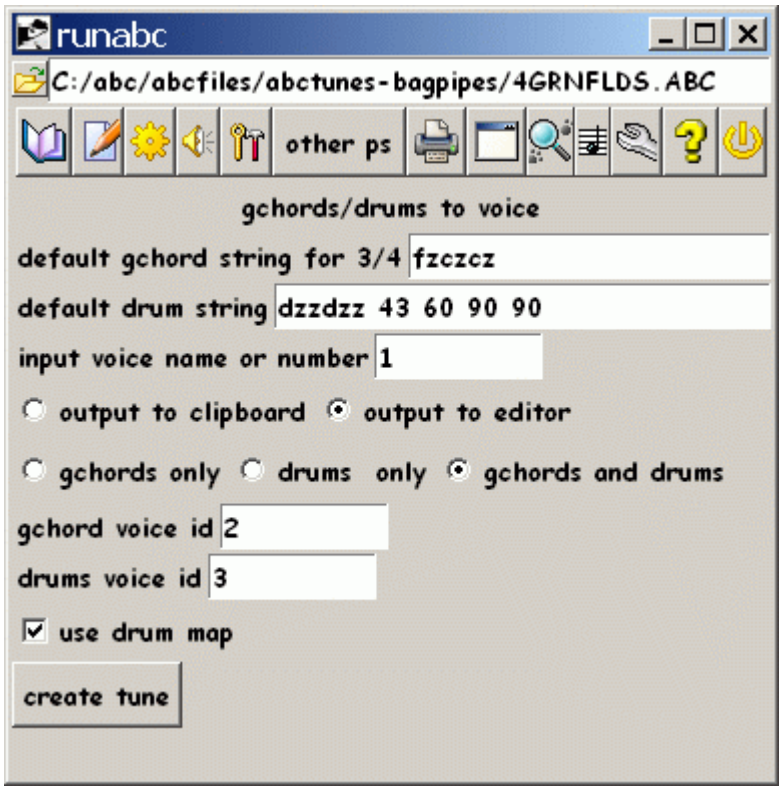
```
X:1
T:transpose one voice
M:2/4
```

```
L:1/8
K: C
V:1
CDEF|GABc|
V:2
K:Bbmaj
B,CDE|FGAB|
```

Note that the input tune must specify the K:C in voice 2 in order for the function to work correctly.

Abc2abc can perform several operations at a time if more than one option has been selected. It has not been tested with all combinations of options, so it is recommended that the user keep things simple. The program performs only one pass through the abc file and the source code has become quite complex in some places. Other useful formatting features such as diatonic transposition has been introduced into the runabc builtin editor which is described in the next section.

Gchords/drums to voice



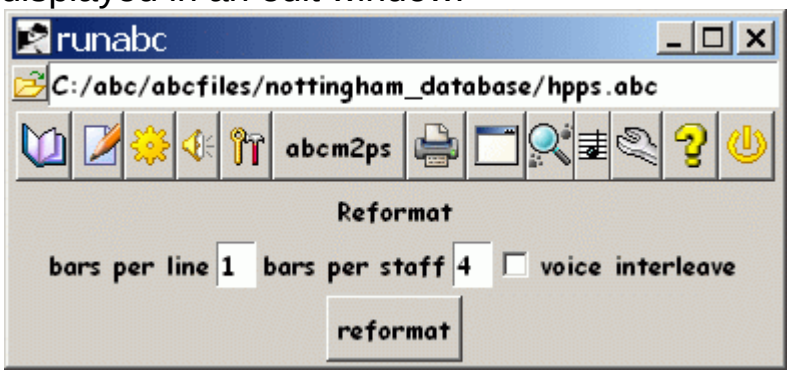
This functions converts the guitar chord indications and drum MIDI commands into separate voices. The benefit of expressing them into separate voices is that the lines can now be edited so that they sound less mechanical. The gchord string determines how the guitar chord is expanded. Similarly the MIDI drum command specifies the drum pattern and drum instruments to use. If the gchord strings or MIDI drum command are already embedded in the tune, they have priority. Otherwise, the program uses the default strings in the two entry boxes. These strings can be edited directly assuming you know what you are doing; alternatively you can go to the Play options/arrangement toolbox. If no gchord string is given, abc2midi automatically selects the one appropriate for the time signature in the tune. The gchord voice is put into voice 2 and the drum voice is put into voice 3. If these are not the desired defaults, you may wish to manually insert these voices into the file by first putting them in a clipboard by pressing **create tune**. Otherwise the program will create a file edit.abc with the original lines and the added voices and open this file with the builtin editor TclAbcEditor when the **create tune** button is pressed.

In most cases the guitar chords are found in a none labeled voice (for a single voiced tune) or in the first voice called 1. If this is not the case, then the voice name or number to use should be put in the entry box.

Beware: if no %%MIDI drum indications or %%MIDI gchord indications are present in the file (tune), the program tries to act in a similar way as when it is just playing the file. The indications in the play options/arrangement toolbox rule. In particular, there will be no drum output unless the checkbox **drum output** is on.

Reformat

The function changes the structure of an abc tune and is put in a Tcl abc edit window. Presently, some inline commands, lyrics and multipart tunes are not handled correctly. The function, chops up the tune into pieces corresponding to bars and then reassembles it according to the selected options. The reassembled tune is displayed in an edit window.

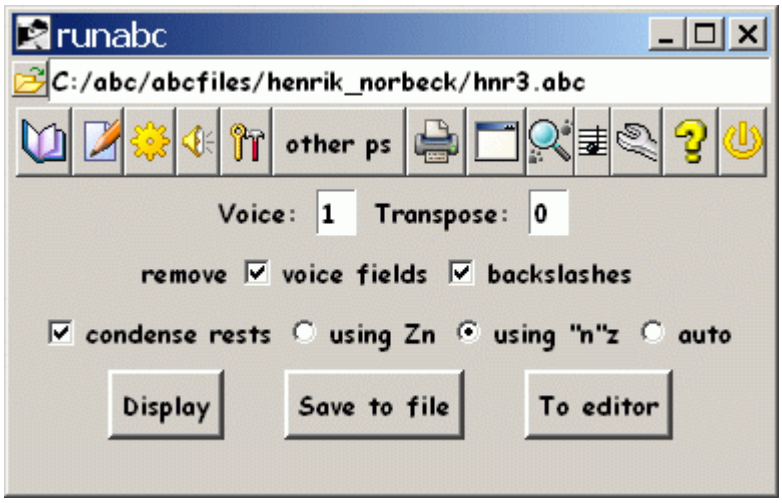


Multivoice extraction functions

The purpose of this function is to allow you to go from a full score (i.e. music for all instruments encoded in separate voices) to the sheet music of one part (one instrument). Musicians do not like turning pages while performing and would prefer if all the music fits on one or two pages on their music stand; so they would prefer to have the music for just their part. If there is a long series of rests where they are not playing, it is preferable that they are grouped together into one long rest. Sometimes their instrument automatically transposes the music to another key, so they would like the sheet music to be transposed accordingly. In contrast when the music is being notated, it is preferable to have all the parts together and interleaved.

The multivoice extraction function attempts to address this problem. First there is the problem of extracting and possibly transposing one of the voices. This is not trivial if the voices are interleaved. Next there is the problem of combining a sequence of bar rests. They would be indicated for each bar so that the music interleaves properly.

For historic reasons there are two conventions for indicating multirests. The old notation required by abc2ps uses something like "15"z8 where the number 15 indicates 15 consecutive bars and z8 is the length of a rest covering one bar. The newer notation would indicate this as Z15, where the upper case Z implies a full bar rest. Abc2midi, abcm2ps, yaps and other applications only understand the new notation.



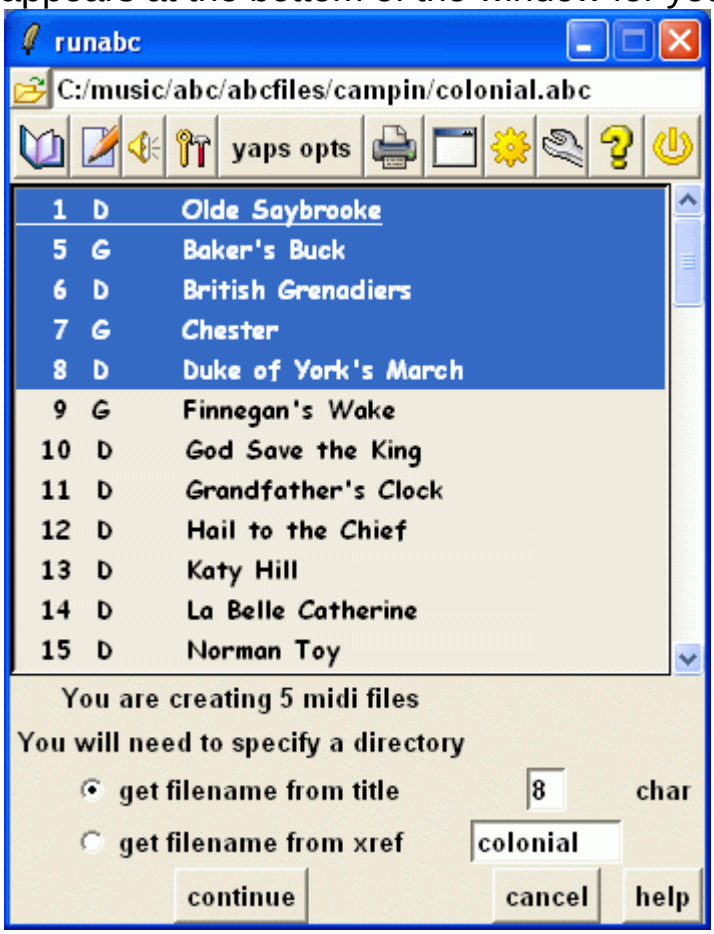
Now here is a description of how this is done. First you indicate which voice number and any transposition in the first two entry boxes. Tranposition is indicated by an integer specifying the number of semitones to shift the music. Positive numbers shift the pitch upwards. Negative numbers shift downwards. Zero implies no transposition. If you tick the checkbox condense rests, then a line of music written as:

z4|z4|z4|z4|z4|AB CD|BC AA|

would appear either like:
"5"z4|AB CD|BC AA|
or
Z5| AB CD| BC AA|
depending on which radio button you have selected. If you select auto, then runabc will make its selection depending on which postscript converter you have

chosen (abc2ps or other). The buttons marked "Display", "Save to file" or "To editor", performs the appropriate action. If you select "Display", the part will be extracted, converted to a Postscript file and displayed using gsview or whatever. If you select "Save to file", you will be asked for a abc file name for saving the part. If you select "To editor", the part will appear in the TclAbcEditor.

The extraction, transposition and rest condensation are all done by the external application abc2abc. In fact, when you perform the action the exec command appears appears at the bottom of the window for your information.



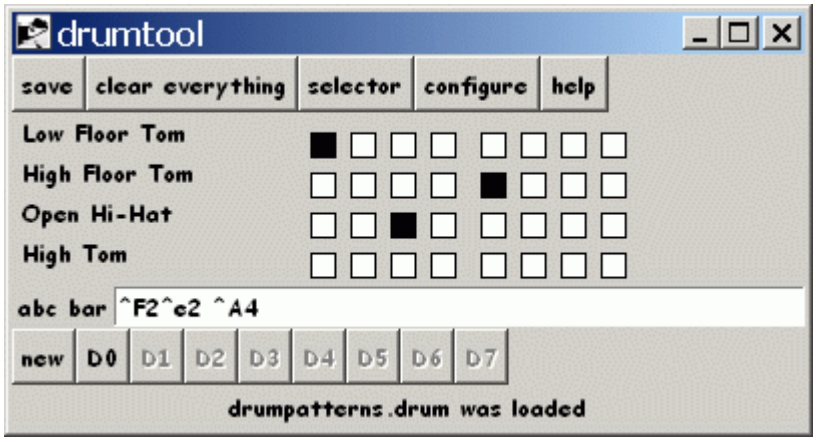
The midi files will be named automatically in one of two ways depending on the radio buttons selection. The midi file name can be derived from the tune's title or else it can be derived from its xref number in the file. If you derive it from the title, the maximum number of characters in the tail part of the file name is by default 8

letters. So the midi file derived from the tune "April Waltz" would be called April_Wa.mid. You can change this default by replacing the value in the adjacent entry box. Note that if there are several tunes with the same title, that the same midi file may be overwritten several times.

Alternatively, you can choose to derive the midi file name from its xref number. The names of the midi files will be based on the name of the open abc file (in the TOC) and the X reference numbers. Thus if your active file is waltz.abc and you selected tunes 5 and 8, the file names will be waltz5.mid and waltz8.mid. You can choose a different root name by replacing the string in the adjacent entry box.

When you click the continue button, the program will proceed to create the midi files. All the files will be put into a separate folder that you will select. If the folder does not exist, you will can enter its name in the entry box and the folder will be automatically created.

Drum Toolbox



This toolbox provides a means of generating a separate voice for the percussion instruments using a symbolic notation.

Below is a sample drum voice.

```
X:1
T: percussion sample
M: 3/4
L: 1/8
K: C
V: 1
%%MIDI channel 10
[E,,G,,]2 z1G,,1 G,,2 | [E,,G,,]2 z1G,,1 G,,2 |\
[E,,^C,]2 ^C,,2 ^C,,2 |[^C,C,]1^C,1^C,1^C,1 ^F,2^F,2
C2C2 |
```

MIDI channel 10 is reserved for percussion instruments. The percussion instruments are indicated by a MIDI pitch which is represented by a particular abc note. For example the pitch E,, represents the Electric Snare.

The drum voice is generally consists of a few patterns which are repeated many times. Each pattern is one bar long. The drum tool represents each drum pattern by a symbol **D0, D1,D2,** and etc. Up to 8 drum patterns can be defined. These drum patterns may be imported into the MultiVoicedEditor.

Prior to using the drum tool it is necessary to indicate the time signature, unit length and number of subbeats using the configuration menu described below.

Assuming you have completed the configuration, you can close this window and select the percussion instruments by clicking on the **selector** button. If you are remapping the drum notes (use drummap is ticked in the advance menu page), the selection of drum instruments must remain constant for the abc tune.

Once this is done you are ready to create drum patterns which are associated with the symbols **D0, D1, D2,**and etc.

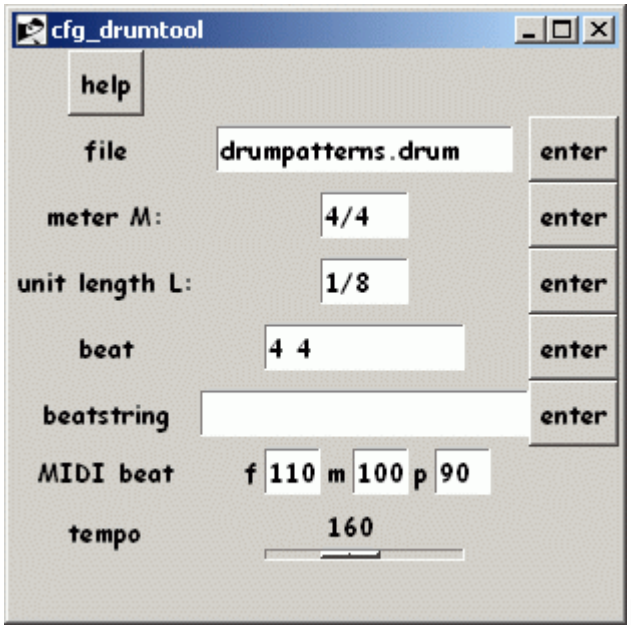
The drum pattern is edited graphically by flipping the color of one of the rectangles occuring in the above array. Clicking on the name of any percussion instrument on the left column allows you to preview the sound of the instrument. The grid of rectangles which fills the main

part of the window is used to create a percussion rhythm. Clicking on one of the rectangles selects a particular instrument and the time it is hit relative to the beginning of the bar. Each column of the grid relates to a specific time in the bar. The abc representation of the pattern is shown in the **abc bar** entry box which is updated each time the color of a rectangle is flipped, or when one of the existing patterns D0, D1, etc is recalled. The abc representation of each pattern that you define is stored with the other configuration parameters in the *.drum file whenever you click on the **save** button.

Initially, the pattern is automatically stored in D0 as the other buttons are disabled. To store another pattern, click the button labeled **new** and D1 will be enabled and selected. As a convenience, the last drum pattern you edited will be transferred to the new button so you can make minor variations. Any modifications to the drum pattern will now be stored in D1. Clicking D0 will restore the pattern stored in p0 and select it for further editing. You can audition the pattern by right clicking on the chosen pattern button.

The **clear everything** button clears all patterns D0, D1, and etc.

Drum Toolbox Configuration



Prior to defining the drum patterns it is necessary to configure the measure into subbeats and to select the percussion instruments. This information can be stored in a configuration file (eg. drumpatterns.drum) which will be loaded automatically each time the drum tool window is invoked. The name of this configuration file can be changed so that you can maintain more than one file. Click on the **configure** button. The name of the drum configuration file is stored in the **file** entry box. If you click the enter button and if the configuration file already exists, then it will be loaded into the toolbox.

You must enter the **meter** of the music and the **unit length (L:)** that you wish to use. The **beat** entry box specifies the number of beats or subbeats (sometimes called tatums) that you wish to use. The subbeat is the smallest unit of time that a drum measure is divided. If there are 8 subbeats in a measure than an array of 8 columns of rectangles will be displayed in the drumtool window. As a convenience you may place spaces between the array of subbeats separating the main beats in the bar. For example if you enter 4 4 (do not enter commas), then the 8 subbeats will be divided into groups of 4. The total number of subbeats must be a multiple of

a power of two of the numerator of the time signature. Thus if the time signature if n/m, then the sum of all the subbeats should be n, 2*n, 4*n, 8*n etc. For example, for 7/8 time, beat could be 2 2 3, or 4 4 6 and etc. The program does not handle triplets, so multiples of 3 will not work well. The program will automatically choose a time factor so that a drum pattern will fill a bar and be consistent with specified unit length. Using a unit length (L:1/n) where n is a power of 2 and close to the total number of subbeats may avoid fractions in the abc representation.

The **beatstring** provides fine control on the velocities (loudness) of each of the subbeats. It corresponds to the MIDI beatstring that abc2midi recognizes. Only f,m, or p standing for forte, mezzo, or piano are recognized. For example the string fpppmppp would assign each of the subbeats f, p, p, and etc. The velocities associated with these are entered in the **MIDI beat** entry boxes. The values must not exceed 127.

When you click on one of the enter buttons, the program checks the consistencies of the parameters and reports any problems in a message string which may appear at the bottom of the **cfg_drumtool** window.

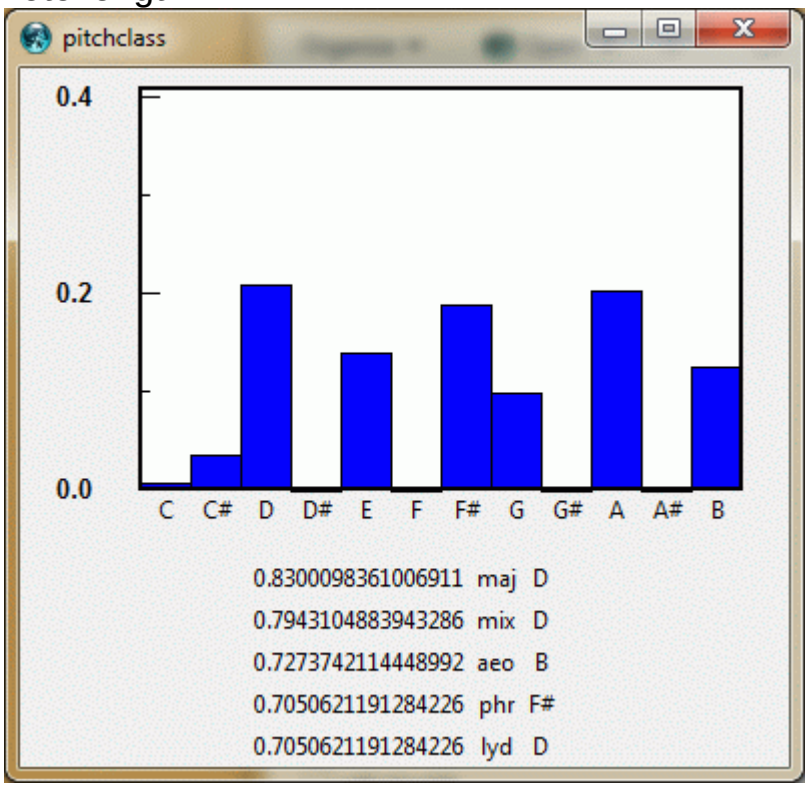
The tempo scale (Q: 1/4=n), specifies the tempo that the drum patterns will be played when you audition them using one of the methods to be discussed. It does not need to be the tempo of the actual abc file.

The configuration parameters should be set before creating any drum patterns since, changing them later will invalidate any parameters that you already created. (It may be adviseable to **clear everything** if this happens.)

Pitch Histogram

The type of guitar chords to be added to a tune depends to some degree on the scale mode. The mode is usually

determined from tonal center and the key signature; however, this method is not always reliable. This utility determines the histogram of the pitches used in the tune and attempts to find the best mode which matches the distribution. The pitch frequencies are weighted by the note length.



A histogram normalized to a probability values is displayed and the best 5 models are listed. The models are ranked by the correlation value between the distribution and the mode model.

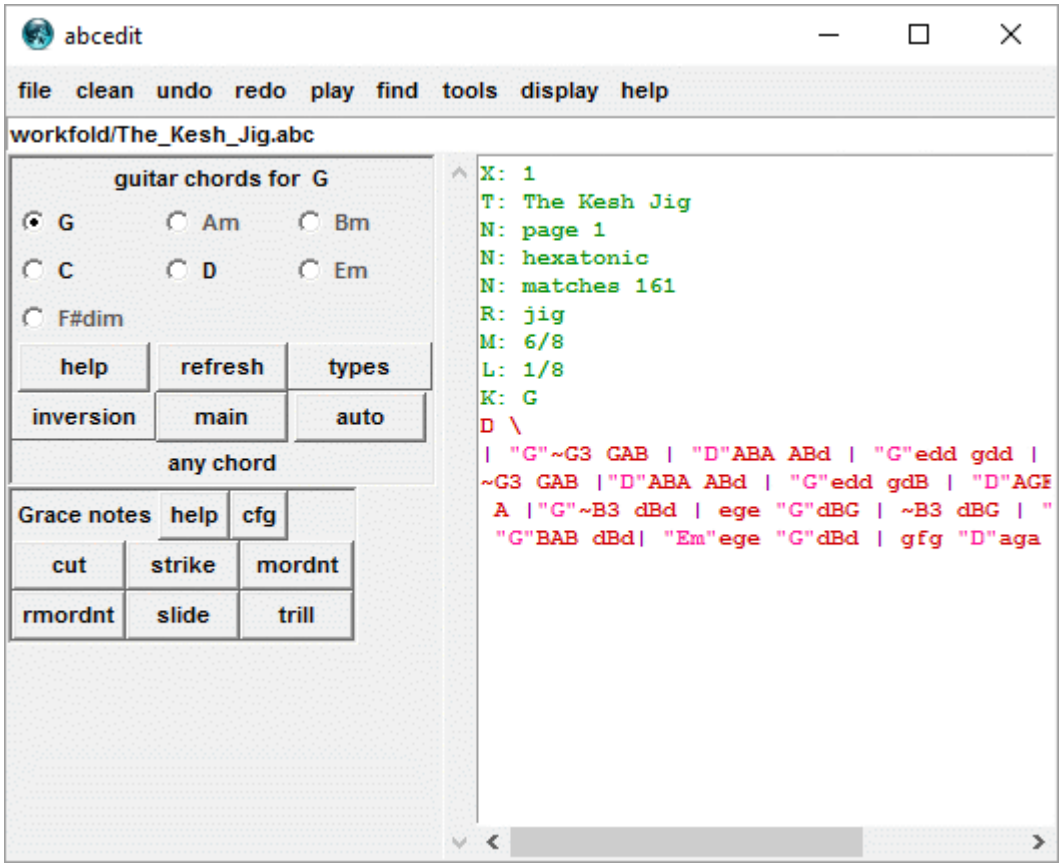
Note as a convenience, the plot is updated any time you select another tune in the TOC (table of contents window).

You can save the histogram plot as a PostScript file by right clicking the mouse pointer while the pointer is on the histogram. The program will prompt you for a file name to store the file. The file name should have a *.ps extension like hist.ps. Ghostview contains software for converting a PostScript file to other formats. For example

on Linux you can convert the file to a png file format as follows.
gs -sDEVICE=png16 -SOutputFile=hist.png hist.ps
*.png formatted image files are suitable for inclusion on web pages.

I am grateful to Hudson Lacerda, who supplied the algorithm, reference models, and sample code.

Edit/TclAbcEditor



Introduction

As a text editor, this is not the best. I prefer to use a different editor most of the time. However, in order to provide special editing features such as reformatting, transposing, introducing grace notes or guitar chords, and various clean up features, it was necessary to

design my own editor. The play button is one of the most useful features that allows you to play any selected section of abc tune. This is useful when you are trying out different chords or trying to identify a bar that does not sound right.

The editor requires Tcl/Tk version 8.5 or higher. It will not run properly with older versions of Tcl/Tk. If you are not sure which version it uses, you can run the sanity check by pressing going to the **config/sanity check** menu item. Alternatively you can press the alt-s key on the keyboard as soon as runabc starts and look at the runabc.out text file. (Be sure that the runabc window is in focus, or else the program will not pick up the alt-s key.)

Syntax highlighting is done in real time while you are editing the text; however, if for some reason the highlighting appears incorrect, you can restore the correct colours by clicking the clean/retag button. The choice of colours for syntax highlighting can be changed by editing the variables edit_body_colour, edit_field_colour etc in the runabc.ini file. You can find out the names of the various colours by running one of the listboxes demos which comes in the Tk Widget Demonstration package in the Tcl/Tk distribution.)

The editor does not copy the global headers which appear at the beginning of a abc file; however, if you do require them you can import them using the file menu command 'insert global header'.

The undo button or the <cntl-z> key will undo any of your changes. You have unlimited undo's provided there is sufficient memory in your computer. The redo button or the <cntl-y> keys on Windows or the <cntl-Z> keys on all other platforms, will redo your changes.

Before running any editors, you should designate your favourite editor in the **Options/abc executables** menu page. If you have not done this, then this editor will

remain your default. However even if you have designated a different editor, you can still start this editor from the menu item **Edit menu/TclAbcEditor**.

Secondly, you should specify a directory name in the **work folder** entry box where your work will be stored. Don't worry if the directory does not exist. It will be created automatically if it is not found. The directory is relative to where you are running runabc. Thirdly, you should ensure that a fixed spacing font (the same one used in the TOC) is chosen. This is the default unless, you have reconfigured this in the **Options/font**.

Assuming that you are editing a particular tune in a file containing many tunes, then runabc will copy this tune to a separate file, with a file name derived from the title of the tune. The file will be placed in your working folder which you should have designated in the **Options/abc executables** property sheet. Then this file will be opened by either your own editor or by **TclAbcEditor** depending on whether you choose **edit selection** or **TclAbcEditor**. If you choose the menu item, **edit file**, then the active file containing all the tunes would be opened by the editor. Note that if you decide to do it this way, you should have runabc reread this file (by reopening the same file), after you have done the save so that its table of contents is resynced. Otherwise, runabc may behave strangely and play the wrong tune that you selected. Also note, this method is not as safe as no backup is made unless your particular editor does this automatically.

TclAbcEditor, uses the Tcl/Tk Text Widget standard bindings described here. These bindings are also listed in the runabc context help.

Text Widget standard binding.

- Any-key: inserts normal printing characters.
- Button-1: set the insert point, clear the selection, set focus.

- Button-1-Motion: sweep out a selection from insert point.
- Shift-Button-1: adjust the end of the selection closest to the mouse.
- Shift-Left: move cursor and extend selection.
- Button-2: paste the selection, or set the scrolling anchor.
- Button-2-motion: scroll the window.
- Arrow-keys: shift insert point.
- Shift-Arrow-keys: shift insert point and extend or clear selection.
- Cntl-n: shift insert point to next line.
- Cntl-p: shift insert point to previous line.
- Cntl-f: shift insert point one character to the right.
- Cntl-b: shift insert point one character to the left.
- Cntl-d: deletes character to right of the cursor.
- Cntl-k: deletes from cursor to end of the line.
- Cntl-o: inserts a new line but does not advance cursor.
- Cntl-t: transposes two characters.
- Cntl-z: undo last insert or delete.
- Cntl-y: redo last undo (for Windows only).
- Cntl-Z: redo last undo (for all other platforms).
- Cntl-c: copies the selection to the clipboard.
- Cntl-x: cuts the selection and copies to the clipboard.
- Cntl-v: pastes from the clipboard (Windows).
- Cntl-y: pastes from the clipboard (Unix).
- Cntl-slash: selects everything in the text widget.
- Cntl-backslash: clears the selection.
- Shift-arrow-keys: alter the selection.
- Delete: delete selection if any, otherwise delete character to the right.
- Backspace: delete selection if any, otherwise delete character to the left.

In addition you there are customized bindings listed here:

- Alt-f: shift insert point one bar line to the left.
- Alt-b: shift insert point one bar line to the right.

- Alt-r: raise the note in front of the cursor.
- Alt-l: lower the note in front of the cursor.
- Alt-e: expand the duration of the note in front of the cursor.
- Alt-c: contract the duration of the note in front of the cursor.
- Alt-t: transfer editor buffer information to abcmatch (discussed later).
- Alt-s: will copy the buffer to a file using 'save as'.
- Alt-S: will copy the buffer to a file using 'save'.
- Alt-d: shortcut to display.

In addition to the keyboard shortcuts, if you right click inside the edit window a small pop-up menu allows you to play or display the music or the selected area.

In order to save the results, you must go to the **file/save** or **file/save as** menu item. On Unix systems, you may hear a bell during a file write operation; however, I did not manage to get the bell working on Microsoft Windows Tcl/Tk. If you have modified the file and did not perform a save, the editor will ask you whether you wish to save the file prior to exiting.

If you are editing a particular tune in a file containing a collection of tunes, you can replace that tune in the collection using the menu item **file / replace tune in collection** . The program will also create a backup file of this collection, however it is recommended that you have an independent backup.

If you are creating a new tune using the menu item **Edit menu/new tune**, will automatically create a file **edit.abc** for a lack of a better name. This file will have a template (X:.. T: etc.) for you to fill in. Note that you should do a **save as** to specify the desired file name, or else you may remain with a file called edit.abc which will be overwritten or deleted many times.

At this point, I shall describe the many special features of this editor. Most of these features all called up from the menu items **clean**, **play** and **tools**; however, other features such as the guitar chord toolbox and grace notes toolbox appear on the right. The program assigns an initial width of 60 columns for the editor. If you need more space, you can move the toolbox out of the way or you can expand the window. If you always want it to start with more than 60 columns, you can change the value associated with the variable edit_initial_width in the file runabc.ini to something a little larger.

Other features are accessible from the cascaded menus at the top of the window. Many of the menus contain an individual **help** button that provides information relevant to these functions. Many of these features are not applied to the entire file you are editing but to only the selected area. You select an area by sweeping the mouse pointer while holding the left button down. (Other methods are described in the online help.)

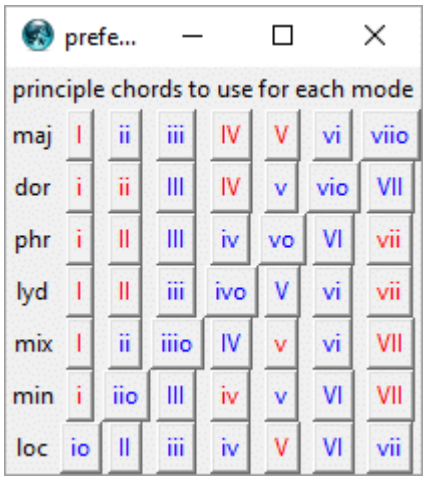
Guitar chords

A lot of abc tunes contain a single voice without any harmony. This sounds rather plain when it is converted to a MIDI file. The addition of guitar chords (contained in double quotes) greatly enhances the quality of the reproduction. Abc2midi will generate a chordal/bass accompaniment that helps the listener to quickly establish the key of the music and the beat of the tune. The guitar toolbox on the right contains various functions for automatically or manually inserting guitar chords.

There are general rules for adding guitar chords. If the music is in a major key signature, eg. you should stay with the major chords which are I, IV and V. For C major they would translate to G, C and D. For minor key signatures which includes modes like Dorian and Phrygian, you should also include the minor chords II, III, VI, VII. You are also free to use the IV and V when

appropriate. The editor automatically figures out the chords appropriate for the key signature and places the list in the **guitar chords** labeled frame on the left. The primary chords for that mode are shown in a darker color relative to the secondary chords. (They were chosen to accentuate the characteristic note of the particular mode.)

To insert chords using a built-in algorithm, press the button marked **auto**. The algorithm restricts the chords to the primary chords for the current mode. You can change the set of primary chords by clicking the button labeled **main**.



Clicking any chord symbol button, with flip its status. To see its effect on the chord table in the TclEditor chord window, you need to also click on the button labeled **refresh**.

To manually place a chord, position the edit window cursor at the appropriate spot in the music, and then click one of the chord menu buttons. If the cursor precedes an existing guitar chord, you can replace it with another chord the same way. Usually a guitar chord should be specified for each bar, but if it has not changed in the previous bars, it may be left out.

If the key signature has changed, you may get the recommended chords for the new key signature by

clicking the **refresh** button when the cursor in the edit window is past the key change.

To change the chord type and inversion type for a specific chord, first indicate which chord you wish to modify by selecting it from the list in the **guitar chords** frame, here Bb Cm Dm etc. When you select it, the chord will still be placed in the position of the insert cursor in your edit window but the corresponding radio button will also be ticked. (If you place the cursor at the end of the tune -- past the last barline --, then no chord symbol will be inserted into the tune.) Now press the **types** menu button and select the type of chord you want. (There is some duplication in this list.) For example, if F is your active chord and you selected 7, then F would be changed to F7. If this is the chord you want then just click F7 and the guitar chord F7 will replace F at your current cursor position assuming you had not moved the cursor. If you also want the first inversion, then click **inversion** to change F7 to F7/A. This chord type and inversion type will remain fixed for that chord until you close the edit window or click the **refresh** button.

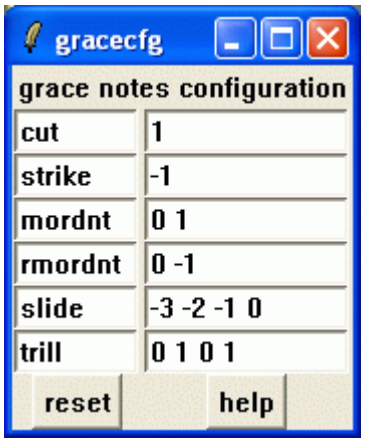
Below the **inversion** button is a list of suggested chords that should follow based on the chordal progression. You do not have to follow this progression, however the music may sound strange if you do not.

Grace Notes

The grace toolbox which occurs below the guitar toolbox, is used for inserting various **grace notes** prior to a specific note in the file. Position, the cursor just before the note you want to grace (eg. A) and then select one of the grace sequences. For example if you click trill, {ABAB} will be inserted just before the note. If you change your mind and want slide, you can click that button and the grace note sequence will be changed. This only works if you have not moved the edit cursor and it is positioned just before the start of the trill. The

sequence labeled **cut** is more formally known as appoggiatura. The sequence labeled **strike** is musically known as acciacccatura. Other sequences are mordent and reverse mordent, slide and trill.

The button labeled **cfg** is used for configuring the grace note labels and sequences; however, their labels should be seven or less letters. To make a change, place the cursor in one of the entry boxes shown below and type in the new name or sequence followed with a carriage return. These changes will remain the next time you start runabc. To return to the initial settings, click the reset button.



The grace note sequence is indicated by a series of small positive or negative numbers. They indicate the relative pitch offset between the grace note and the note to which it is being applied.

Other formatting and editing tools

The cascaded menu item **clean** contains numerous functions. The **retag** item will retag the field commands and body of the file in different colours. Otherwise any new items that you have added will remain in black. **erase all** does what it says. You end up with a blank buffer.

You can remove all **redundant guitar chords**. (A guitar chord is redundant to abc2midi if it has not changed in the previous bar.)

You can remove all guitar chords or anything else included in double quotes from the designated portion of the file.

You can remove all grace notes or anything else included in curly braces from the designated part of the file.

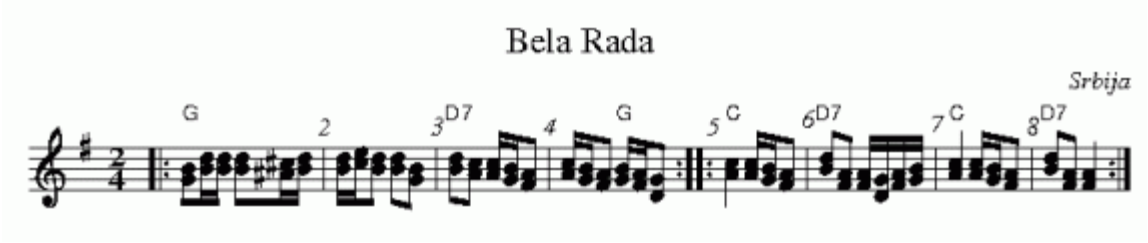
Other functions such as **remove inline voice fields**, **remove backslash continuations** and **remove tab chars** are also self explanatory. These functions are handy when you are extracting a single voice from a multivoice file using the **edit/extract part** menu function.

There are special tools for **transposing** all the notes in certain section of the edit window.

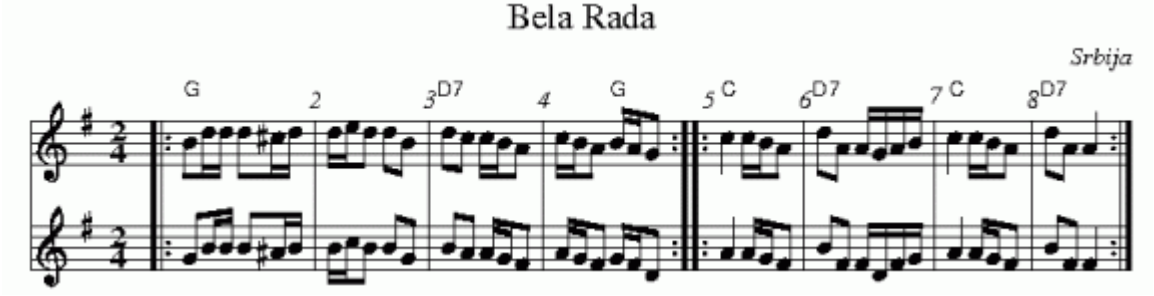
You can replace each note in selected group of notes with the **chords**. For example the notes FAA FAd can be converted to [FD][AF][AF] [FD][AF][dB] by selecting **tools/chords/third**.

The above operation can be reversed using the tool **replace chords**. For example if your selected region includes
[A2D2][AD][BE] [c2F2][d2G2] | [cF][BE][cF][A-D-] [A4D4]
you can replace it with either
A2AB c2d2 | cBcA A4 or
D2DE F2G2 | FEFD D4
using this tool. The tool handles chords containing up to 4 notes. The notes in the chord are sorted by pitch and you select which note (eg. highest pitch) that should replace the chord.

This tool is useful for formatting the music into separate voices. For example you can change,



to



This is illustrated below for the following abc file.

```
X: 6
T: Bela Rada
R:
O: Srbija
B:
D:
Z: John Chambers <jc@eddie.mit.edu> http://ecf-
guest.mit.edu/~jc/music/
M: 2/4
L: 1/16
K: G
|: "G"[B2G2][dB][dB] [d2B2][^c^A][dB] |
[dB][ec][d2B2] [d2B2][B2G2] \
| "D7"[d2B2][c2A2] [cA][BG][A2F2] | [cA][BG][A2F2]
"G"[BG][AF][G2D2] :|
|: "C"[c4A4] [cA][BG][A2F2] | "D7"[d2B2][A2F2]
[AF][GD][AF][BG] \
|  "C"[c4A4] [cA][BG][A2F2] | "D7"[d2B2][A2F2] [A4F4]
:|
```

The body of the music was duplicated by highlighting, grabbing it into the clipboard using the cntl-c, and dumping it using the cntl-v (or cntl-y in unix) command. V: fields were added to separate the copies so that the edit window now looks like

```
X: 6
T: Bela Rada
```

```
R:
O: Srbija
B:
D:
Z: John Chambers <jc@eddie.mit.edu> http://ecf-
guest.mit.edu/~jc/music/
M: 2/4
L: 1/16
K: G
V:1
|: "G"[B2G2][dB][dB] [d2B2][^c^A][dB] |
[dB][ec][d2B2] [d2B2][B2G2] \
| "D7"[d2B2][c2A2] [cA][BG][A2F2] | [cA][BG][A2F2]
"G"[BG][AF][G2D2] :|
|: "C"[c4A4] [cA][BG][A2F2] | "D7"[d2B2][A2F2]
[AF][GD][AF][BG] \
|  "C"[c4A4] [cA][BG][A2F2] | "D7"[d2B2][A2F2] [A4F4]
:|
V:2
|: "G"[B2G2][dB][dB] [d2B2][^c^A][dB] |
[dB][ec][d2B2] [d2B2][B2G2] \
| "D7"[d2B2][c2A2] [cA][BG][A2F2] | [cA][BG][A2F2]
"G"[BG][AF][G2D2] :|
|: "C"[c4A4] [cA][BG][A2F2] | "D7"[d2B2][A2F2]
[AF][GD][AF][BG] \
|  "C"[c4A4] [cA][BG][A2F2] | "D7"[d2B2][A2F2] [A4F4]
:|
```

V:1 body was selected and the "tools/replace chords/with top note" was used to replace each chord with the top note. Guitar chords were removed from the second voice using "clean/remove all guitar chords". Finally the chords in the second voice were replaced by the second highest note using "tools/x replace chords/with 2nd note". The resulting edit window now appears as follows.

```
X: 6
T: Bela Rada
R:
O: Srbija
B:
D:
Z: John Chambers <jc@eddie.mit.edu> http://ecf-
guest.mit.edu/~jc/music/
M: 2/4
L: 1/16
K: G
V:1
|: "G"B2dd d2^cd | ded2 d2B2 \
| "D7"d2c2 cBA2 | cBA2 "G"BAG2 :|
```

```
|: "C"c4 cBA2 | "D7"d2A2 AGAB \
|  "C"c4 cBA2 | "D7"d2A2 A4 :|
V:2
|: G2BB B2^AB | BcB2 B2G2 \
| B2A2 AGF2 | AGF2 GFD2 :|
|: A4 AGF2 | B2F2 FDFG \
|  A4 AGF2 | B2F2 F4 :|
```

The tool **x replace chords** differs from **replace chords** in the manner that it treats notes that are not embedded in chords. Instead of repeating the note, it is replaced with an invisible rest. Thus

```
G2 [A2c2]
```

would be replaced with

```
x2 A2
```

The tool **solfege vocalization** appends the solfege do/re/me.. symbols to the notes as a lyric line. For example if the following lines were highlighted for a tune in the key of Em,

```
A2 A3 c BA|B2 G3 B AG|A2 D2 ddcA|B8|!
A2 A3 c BA|B2 B2 c2 BA|G2 G2 AAGF|E8:|!
```

The function would replace these lines with

```
A2 A3 c BA|B2 G3 B AG|A2 D2 ddcA|B8|!
w: re re fa me re | me do me re do | re so so so fa
re | me |
A2 A3 c BA|B2 B2 c2 BA|G2 G2 AAGF|E8:|!
w: re re fa me re | me me fa me re | do do re re do
ti | la |
```

The vocalizations use the moveable-do system (as opposed to fixed-do). For the key of E minor, the relative major is G major so G is represented by do. The purpose of this function is to assist in learning music sight reading. The function figures out the key signature by searching backwards for the first K: field indication. (If the music contains key modulations, it is recommended that you highlight only the part of the music in the same key.) The program attempts to ignore guitar chords, decorations, field commands etc. but it is not perfect. For example something like ... A:| is mistaken for a field command and ignored, so the output may require minor

editing. The program also ignores all accidentals since I have not learnt how to treat them.

The function **align bars** will cause the editor to insert spaces before the bar lines so that they line up vertically. This is done without changing the way the tune would be converted to a postscript or midi file. The image below shows part of a tune before the alignment.

```
Q:1/4=120
K:D
"Em"B2 B2| E4| "D"A>B A>G| FE "Em"ED|\
B2 B2| E2 "D"FG|FE "Em"ED| "D"A2 A2|
A/G/A2 G| FGAG| FF "Em"ED| "D"F2 F2|\
A/G/A2 G| FGAG| FF "Em"ED|E2 E2|
G>F GA| "Bm"Bd "A"^cB| "D"A A2 B|\
```

The next image shows the effect of the alignment. Though the alignment expands the size of the abc file, it is easier to read or edit. The alignment is applied on the entire contents of the edit window, so only one tune should be loaded. The algorithm is not very smart, so funny results may be obtained for some files. (For example tunes containing double bar lines.)

```
Q:1/4=120
K:D
 "Em"B2 B2    | E4            | "D"A>B A>G | FE "Em"ED    |\
 B2 B2        | E2 "D"FG      |FE "Em"ED   | "D"A2 A2     |
 A/G/A2 G     | FGAG          | FF "Em"ED  | "D"F2 F2     |\
 A/G/A2 G     | FGAG          | FF "Em"ED  |E2 E2          |
 G>F GA       | "Bm"Bd "A"^cB| "D"A A2 B  |\
```

The function **add guitar chords** will insert appropriate guitar chords in the tune based on the key signature and the configuration of notes in each bar. For each key signature which also includes modes like maj, min, dor, and etc., the function picks three suitable guitar chords. For example for E minor, the function would choose Em, Am, and D. For each bar, the function would pick the guitar chord from this set whose notes matches closest to the notes in the bar.

There is a separate **display** button for converting the entire contents in the editor to a common music notation postscript file and displaying it on the computer.

The edit button now gives you a choice of editing the entire abc file or just the selected tune. If you edit only a selected tune then it will be copied into a file called edit.abc in the same directory as runabc.tcl. This file will then be renamed to another file based on the title of the first tune in your selection. The renamed file will be placed in a work folder created by runabc, called workfold. In event there is another file with the same name, in the work folder, it will be replaced. You may use the save-as button to save the tune under a different file name, but under no condition overwrite the original file containing the collection since only the contents of the edit window are copied. When you do any editing, it is strongly recommended that you keep backups somewhere else just in case the unexpected occurs. Further notes about the edit button may be found in the runabc.txt file included in the runabc.zip distribution.

The play and display commands always rereads the original abc file, so you must save your changes to the disk file to hear the edited results. I always prefer editing a single tune files and update the compilation abc file using cut and paste or something similar when I am finished editing. I prefer to use the editor with which I am most familiar rather than the Tcl/Tk text widget. In any case, other people may have different styles.

Also be aware that if you are editing a compilation or deleting, adding or renumbering a tune, the table of contents window (title index) will need to be updated by rereading the same file. Otherwise, the play, display and edit selected tune may go to the wrong tune.

The edit/new option will create a template edit.abc file.

Utilities menu/ Copy

The function will copy the selected tunes in the table of contents to a designated abc file. If the file does not already exist, it will create a new file; otherwise, it will destroy the existing file and overwrite it with the selected tunes. The X: numbers will be preserved.

Copy and renumber will do the same as above but it will renumber the selected tunes increasing sequentially from a selected number.

Copy all will copy the entire open abc file including all text to another file and renumber the X: reference numbers sequentially starting from a selected number. The user specifies the output file (save file) and the starting X: reference number.

Append will append the selected tunes to an existing file, preserving the original numbering.

Append and renumber will do the same but renumber the selected tunes.

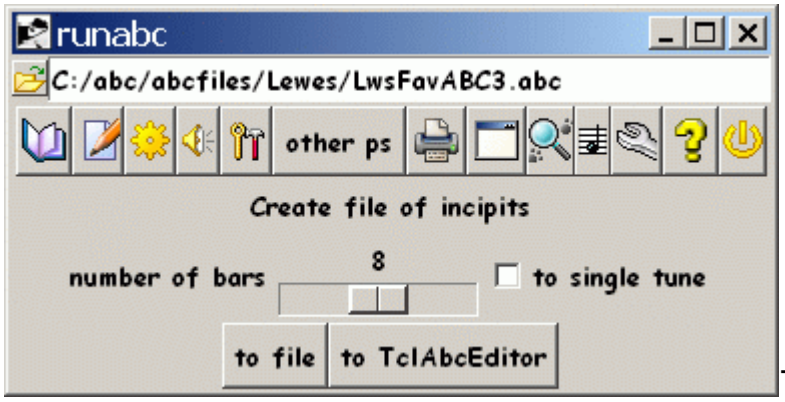
The copy combine parts function is specificly designed to reformat Laura Conrads renaissance music in her allparts.abc files. Each part is written as a separate tune rather than a separate voice. Therefore it is not possible to create a midi file with all parts playing simultaneously. This function combines all the parts into one tune, giving each part a separate voice. Duplicate titles, and lyrics are removed. When using this function, you must first select (highlight) all the tunes that you wish to combine. Like other copy functions, you will prompted for the name of an output file.

Caution: do not try to copy over the source file already displayed in the table of contents.

The function 'separate tunes' splits a multitune abc file into separate files each containing one tune and puts the files into a directory with the same name as the input file (without the abc extension). You should select all the

tunes that you want to extract in the TOC before using this function. To select all tunes press cntl-/ (i.e. control-slash).

Utilities menu/ Incipits

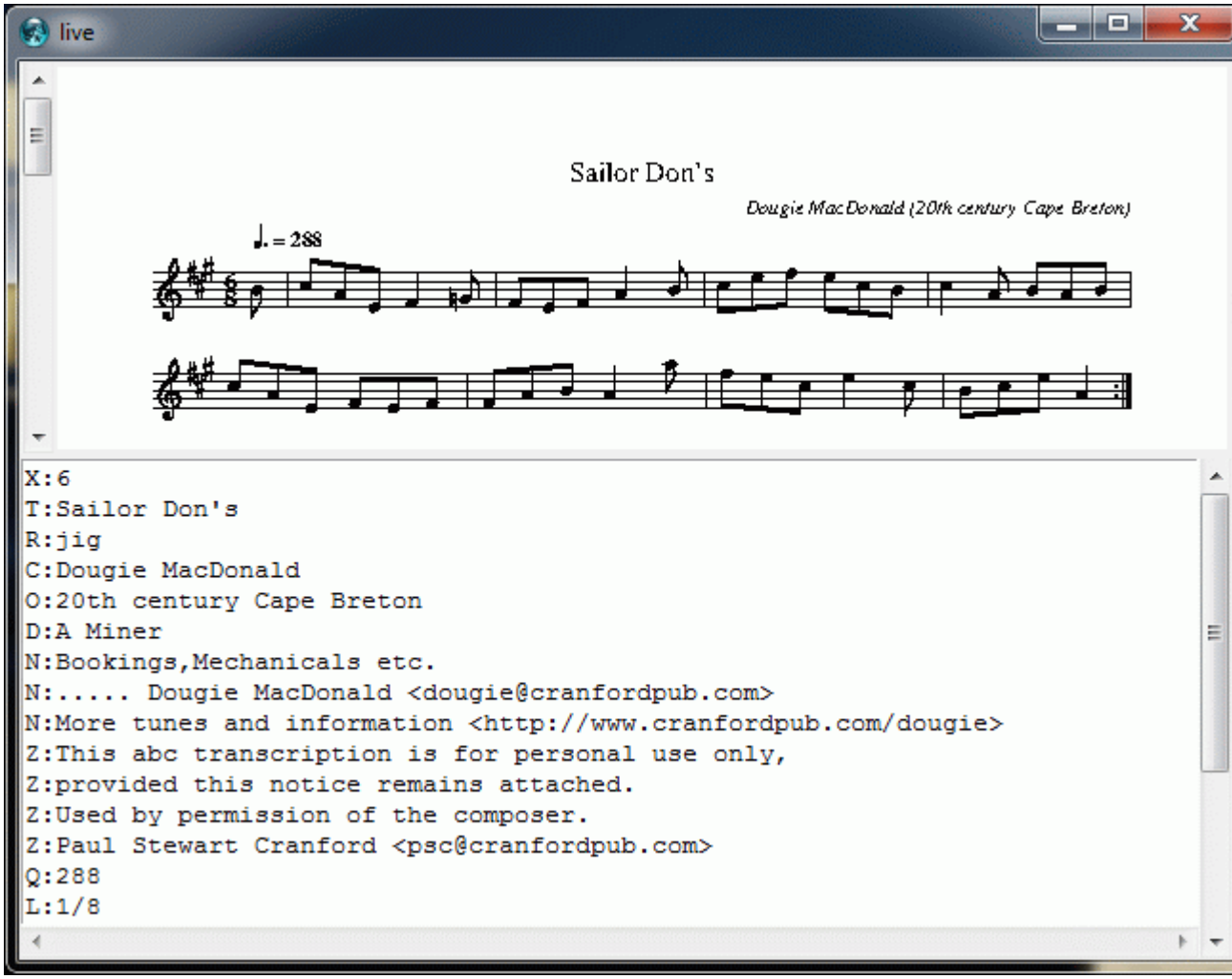


The function will copy the first few bars of all the tunes in the table of contents to a designated file or place it in the TclAbcEditor buffer. If the checkbox 'to single tune' is ticked, all the incipits will be stuffed into a single tune. This produces the most compact Postscript file when abcm2ps is executed on the output file and also allows you to put all the incipits in one MIDI file. If the checkbox is not ticked then each incipit goes into a separate tune and all the X: reference numbers are preserved. The number of bars in the incipit can be configured using the scale widget.

For multivoiced files, the first few bars of each voice will be copied. The function handles inline voice commands eg \[V:2\]\ but they should be placed at the beginning of the line.

If you want to produce incipits for any a selection of tunes, first copy the selected tunes to a separate abc file using runabc edit/copy command and then load that file into the TOC.

Live Editor

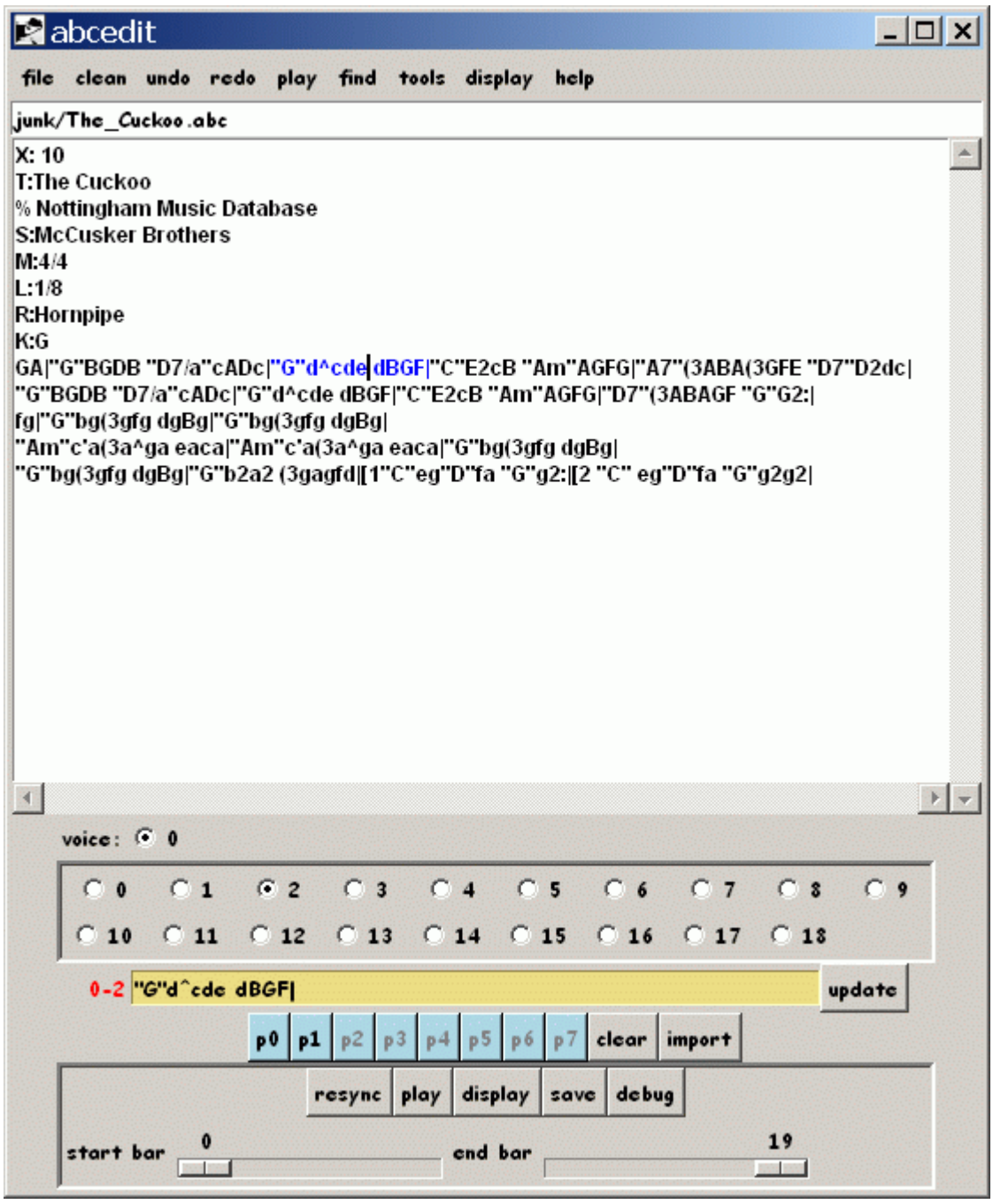


This editor requires ghostscript to operate. A separate window, pops up similar to what is shown above. This window shows the the music score and the abc notation for any tune that is selected in the TOC (table of contents) list box. If you edit the music notation, the music score will be updated immediately.

Clicking the mouse pointer over one of the note heads in the music score will place the cursor in the edit window adjacent to the the corresponding note in the abc notation. Holding the left alt key down while the edit window is in focus, will cause the corresponding note in the music score to be highlighted. Problems may occur

when you try to include the postscript header block which may occur before the first X: reference command.

MultiVoicedEditor



This is a clone of the TclAbcEditor. The editor provides direct access to any specific bar and voice, assuming

you know the bar number. Alternatively if you click inside any bar in the text window, the bar is highlighted in blue, the bar and voice number is indicated and the bar contents appears in an entry box. This provides a means of establishing or verifying synchrony when it is not too obvious how the bars match in the different voice. In addition, you can paste any repetitive sequence of notes into any bar (which is useful when you are creating drum accompaniment). The editor also allows you to play, display, or save a subsection of the notated tune.

Like the reformat function in the utilities menu, the tune is chopped up into pieces corresponding to the individual bars. (For debugging you can print the pieces in a separate window by pressing debug button.) The pieces are displayed in the text edit window with individual tags so they appear in blue when the mouse is clicked inside the region of the piece. In order to maintain synchrony between the internal representation and the edit window representation, edits should be done on the individual piece displayed in the entry box and then pressing the **update** button. This will also save the bar in one of the pattern buttons below in case you wish to paste it into another bar. (To paste one of the saved bar, simply click on one of the **p** buttons, and the current bar (in blue) will be replaced.)

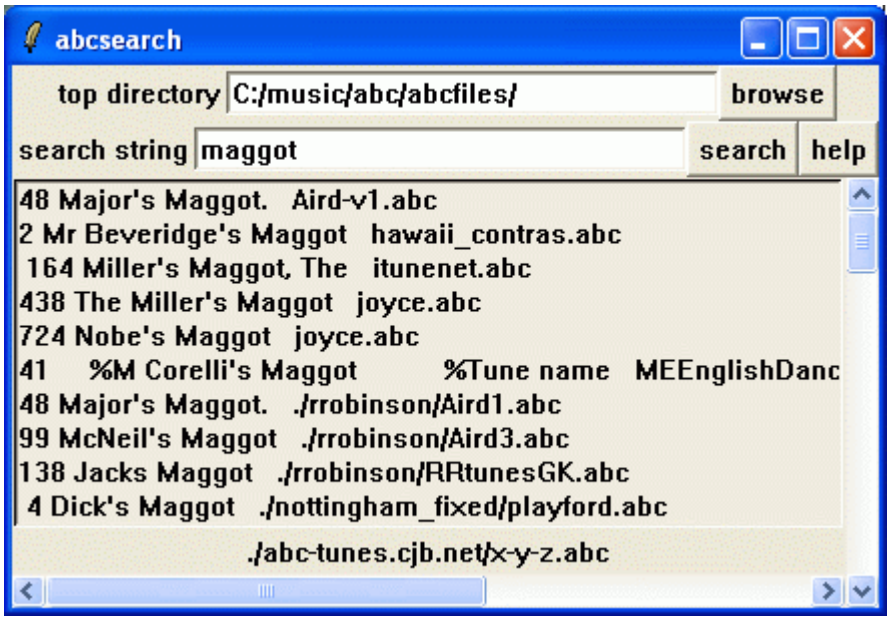
You can still make direct edits in the text window, however, it is necessary to click on the **resync** button after making these direct changes in order that the internal representation is updated.

The **import** button provides a link to the drum patterns created by the drum tool.

Search Menu/Find Title

The **Search Menu** button shows a picture of a magnifying glass. If you are like me, you probably have a collection of several hundred abcfiles. Finding a specific

tune can be quite laborious. If you have placed all your abcfiles into a specific folder, there is now a tool which makes it much easier to find a specific file or tune. When you click the button labeled 'find', a new tool will be displayed on your screen.



If this is the first time you are running this tool, it is necessary to enter the path name of the folder where all the abc files are located. This folder can contain sub-folders with more abc files. Now you are all set up. Just enter a word or two in the title in the search string entry box and then press carriage return or click the button labeled search. The program will search every abc file it finds for the specific word, and display the title of tunes in the listbox. (In this case, we were searching for any tunes with the word maggot.) If you have a big directory and some large files, please allow some time for the program to perform the search. You may abort the search anytime if you are getting too many hits.

To access any tune in the list box, just click that entry and the table of contents of that file will be displayed. Furthermore, the table of contents will be scrolled to the position where the file is visible.

The tool does not distinguish between upper and lower case letters; however, you should avoid punctuation marks and special characters as they mean something special to the string matching algorithm. The string you enter is interpreted as a regular Tcl expression using the regexp. As a result you can make fairly complex searches. For example,

mary | john will return any title containing the word mary or john
fairies$ will return any title ending with the word fairies
^some will return any title starting with the word some

Search/Find Bar

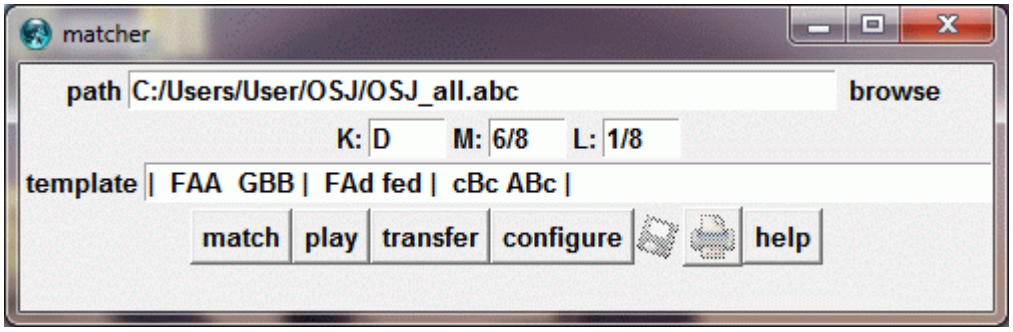
Find Bar is the first of several tools for analyzing the contents of an abc file. Its objective is for searching a library of abc notated tunes for certain melodic fragments. Most of the processing is done by an external program called abcmatch which is part of the abcMIDI package. Over the past few years other search methods were added to abcmatch and runabc was extended to serve as user interface to these tools.

Most melodic matching applications are restricted to the the beginning sequence of notes in the tune which defines the main melody of the tune that listeners remember. Most tunes contain an A and B section and there are no tools for handling the B section. Furthermore, the goal was to develop a tool that could search for musical fragments in any part of the tune. To limit the computational processing time, the musical fragments had to fit in a musical measure or bar or a sequence of measures.

Many abc notated tunes contain guitar chords, grace notes and decorations. They are ignored since they can vary in the music representation of the tune. Also the same tune could be notated in different keys, so the search algorithm should be able to compensate for the different key signatures. In addition, the search algorithm

should be tolerant to minor variations without having significant impact on the search time.

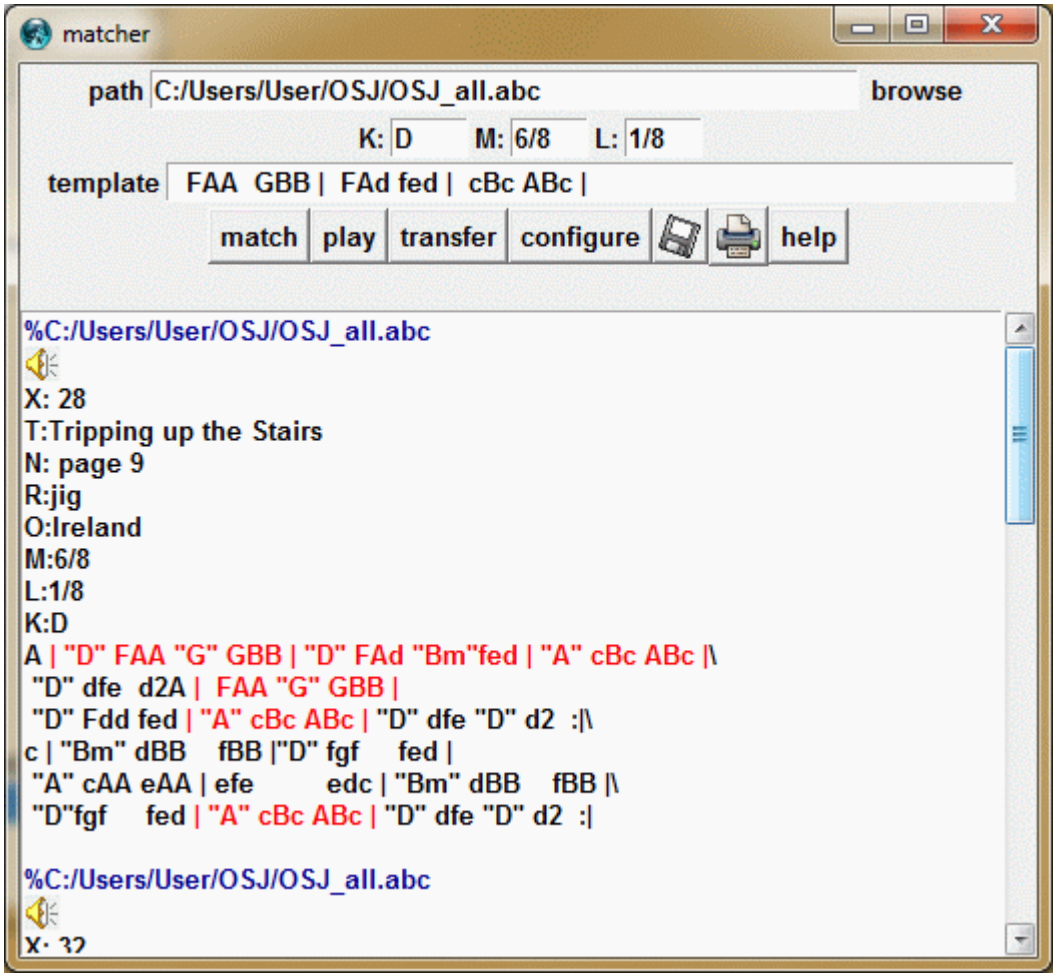
The **find bars** function was designed to handle a large collection of tunes. They could be in a single file or in multiple files stored in a folder or a folder tree structure. The user specifies the file or the directory to be searched. The template which specifies the musical information to be matched is given in another file called match.abc. Runabc contains the user interface for creating match.abc and specifying the file or directory to be searched.



To use this tool, you enter one or more bars from the tune in the body entry box using abc notation. Also specify the meter, note length and key signature in the entry boxes M: L: and K:. Then press the **match** button.

A more convenient way to enter this information is to use **TclAbcEditor**. Edit a tune containing the musical fragments of interest and highlight the bars. The bars have to be contiguous. Then copy this information by clicking the **transfer** button or press **alt-t** on your keyboard. The selected bars will be transferred to the **template** entry box, and the meter, note length, and key signature will be obtained from the active tune. The **matcher** window will open automatically and the selected bars will be transferred. The **play** button allows you to listen to the fragment you selected. Clicking the **match** button will start the search and the output of the

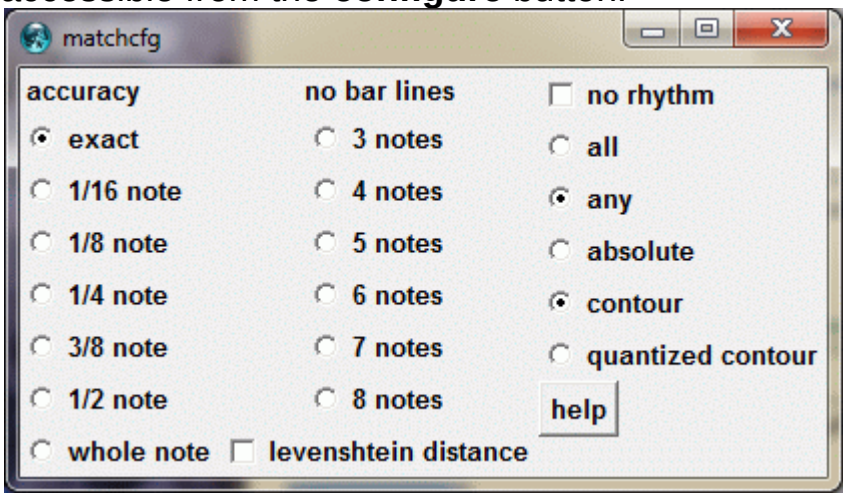
search will be displayed in a scrolled text window shown below.



Bars which match the given criterion will be shown in red. If you click the file names shown in blue, that file will be automatically loaded in the **table of contents** and the specific matched tune will be selected in the list box. To listen to the matched tune click on the speaker icon.

The characteristics of the matching algorithm is configured by means of the **matchcfg** window,

accessible from the **configure** button.



These configuration buttons also apply to the **match tune** and **grouper** functions that will be described below.

The buttons control how the matching algorithm is executed on the collection of tunes. For example, if the **no rhythm** checkbutton is ticked, the duration of the notes are ignored allowing for example bar |ABcd| to match any of the following |(3ABc d2|A>B c>d| A/B/cd2| and any other rhythm variations fitting in a measure. Note tied notes are treated as separate notes.

The options below the left most column, **accuracy** affect the temporal resolution of the matching algorithm. These options require that the time signature of the template, matches the time signature of the matching tune and is best described with the following example. Suppose the template consists of a bar of sixteenth notes given here.

```
GAGc AGFE GEGB FEGA|
```

and it is being compared with the following 4 bars.

```
GBGc AGFE GeGB FEGA| G2Gc AEFD GEGd FEGG|
GABc AGED GEAB FEAB| GABc BGED GDEF DEAG|
```

If the resolution is set to **exact** or **1/16 note**, only the first bar will match with the template. If the resolution is reduced to **1/8 note**, then the template is approximated by a string of 1/8 notes

```
G2G2 A2F2 G2G2 F2G2|
```
and similarly the 4 bars now look as follows to the matcher,

```
G2G2 A2F2 G2G2 F2G2| G2G2 A2F2 G2G2 F2G2|
G2B2 A2E2 G2A2 F2A2| G2B2 B2E2 G2E2 D2A2|
```
so both the first and second bar will match. Essentially, the matching algorithm replaces the notes, in the bars by a stream of 1/8 notes or whatever was selected and compares the two streams. The pitch value of each note in the stream corresponds to the pitch value in the given bar at the specific time position.

If the resolution is reduced to **1/4 notes**, then the template, will be approximated by a string of 1/4 notes.

```
G4 A4 G4 F4|
```
and the first 3 bars will match.

Reducing the resolution to 1/2 notes would cause all four bars to match which may result in a lot of trivial matches being reported unless the **all** radiobutton (on the right column) is selected instead of the **any** any button.

If **exact** is selected, the notes must match exactly (allowing for key transposition).

If any of the options in the middle column are set, it is not necessary for the time signature of the template to match the tune in consideration. The matching algorithm still starts from the beginning of a bar, however only the first n notes are considered. If there are fewer than n notes in the bar, the matcher will continue through the next bar.

There are two sets of choices in the right most column options. The first set consists of the choice **all** or **any**. If **all** is selected, then all the bars in the template must match in the given sequence. If **any** is selected, then the bars in the template match independently. In fact only one of the bars may match in the tune.

The other choices are **absolute**, **contour**, and **quantized contour**. In **absolute** mode, the pitches of the notes must match exactly relative to the key signature. Provided the key difference is less than six semitones in either direction.

The differences between the three methods is best described with the following example. Let the following bar be the template

```
CEGE|
```

and the tune being matched be

```
CEGE|FAcA|GBdB|EGBG|
```

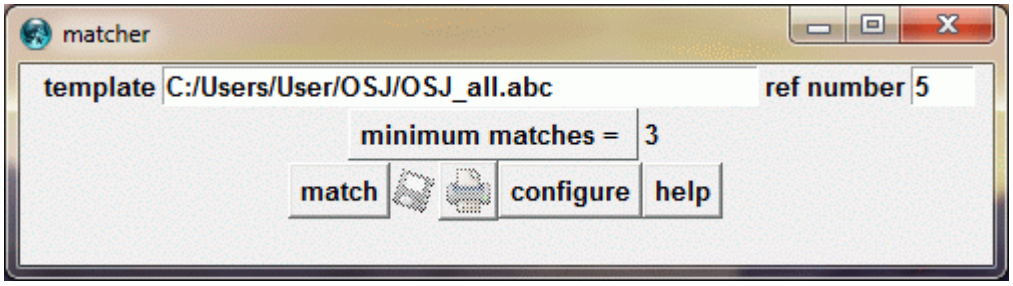
The key signature is C major. If **method** is set to **absolute** only the first bar CEGE is matched. The next two bars also have the same pattern, but they are not placed in the correct position in the C major scale. However, if the matching method is set to **contour**, they two will be matched. Contour matching only looks at the relationships between the notes in the bar. Essentially, FAcA and GBdB are just transposed versions of CEGE, so they are matched. The last bar is not an exact transposition, since EGBG is a minor triad rather than a major triad. Finally, if **method** is set to **quantized contour** all bars are matched. The matching algorithm considers major and minor thirds the same. All intervals greater than a third are not distinguished.

Finally if the Levenshtein checkbox is checked, the program would allow one substitution, insertion or deletion error to occur for matches of at least 4 notes. Thus two sequences |CEF GBF| and |CAF GBD| would be accepted as a match.

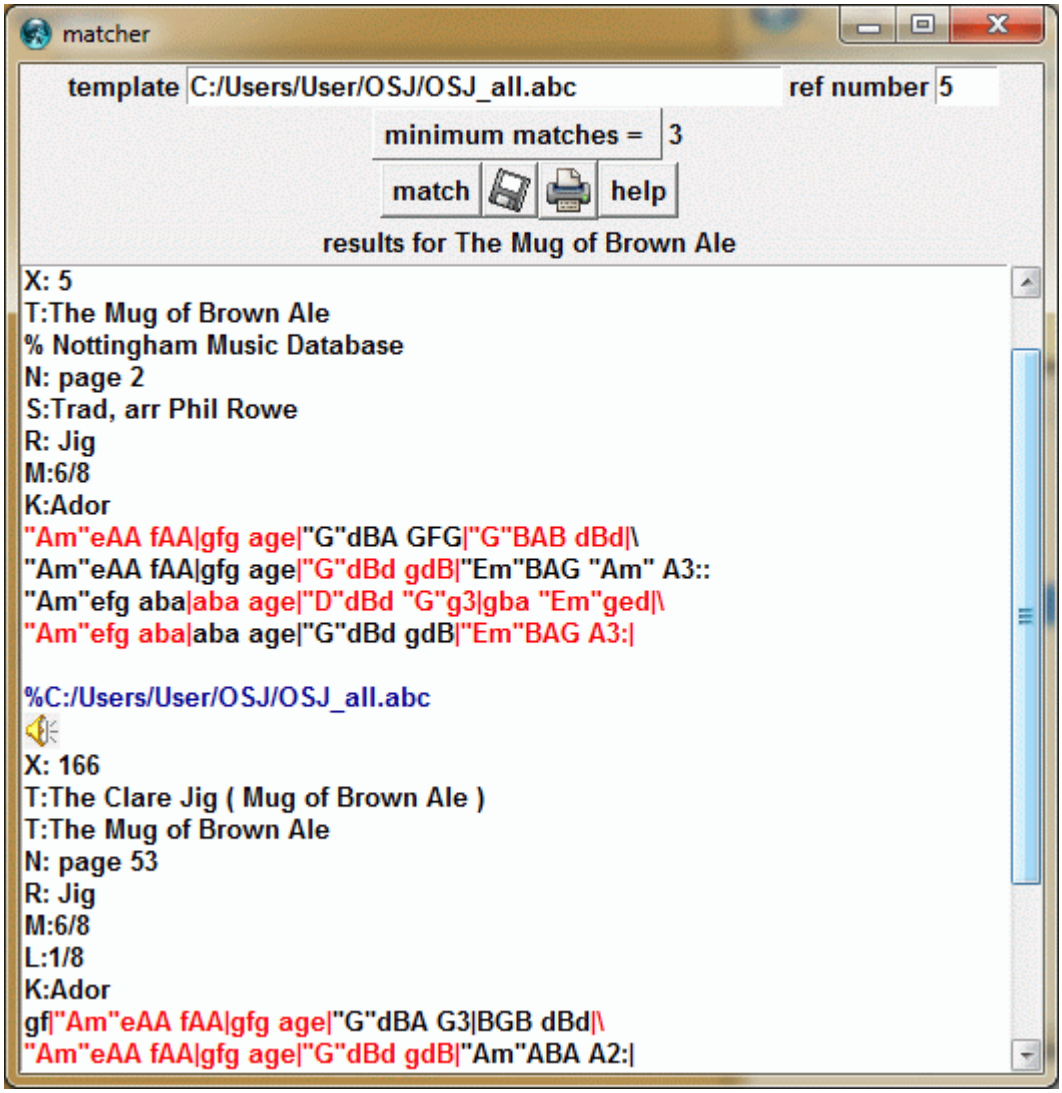
Search Menu/Match Tune

Frequently the user would like to use an entire tune as a template. Rather than going through the procedure of

cutting and pasting all the bars in the selected tune into the **Find bars** entry box, it is more convenient to run the **Match tune** user interface. This function behaves somewhat similar to **Find bars** but only handles a collection of tunes in the active open file corresponding to the **TOC**. When the user selects a particular tune in the **TOC** the entire tunes acts as the template. The matching algorithm may be configured using the same menu used for finding bars; however, certain modes like matching **all** bars is not likely to be fruitful.



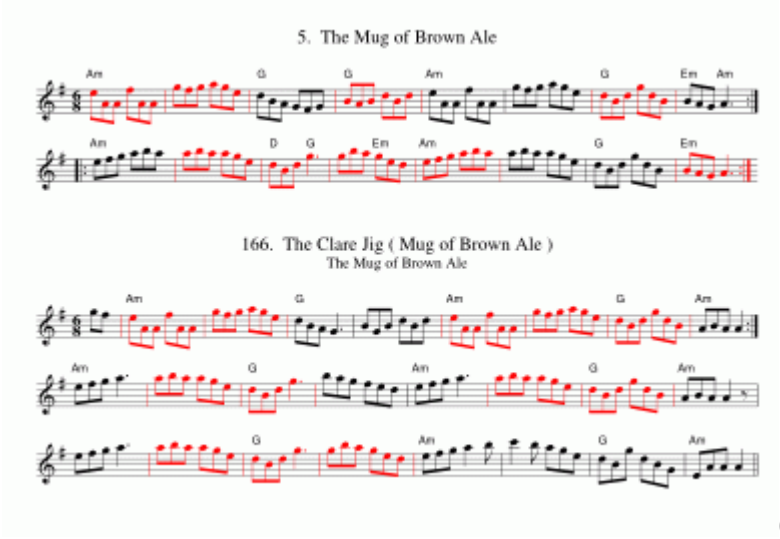
The parameter **minimum matches** specifies the minimum number of bars in the template that must match in order for the matching tune to be displayed. The **ref number** refers to the X: reference number of the tune to be used as a template. The reference number follows the selected tune in the **TOC**. The following image shows the output you may see after you click the **match** button,



The matching bars in the template and in the tune are shown in red. Clicking the speaker icon allows you to hear the tune played. Clicking the **save results** button (diskette icon) saves all the tunes in the window to a separate abc file which you specify. You have a choice of saving the abc tunes in regular format, saving it in a form where the matching bars will be displayed in red (see below), or saving it in a form to be pasted into an html document. Since a lot of word processing software can import html documents, this is a convenient way for creating a word document preserving the color information.

Note that the matching algorithm is not exactly symmetrical. Though every measure which matches a measure in the template tune is highlighted in red, the same does not apply to the template tune. Only the first matching measure in the template tune is highlighted in red. Once the matching algorithm, finds a match in the template tune for a given bar, it does not continue to look further.

You may use either abcm2ps or yaps as a PostScript generator for viewing the results in common music notation; however, in this

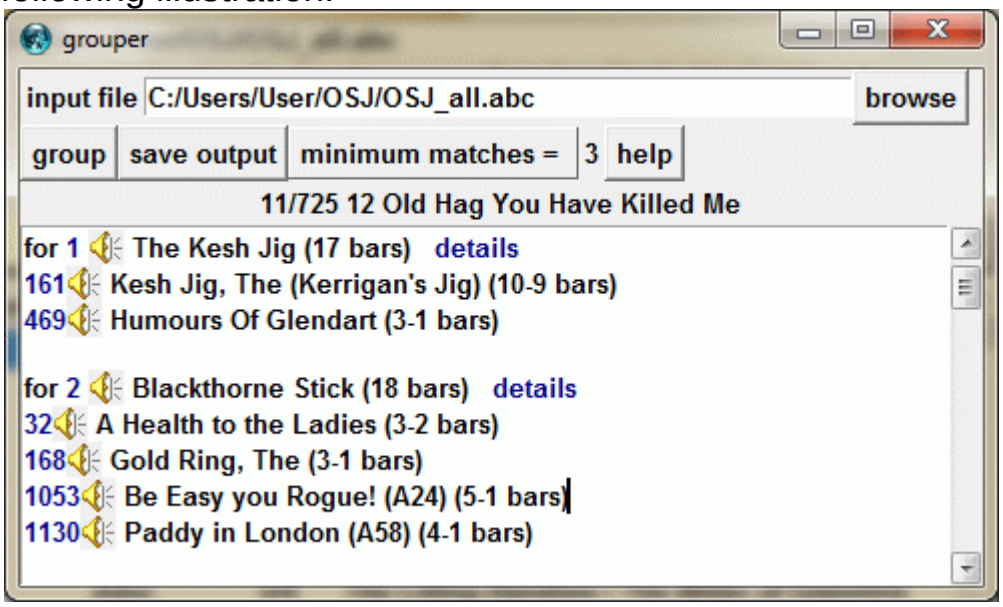


case yaps is recommended. The common measures are accentuated in red. If you are using abcm2ps, the clefs or music staff may occasionally be displayed in red. Yaps avoids generating these artifacts. If you insist on using abcm2ps, it may help to ensure that abcm2ps displays the music lines the same way it written in abc format. In other words the scale factor should be small enough that the music line as written in abc notation does not run into the next line. Do not use 'auto line break'.

An example of an application of this function can be found in the note Abc Similarity.

Search Menu/Grouper

This function applies to a single file composed of a collection of tunes. The goal of the function is to identify tunes in the file which are somewhat similar. Presently the program finds tunes which share common content based on the above bar matcher. The tunes containing common bars form groups as they are listed in the following illustration.



Essentially, the function runs abcmatch repeatedly on every tune in the file. For each tune, the entire body of the tune is made a template and compared with all the tunes in the file. The number of bars in the tune that are common with the template are presented as a pair separated by a hyphen. The first number is the number of common bars in the tune and the second is the number of common bars in the template. For example, a single bar in the template may appear many times in the tune being matched.

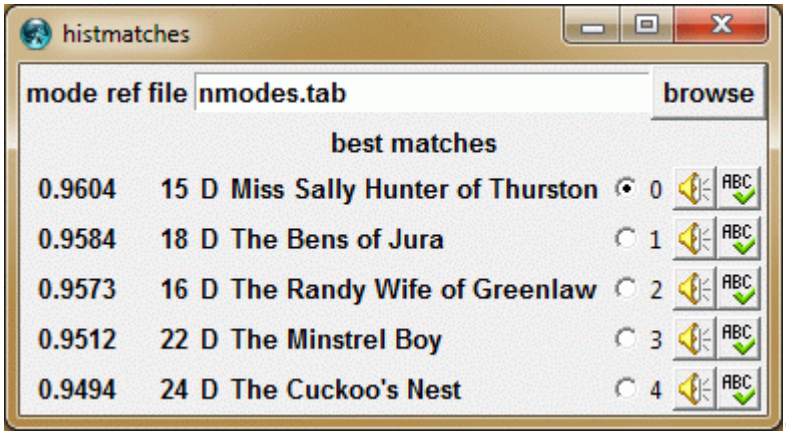
To reduce output, you may set the variable **minimum matches** to a small number greater than one. This specifies the minimum number of common bars in the tune, in order for it to appear in the list.

The button labeled **save results** allows you to save this output to a separate text file.

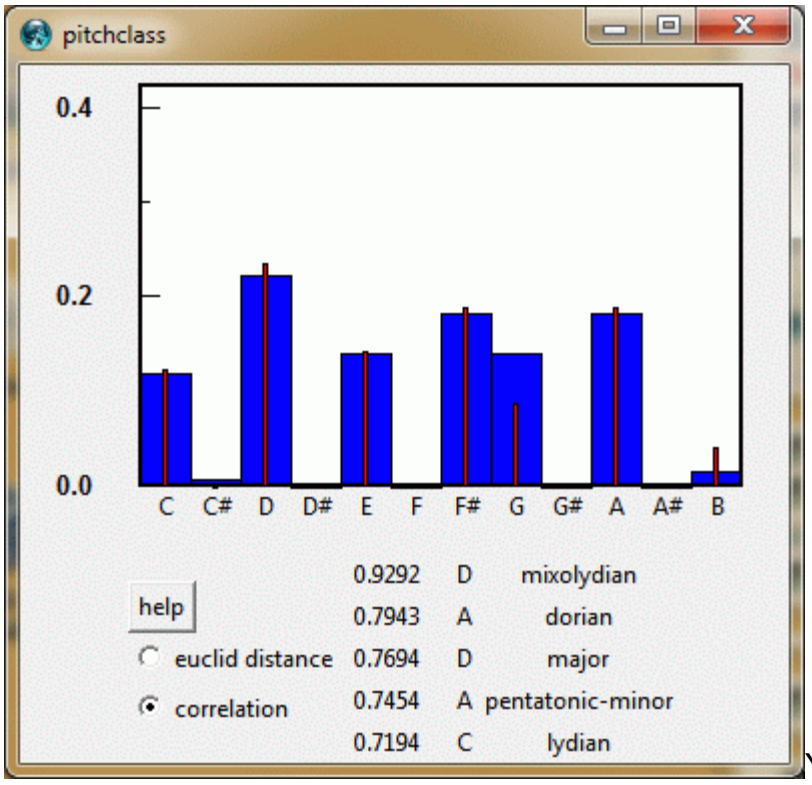
If you click on the blue text marked **details**, then the group of tunes will be displayed in a separate window labeled **matcher** (the same one used by find bars) and all the matching bars will be highlighted in red. Essentially, the find bars function is run using the selected tune as a template on the active file. The function is not run with the same parameters indicated in the matcher window so the output is not the same that you would get if you clicked on the match button on the matcher window.

Search Menu/Histogram Matcher

This is an extension of the utility **Pitch Histogram**. If the pitch histogram has not been computed and displayed for a particular selection, this is automatically done. The program next attempts to match the histogram with a database (nmodes.tab) which was generated from nmodes.abc. Nmodes.abc was derived from a collection of web pages created by Jack Campin on scales and modes. A more recent version can be derived from Scales and Modes in Scottish Traditional Music. The best five matches are listed in a separate window as shown below



and red vertical lines indicate the corresponding distribution for the best match in the pitch class distribution.



You can view the match for the other for best matches, by clicking one of the radio buttons. You can hear the tune of one of the matches by clicking on the adjoining speaker icon. You can view the abc representation by clicking the adjoining abc icon.

This is an experimental program to familiarize myself with Jack Campin's analysis. So the matching algorithm does not compensate for different key signatures (like **pitch histogram**). An example of an application of this function can be found in the note Abc Similarity.

You can create your own .tab database from an abc file by browsing and selecting an abc file which contains a collection of tunes. nmodes.abc comes with the runabc.zip distribution or Runabc_setup.exe and if nmodes.tab is not found it is automatically created from nmodes.abc. The nmodes.abc file was recently updated to be in line with John Campin's updated web page. Runabc will check whether the modification date of nmodes.abc is later than modes.tab and recommend that you recreate nmodes.tab if this is true.

Creating Midi Files

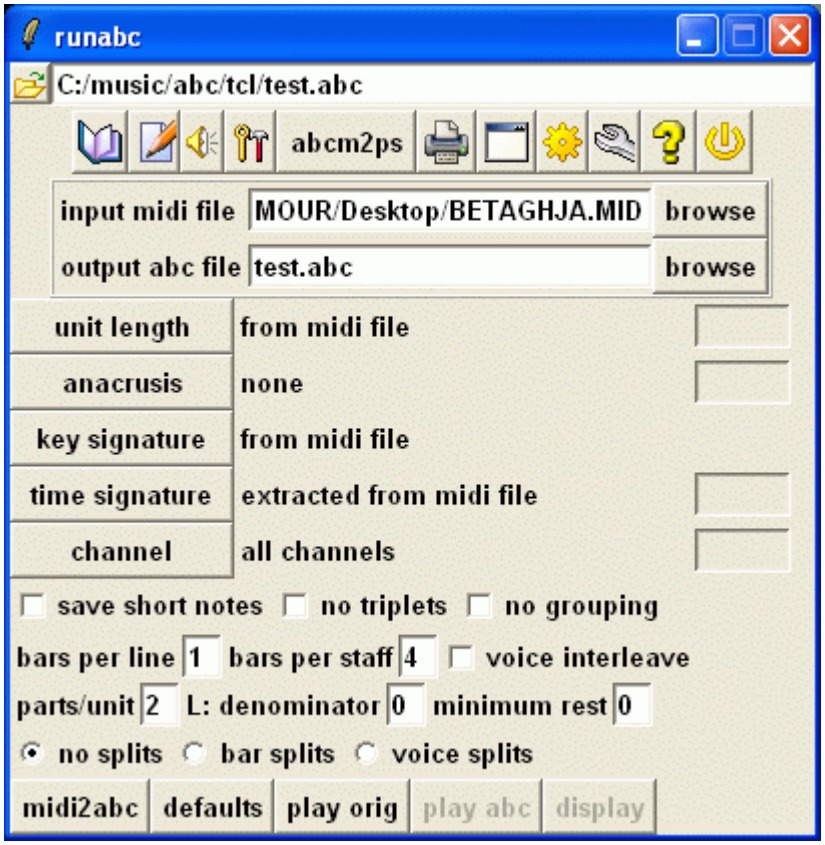
You can save a tune as a midi file using the *edit/save midi file(s)* menu item. Runabc will prompt you for the name (path name) of the midi file. It is not necessary for you to enter a mid extension, but if you include it the program will not insert another one. If you wish to make many midi files at once, just select the tunes in the TOC and use the same function. Recall that the <cntl>-/ will select all tunes, <cntl>-\ will deselect all tunes, <cntl>-mouse click will select or deselect a tune in the TOC. When you select this menu item, a property sheet shown below will appear below the TOC.

Midi Menu/ miditoabc

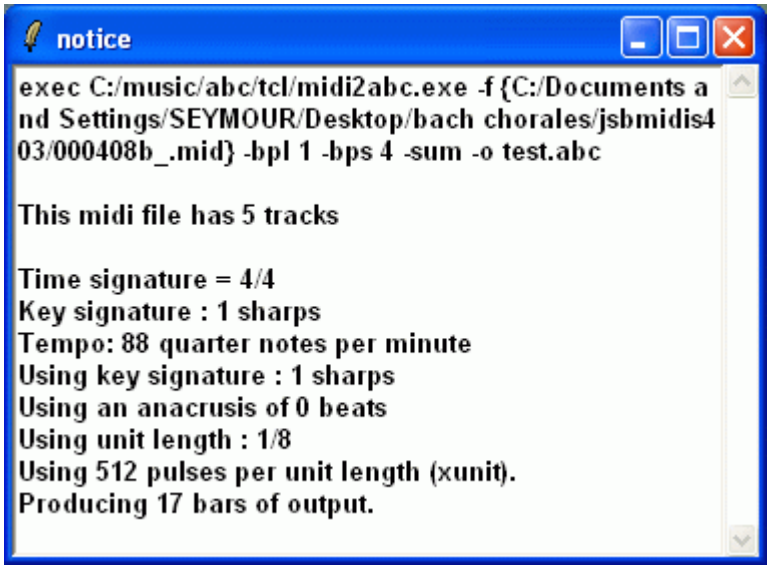
It is quite difficult to find multivoiced abc files on the Web. Furthermore the genre of the abc files are fairly limited. Fortunately, you can make your own multivoiced abc files from the many MIDI files on the internet. In most cases the midi2abc tool does this completely automatically; however, a few MIDI files provide a challenge.

Besides abc, there are probably 50 or so music notation formats in common use. Many of them are proprietary to a commercial product and there are few applications for converting one format to another. Fortunately all music notation programs usually have provision to export the music in MIDI format. This provides a means of converting the music into abc format. Therefore, a lot of effort has been made in providing a good tool for converting a MIDI file into an abc file. Runabc provides three main tools for handling and viewing MIDI files. They are midi2abc, midishow and mftext which are all accessible through the Midi Menu. They shall be described in detail.

To get to the midi2abc interface, select the meu item **Midi Menu/midi2abc**. The following graphical interface will be displayed.



To use it, you first need to select the input midi file using the browse button. You also need to designate the name of an output abc file that will be created. Now click on the lower left hand button **midi2abc** which will execute the midi2abc.exe program. Once this program is executed, the specified abc file will be created and the **play abc** will be enabled. You may also click the top **console** button, to view the messages returned by midi2abc which are sometimes useful. See the sample below.



The button at the bottom, **play orig** will allow you to hear the original MIDI file. If you click on the button **play abc**, abc2midi will be convert the output abc file back to a MIDI file and send it to a media player program. If you click the next button labeled **display** at the bottom right of the window, the output abc file will be converted to a postscript file and the postscript viewer will display the results. If you wish to edit the file you will have to change the active file in the top entry box to the output abc file before selecting the editor. Pressing the top **play** button may produce different results since runabc may change the tempo or introduce other %%MIDI instructions to control the voice assignments which were selected by the user.

For most of the midi files posted on the web you should run midi2abc with the default parameters. These defaults can be restored by clicking the button labeled **defaults**.

Here is an easy example, you can try. Go to the web site http://www.contemplator.com/tunebook/ and find a MIDI file you like. Download this MIDI file and select this file as the **input midi file**. Click the **midi2abc** button and play and display the resulting abc file.

Now if you set this output abc file as you active file (in the top file entry box), you can do many more things with the result. Using the **edit/extract part** function you can extract a single voice from the multipart score and display it. Now suppose, you wish to play along with the MIDI file on your own musical instrument but you wish to slow it down. The tempo is already indicated in the output abc file, but you can still override it if you go to the **Play options/tempo/pitch** menu item. Tick the **override tempo indications** checkbox and it will play with whatever tempo you set. Suppose now you want to turn off some of the instruments. Select **Play options/voices** and adjust the audio levels of the different voices. Ignore, the program selections as they will not override the current indications in the abc file unless you have indicated that in the **Play options/tempo/pitch** window. Note after you have finished experimenting, you should remember to restore these settings to their nominal values before you quit or else all abc files will sound funny.

For some MIDI files especially the raw output of a MIDI keyboard it may be necessary to run midi2abc with different parameters. Though the output abc file converts back to a reasonable MIDI file, it may produce a PostScript file that is difficult to read. For those files it may be necessary to adjust some of the run time parameters in order to improve these results. This is explained below but first you need to understand how a midi file is encoded.

A midi file contains a list of events which are mainly note-on and note-off commands. A note-on/off command indicates the relative time from the previous command in units of midi pulses, the particular midi channel, the pitch in midi units and the loudness or velocity. There is a direct mapping between midi pitch units and the keys of a musical instrument so extracting the musical notes is generally simple. The mapping between note duration in

midi pulses and note type (quarter note, half note, etc.) may be less straight forward in some cases.

All midi files contain an indication of the number of midi pulses per quarter note, but this may not be relevant for some midi files. If the midi file was created using music notation software, then this indication is probably reliable. On the other hand, if the midi file was recorded directly from a performer playing a musical instrument, there is no guarantee that the player will maintain this mapping exactly or approximately. The duration of a midi pulse in seconds is specified by a tempo command in the midi file. Most midi files have only one tempo command, but some may have many.

There are two types of MIDI files in current practice. The earlier types of file recorded are the MIDI files in one track, where the musical instruments are distinguished by the channel numbers. Newer MIDI files are multitrack, where each instrument is recorded in a separate track. Midi2abc is designed to work on the latter format but it can handle the earlier type to a limited extent.

In order to create an abc file, midi2abc needs to convert the note durations specified in MIDI pulses to abc units, where called quantum units. By default midi2abc assumes a quantum unit equal to half of the L: unit length which typically is either 1/8 or 1/16 depending on the time signature encoded in the MIDI file. Thus for L:1/8, the quantum unit is a 1/16 th note and midi2abc quantizes all notes to these units. Notes that are shorter than that (after rounding) are typically ignored. The conversion factor from MIDI pulses to quantum units is **xunits**, which may be determined in one of several ways depending upon the run time parameters of midi2abc. By default, midi2abc determines xunits from the header information in the midi file (PPQN or pulses per quarter note). However, midi2abc allows you to specify xunits as a run time parameter, or determine xunits from other information such as the tempo or desired number of

measures to output. Furthermore, midi2abc has the capability of estimating xunits statistically by attempting to minimizing the quantization error. (For most music the note durations should be approximately integer multiples of some number of MIDI pulses.)

The first menu button on the abc2midi property sheet, labeled **unit length**, enables you to select how to determine the unit length. When the program starts up, the method used is "from midi file". If you change this setting to "from entry box", then you must enter a number in the adjoining entry box specifying this length. It is not recommended that you use this method unless you know a priori this conversion or you are doing some fine tuning. For your information, the unit length used by the program is printed out on the summary every time you click the midi2abc button or execute midi2abc.

If you specify "by minimization quantization error", then midi2abc will use its own algorithm for estimating the unit length. The answer is usually correct, but sometimes it is out by exactly a factor of two or so. If you specify "from tempo in entry box", then the adjacent entry box should contain the estimated number of beats per minute. The program will attempt to use this information to figure out the number of midi pulses in a quarter note and then unit length in order to get this beat. The program assumes the last tempo indication in the file so if the file has more than one tempo indication, this method is not going to work. Finally if you specify "from expected bars in entry box", then you should enter the number of bars or measures you expect in the output abc file. This assumes a constant time signature throughout the file. If the output music notation results is full of tied notes, the program is probably using the wrong unit length.

A lot of music does not begin with a full bar, but may start with one or more leading notes. This is called **anacrusis**. If For some MIDI files it may be necessary to either specify the anacrusis in quantum units, or else tell

midi2abc to estimate the anacrusis using one of two algorithms. (One algorithm, attempts to minimize the tied notes across bar lines. The other algorithm searches for strong beats based on the velocity (or loudness) of the MIDI notes. If all the bar lines are off by a couple of beats, you can adjust that using the anacrusis control.

For some reason, many MIDI files do not specify a **key signature**. This does not affect how the MIDI file is played by the synthesizer, since all the sharps and flats have already been notated in the MIDI file; however, there may be lots of accidentals when you convert the file to abc format. If the key signature is encoded in the MIDI file, midi2abc will use this information in creating the abc file but if it is missing midi2abc will attempt to guess the key signature by minimizing the number of accidentals. Sometimes the key signature indicated in the MIDI file is incorrect and you may wish to use a different one. The next menu button, key signature, provides you with several options. There is a similar menu button for **time signature**.

Finally, if the MIDI file contains several instruments encoded in different MIDI **channels** (0 to 15), you have the option of extracting only a single channel. By default all channels are extracted and the different lines of music (voices) are separated by the track number. Nearly all the recent MIDI files are multitrack format (MIDI format 1)

Certain percussion instruments are represented in the MIDI file by notes of very short durations. These will be ignored by midi2abc unless you tick the box, **save short rests**. In that case, all these short notes will be assigned a duration of one quantum unit.

To improve the articulation of notes, some MIDI music contains short time gaps between every note. This would appear as many rests sprinkled between each note in the abc file. The parameter **minimum rest** allows you to specify the minimum sized rest that can appear in the

abc file. Rests smaller than that will be absorbed by the preceding note.

If you know the music is not full of triplets and broken notes, then you may wish to tick the check box **no triplets** .

The music in MIDI files are generally more complex than you typically find in abc files. Furthermore, midi2abc cannot distinguish grace notes from real notes and a trill will expand to a long series of notes. Therefore the output of midi2abc may is usually very complicated and it is recommended that you limit the output to one measure (or bar) per line. (Some software may have difficulty handling lines longer than 128 characters.) Midi2abc will place a backslash continuation at the end the line so that most abc to postscript converters will not print one bar per staff. The entry boxes in this interface allow you to specify both the number of bars per output line, and the number of bars to continue. Enter small numbers in the entry box **bars per line** and **bars per staff**.

Midi2abc outputs the tracks in separate blocks for each voice. This is quite difficult to edit or read. If you tick the check box **voice interleave**, runabc will run its own script to produce an output in voice interleaved format. This script currently is rather restrictive and only handles the midi2abc output.

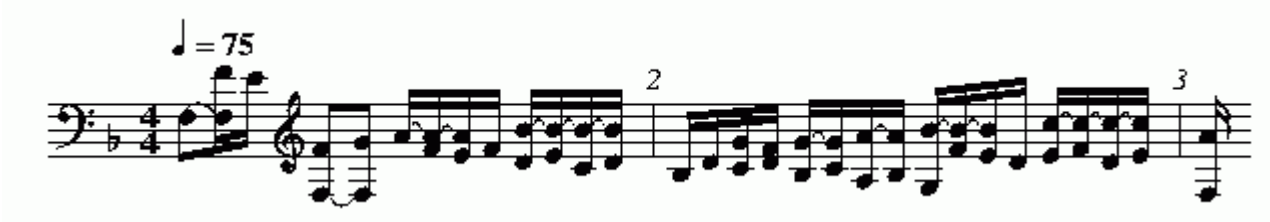
New parameters were recently introduced in midi2abc that provide more control on the size of the quantum unit. As mentioned in the beginning of this discussion, midi2abc splits a L: unit length into two parts called quantum units. Now you may specify the number of parts provided it is a power of 2 and not too large. Midi2abc automatically chooses the L: unit length (either 1/8 or 1/16), but now you also have the option of choosing your own unit length provided the denominator is a power of 2. Increasing the quantization precision by raising **parts/unit** will provide a more accurate representation

however this can introduced strange tied notes like 1/4 tied to 3/64 notes which will be hard to sight read. It is recommended that you stick to the default of 2. By convention **L:denominator**=0 indicates allows midi2abc to choose its own L:unit length.

For some raw MIDI files, in particular keyboard music, all the notes are placed in a single track. There are many nonhomophonic chords -- chords containing notes that do not share a common onset time or stop time. In other words they are polyphonic. Representation of such chords is rather awkward in abc notation producing an awkward notation which is difficult to edit.

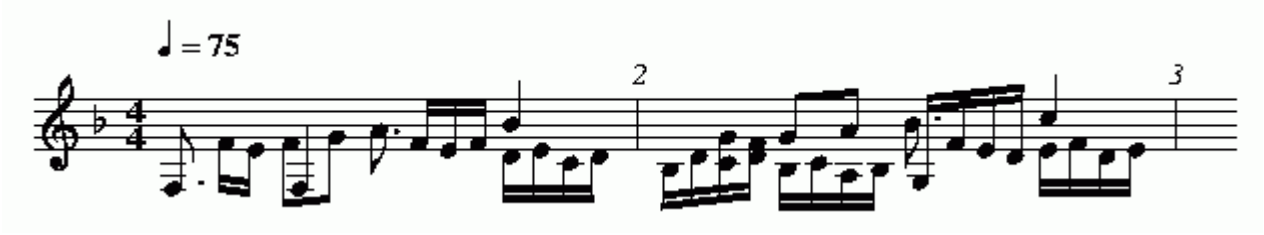
```
F/2E/2[FF,-] [GF,]A/2-[A/2-F/2] [A/2E/2]F/2[B/2-
D/2][B/2-E/2]| \
[B/2-C/2][B/2D/2]B,/2D/2 [G/2C/2][F/2D/2][G/2-
B,/2][G/2C/2] [A/2-A,/2][A/2B,/2][B/2-G,/2][B/2-F/2]
[B/2E/2]D/2[c/2-E/2][c/2-F/2]| \
[c/2-D/2][c/2E/2][A/2-F,/2][A/2F/2] [d/2-E/2][d/2D/2]
```

If the abc to postscript converter is able to handle this file, it produces an almost unreadable output similar to below.



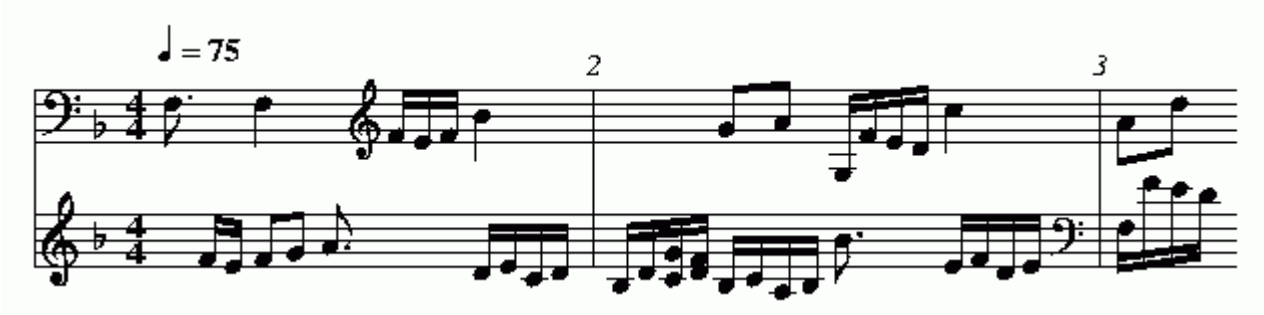
The option **bar splits** attempts to avoid polyphonic chords by splitting a bar into separate lines using the '&' symbol. The output is somewhat easier to edit and looks like this.

```
F/2E/2F GA3/2x/2D/2E/2 C/2D/2B,/2D/2 &  \
xF,2x/2F/2 E/2F/2B2x |  \
[G/2C/2][F/2D/2]B,/2C/2 A,/2B,/2B3/2x/2E/2F/2
D/2E/2F,/2F/2 &  \
xG AG,/2F/2 E/2D/2c2A |
E/2 & d
```



This output is somewhat of an improvement but leaves much to be desired. The option **voice splits** goes a further step and splits the entire voice into separate voices. The output looks like

```
V: split2A
%%MIDI program 24
F/2E/2F GA3/2x/2D/2E/2 C/2D/2B,/2D/2| \
[G/2C/2][F/2D/2]B,/2C/2 A,/2B,/2B3/2x/2E/2F/2
D/2E/2F,/2F/2| \
E/2D/2
V:split2B
xF,2x/2F/2 E/2F/2B2x| \
xG AG,/2F/2 E/2D/2c2A| \
```

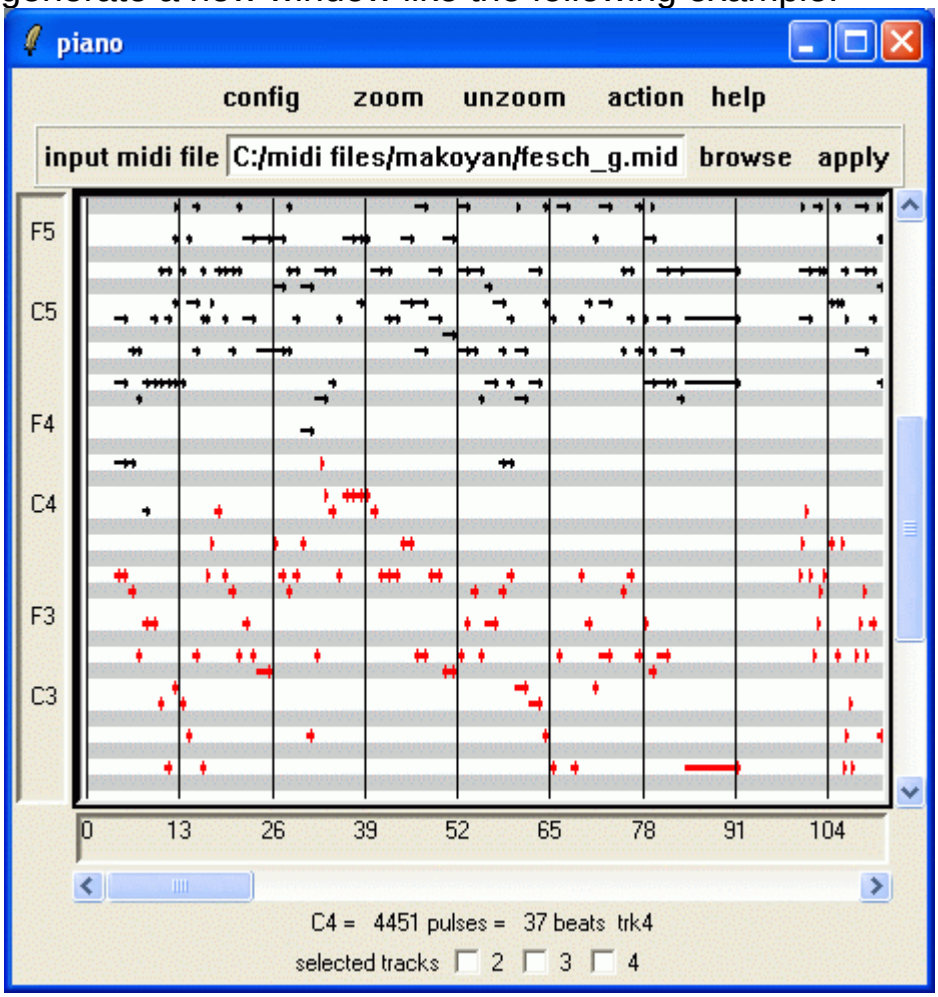


which is possibly easier to interpret. Unfortunately, this is a difficult problem in artificial intelligence and midi2abc's greedy algorithm does not always do a good job. The code is still not fully debugged.

Midi menu/ Midishow - Piano Roll Representation

Midishow is called from the **Midi menu** represented by musical note. Assuming you have selected a midi file in the mid2abc window (described above), midishow will

generate a new window like the following example.



Midishow allows you to visualize a portion of a MIDI file in piano roll form. MIDI files are generally a lot more complicated and longer than abc files. There may be repeats and key signature changes that are not expressed explicitly in the MIDI file. Converting the entire MIDI file into an abc file may produce a big mess requiring much editing. In some cases the output file may not be accepted by other applications and cause it to crash.

Midishow is a MIDI navigation tool built into runabc. It displays the MIDI file in piano roll format in a scrolled Tcl/Tk canvas. Using the scroll and zoom controls, you can select any particular segment of the MIDI file and convert this section into an abc file using midi2abc. Other

functions allow you to examine the characteristics of the MIDI file or part of the MIDI file and determine how it was created.

To use this tool, you must have the latest version of midi2abc and a new program midicopy which comes with the abcmidi distribution.

If the MIDI file is very big (say over 100 kbytes) and your computer is slow (say 600Mhz), there may be a long pause before Midishow responds. Runabc will appear to be frozen for that time. Just be patient and the results should appear in about a minute.

Each note is represented by a black horizontal arrow, whose vertical position represents its pitch and whose width represents its duration. If you place the mouse pointer on any particular note, this note and all the other notes belonging to the same track (or channel) are highlighted in red. (Unfortunately, the mouse pointer was removed when I grabbed this window.) A short descriptor of the note is placed in text near the bottom of the window. If you right click the mouse pointer while it is positioned over this note, all the highlighted notes will be put into a temporary MIDI file and sent to your designated MIDI player. If you right click while the mouse pointer is not over any particular note, then all the displayed notes (i.e. all tracks) are played. The piano window is resizeable and you can change the horizontal scale using the zoom and unzoom buttons.

While the music is playing, you may see a vertical red marker attempt to follow along with the music. Unfortunately, the music is played by a separate application which does not communicate with runabc so there may be a loss of synchronization between the movement of the cursor and the music. If the moving marker is annoying, you can turn off this feature by removing the tick mark from the **config/follow while playing** checkbox. Pressing any key on the keyboard

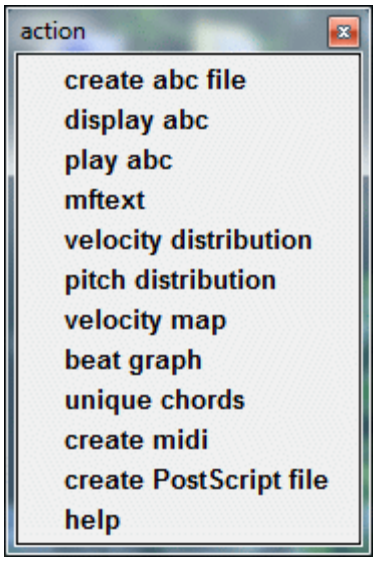
while the piano window is in focus will stop the moving cursor for the current instance.

If you are using TiMidity to play the midi file, TiMidity normally ignores the initial rests at the beginning of the midi file. This poses a problem, if runabc.tcl attempts to follow along with the moving vertical red marker. TiMidity version 2.14 has an option to preserve the initial rest using the option --preserve-silence which you can include in the Options/Player page. (On Linux, I found it necessary to include the option -B2,12 to control the buffering. The option -ik also provides you with a TiMidity interface allowing.)

For finer control, you can select a particular portion of the MIDI file by sweeping the mouse cursor while holding the left mouse button down. The selected area will be highlighted in a light yellow stipple. (Double clicking anywhere in the piano window will remove the highlighted region.) The abcfile button, and right mouse button will now act on only the the highlighted area.

You may configure the program to separate the MIDI file by either tracks or channels. It is recommended that you separate the file into channels rather than tracks. A row of checkbuttons corresponding to the channels or tracks appear at the bottom of the window. If you hover the mouse pointer over one of these checkbuttons, then the program (musical instrument) that was assigned to that channel will be shown for that checkbutton. All the notes associated with that channel will be highlighted in red. (Note that these highlighted notes may not appear in the particular scrolled region that is visible on your screen.) The button labeled 'play selected channels' will play the selected channels (or tracks) for the exposed section of the midi file. If no channels are selected, then all channels will be played.

Action Menu



The action menu button brings up a menu of selected actions that you can apply to the displayed region of the MIDI file. If you select specific channels or tracks using the check buttons at the bottom of the window, then only those tracks/channels will be processed. If no tracks or channels have been selected, then all the channels and tracks will be processed. For example, you can create an abc file of a specific time region and tracks

create abc file It creates a file called test.abc in the directory runabc_home based on the exposed area and track/channel selection. The midi2abc configuration can be customized using the Midi Menu/midi2abc window.

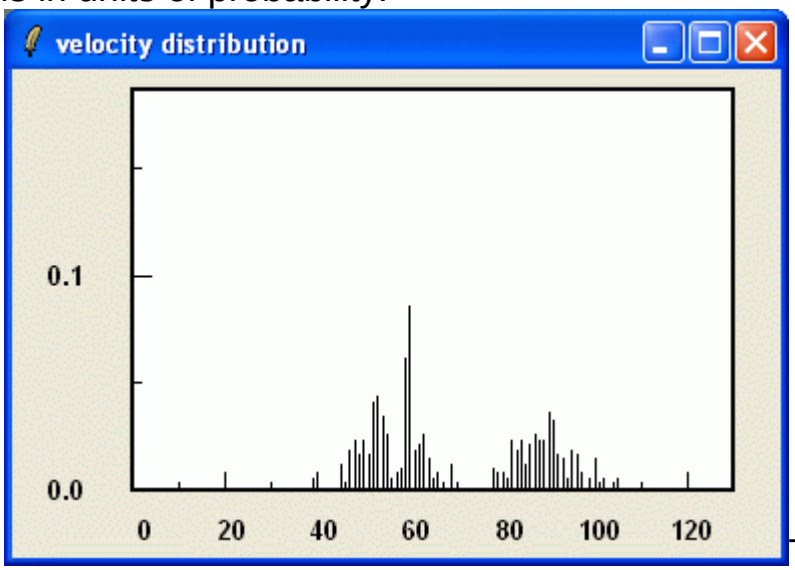
display abc Displays the music notation of the selected area, (channels or tracks).

play abc Creates the abc file of the exposed section, converts it to a MIDI file and plays it.

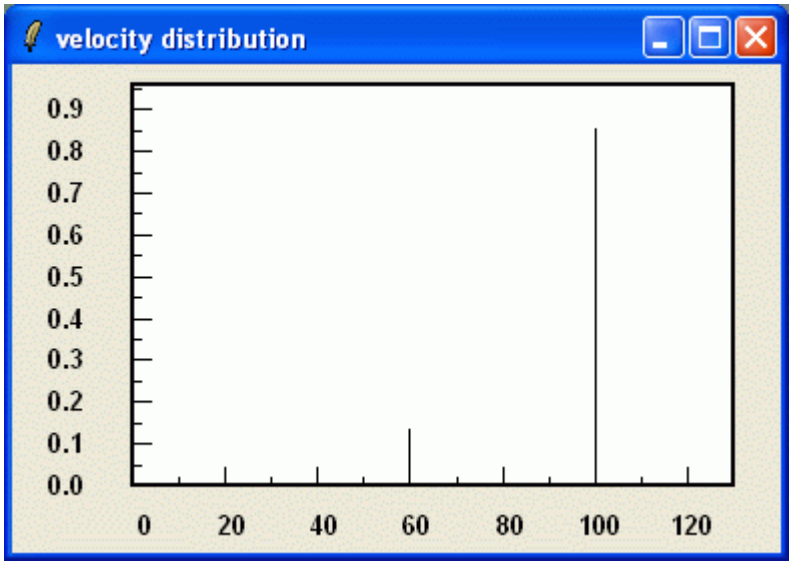
mftext Shows the selected portion of the MIDI file in mftext (textual format). This is useful for viewing the MIDI control commands which may colourize the notes.

velocity distribution If you select action/velocity distribution, the program will analyze the velocity (loudness) indications in the MIDI file and display a graph

of its distribution in a separate window. The vertical scale is in units of probability.

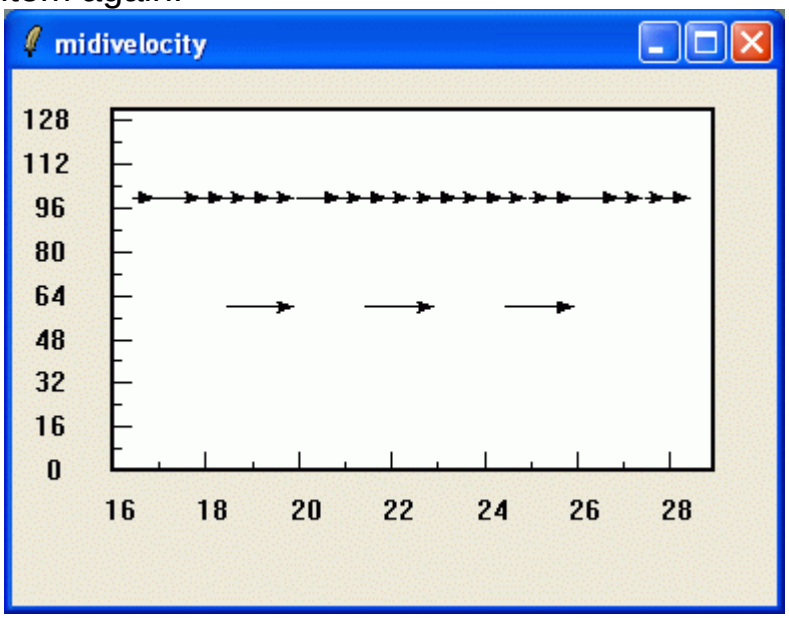


The distribution provides some indication of how the MIDI file was created. If the velocities cover a wide range, the MIDI file was probably produced using a MIDI instrument with velocity sensors. If all the notes are restricted to a few velocity values, then the MIDI file was probably created using a music notation program. An example is shown below.

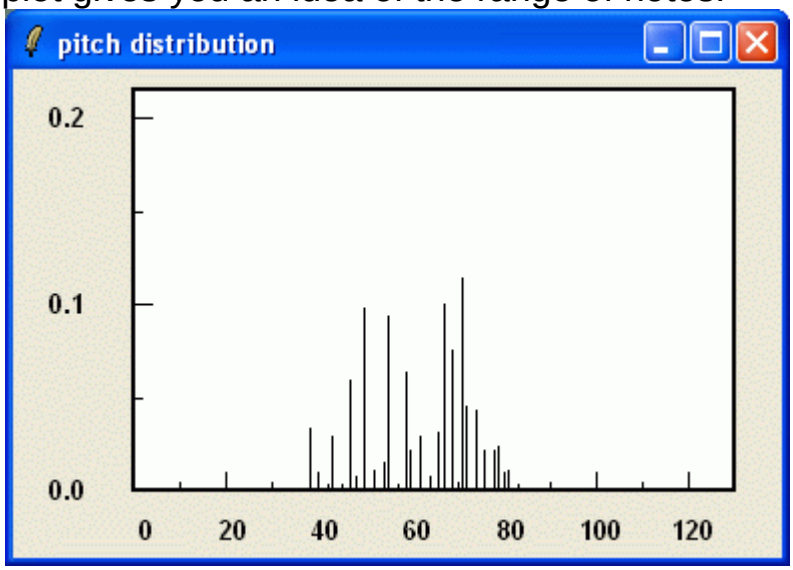


velocity map If you select action/velocity map, the program will display the velocity of the notes versus beats corresponding to the midishow display. Each note is a horizontal arrow, but its elevation now corresponds

to its velocity instead of its pitch. If the music contains many chords of the same velocity, many of the notes will appear on top of each other. You can select particular tracks or channels using the selection menu in the midishow window. If you scroll or zoom, in the midishow window you should update the plot by calling this action item again.

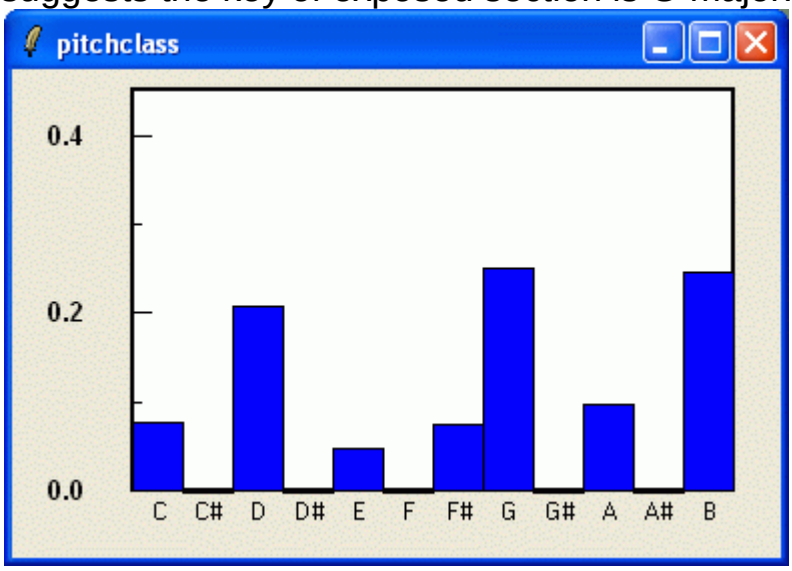


pitch distribution If you select action/pitch distribution, you get two graphs. The first plot is the distribution of all pitches in the the exposed region of the MIDI file. This plot gives you an idea of the range of notes.



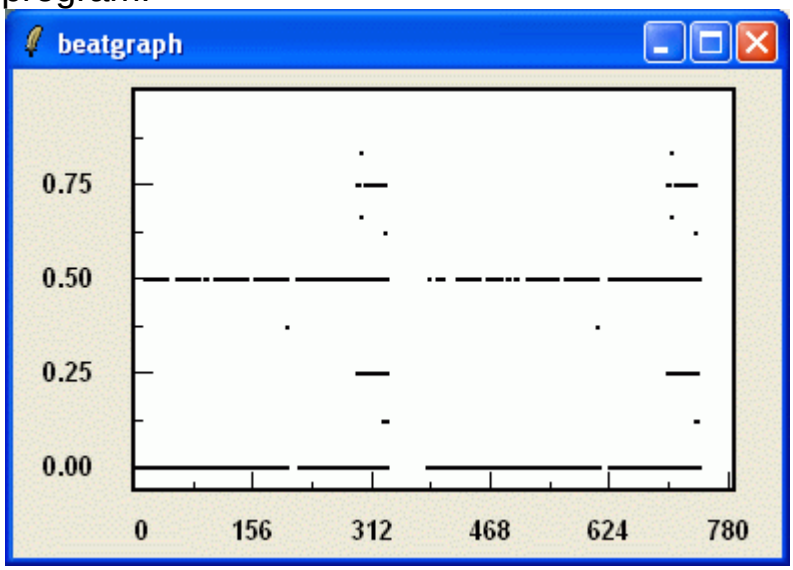
The second plot shows the distribution of pitch classes.

This is useful for guessing the likely key signature of the music. Many MIDI files do not specify the key signature. By observing which keys are absent and which one is the most common, one can frequently infer the musics key signature. In the following plot, the key of G is most common and the key of F# occurs instead of F. This suggests the key of exposed section is G major.



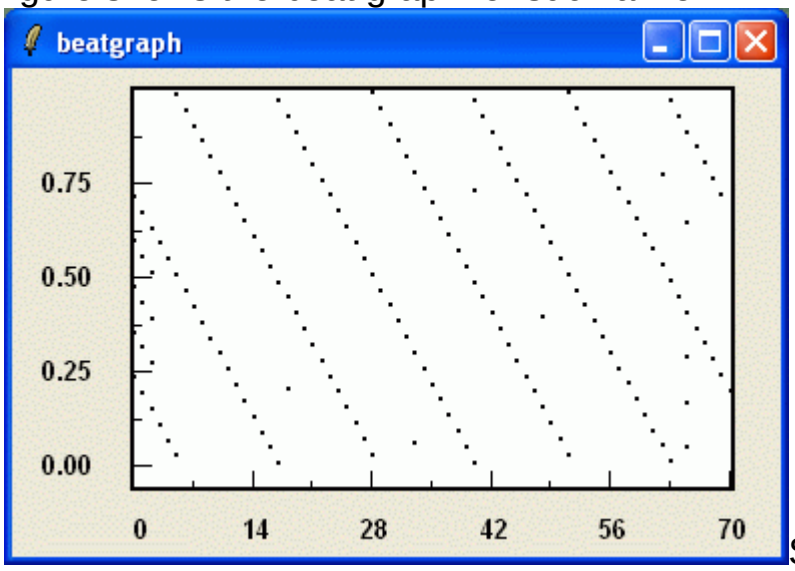
beat graph The beat graph is a useful but complicated representation to describe. It plots the position of the onset time of a note in a beat versus its beat number for all the selected notes. If you look at the mftext output displayed by runabc, note onset times are represented by beat number, where a beat is usually a quarter note. This is more informative, than displaying the MIDI pulse number. The relationship between MIDI pulses and quarter notes is given by the PPQN parameter (pulses per quarter note) which appears in the header of the MIDI file. If the MIDI file was produced by a music notation program, the onset times of the notes follow musical standards at occur at exact fractions of a beat. So the beat numbers of a note are generally numbers like, 10.250, 12.000, 13.50 etc. rather than 10.158, 12.012, 13.683 etc. The beat graph plots the fraction of a beat versus the beat number so for previous onset times the points (10, 0.250), (12, 0.000) and (13.0 0.500) would be plotted. The following plot is an example of a beat

graph for a MIDI file produced by a music notation program.



Note the points generally align along horizontal lines. If there are no notes smaller than a quarter note, then the horizontal line will be along the zero axis.

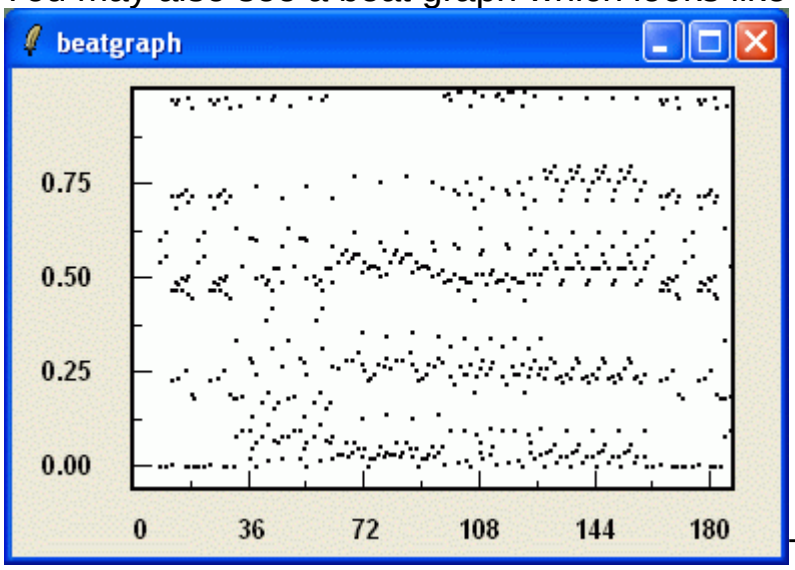
Creating a MIDI file using a music notation program is very slow. MIDI files are also created in real time while the musician is playing a MIDI keyboard. Often the musician plays the music a little fast or a little slow so that all the beats are a little shorter or longer than the nominal value indicated by the PPQN. The following figure shows the beat graph for such a file.



Since the beat positions seem to occur earlier in each subsequent

frames (the points are sloping downwards), it appears that the nominal PPQN is a bit too large. If midi2abc produced a abc file using the value in the MIDI file, there will be lots of tied notes. (In this case, midi2abc should estimate the unit length by minimizing the quantization error and you may probably have to introduce an anacrusis value.)

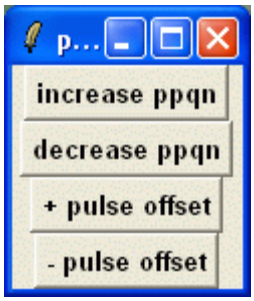
You may also see a beat graph which looks like this.



The PPQN is probably correct, but the notes have not been quantized to musical intervals. The midi2abc output may need considerable editing.

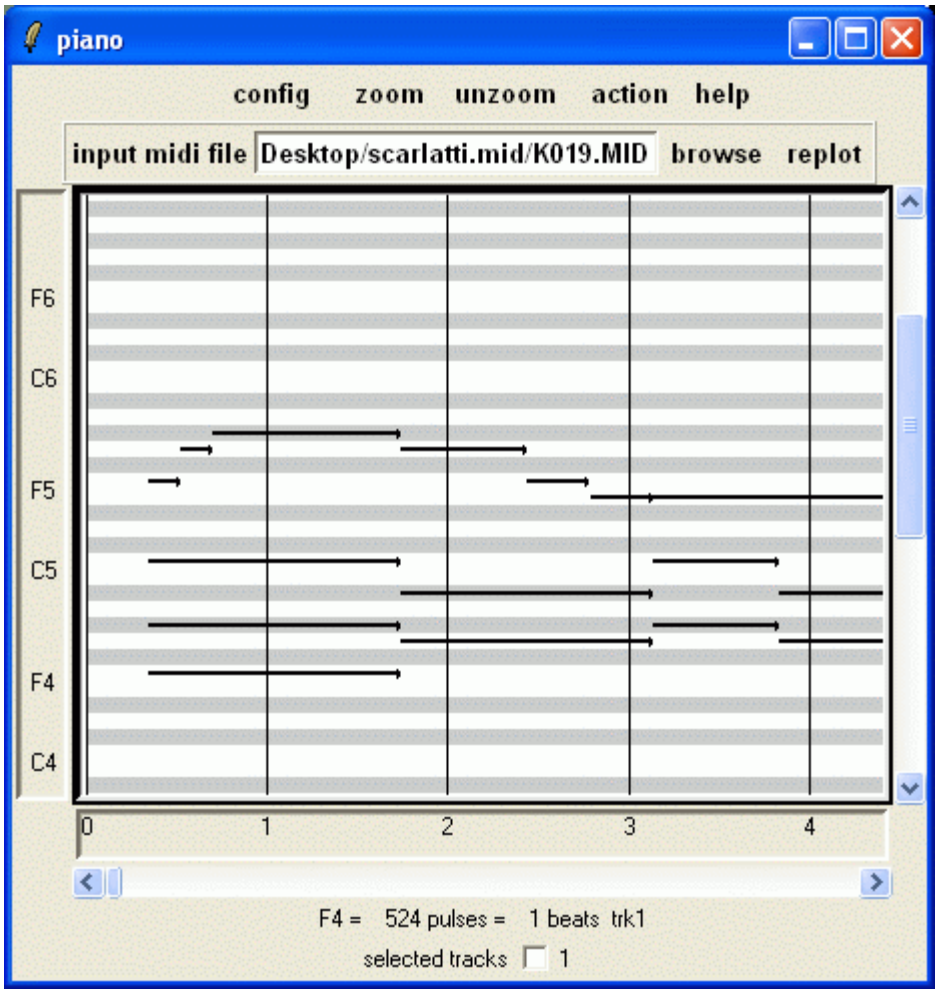
The beat graph is not my original idea, but was first introduced by Van Belle Werner (http://bio6.itek.norut.no/werner/Papers/bpm04/). I adapted it to a MIDI file.

Midishow indicates quarter note beat positions with vertical lines based on the ppqn variable in the MIDI file. (To avoid cluttering the screen they are decimated until you zoom into a specific area.) For some MIDI files, the ppqn has an incorrect as discussed above. You can temporarily change the ppqn and the spacing of the quarter beat indications by going to the **config/ppqn adjustment** menu item on the top left. The following window should pop up.

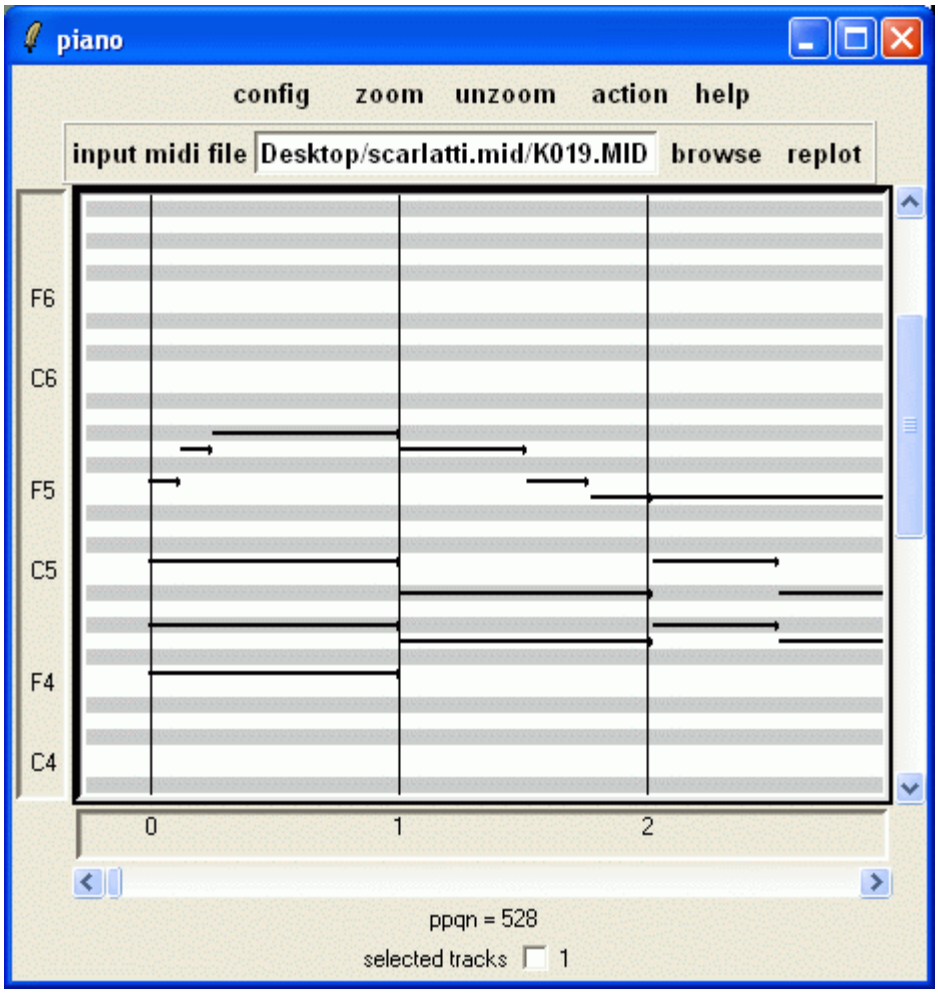


Clicking on the button **increase ppqn** or **decrease ppqn** will increment or decrement the ppqn and increase or decrease the spacing between the quarter note vertical lines. Clicking either the button **+ pulse offset** or **- pulse offset** will not change the spacing but merely shift the quarter note lines to the left or right. If you hold down any of these buttons for more than a half a second, the appropriate action will be automatically repeated about 20 times a second.

To illustrate the usefulness of this feature, you need to download Scarlatti's Sonatas from John Sankey's MIDI site. http://www.johnsankey.ca/harpsichord.html
These MIDI files are difficult to convert to music notation for several reasons. The ppqn indication is frequently incorrect and there is no time signature meta commands. (In addition each note class is in a different MIDI channel to allow pitchbending to the desired temperament.) If you run midishow on one of these files (eg. K019.MID which is in 2/4 time) you will find that the quarter note lines do not line up with the notes since the file assumes a ppqn of 192.



By adjusting the ppqn, you can get something like this.



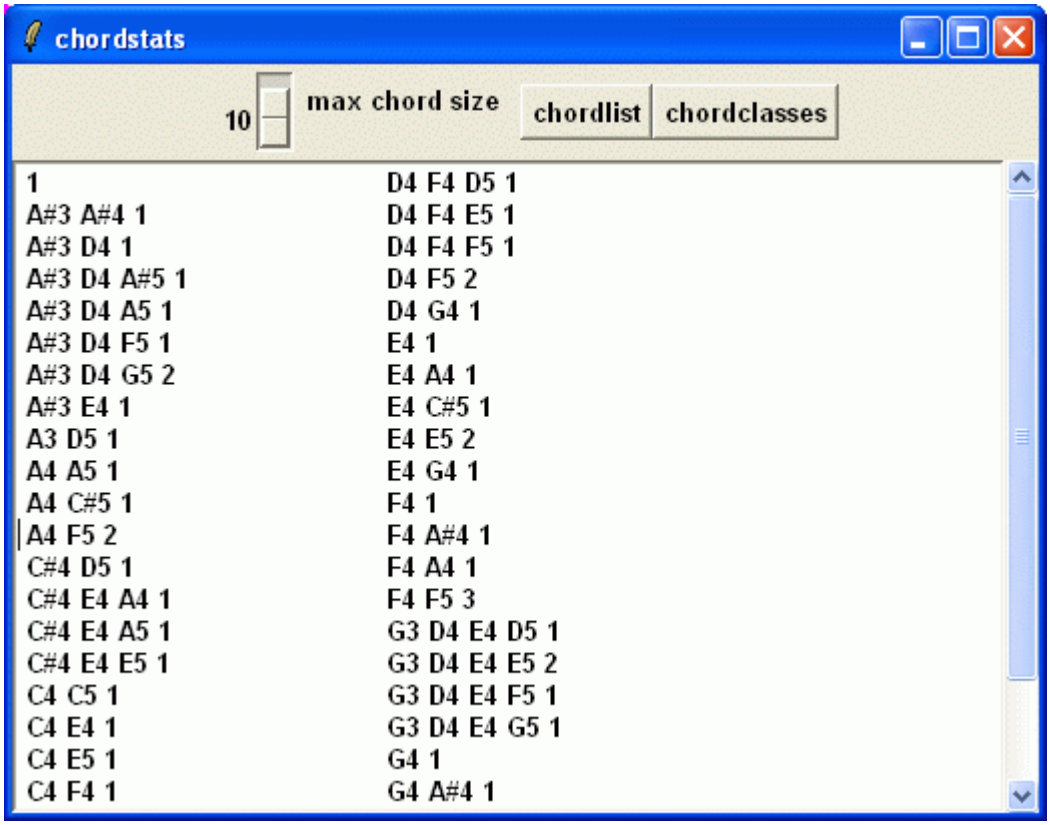
Note the ppqn value of 528 listed at the bottom of this window. Midi2abc is unable to infer correct unit length even when using the -gu option. However, you can tell it to use the value of 264 (for a 1/8 note unit length) (i.e. use options -u 264 -m 2/4 -aul 8) and get something resembling the printed score.

You can also use the **beatgraph** output to infer the ppqn. If the lines are going up, you need to increase the ppqn. (The lines become flat when ppqn is 536. You need to request a new beatgraph output whenever you change the ppqn.)

As a convenience, the actions **create abc file**, **play abc** and **display abc** will migrate your ppqn parameters to the midi2abc options whenever the ppqn window is displayed.

If you are preparing a paper, you may need a copy of the displayed piano roll as a PostScript file. Click the button **action/Create PostScript file** to produce a file called piano.ps.

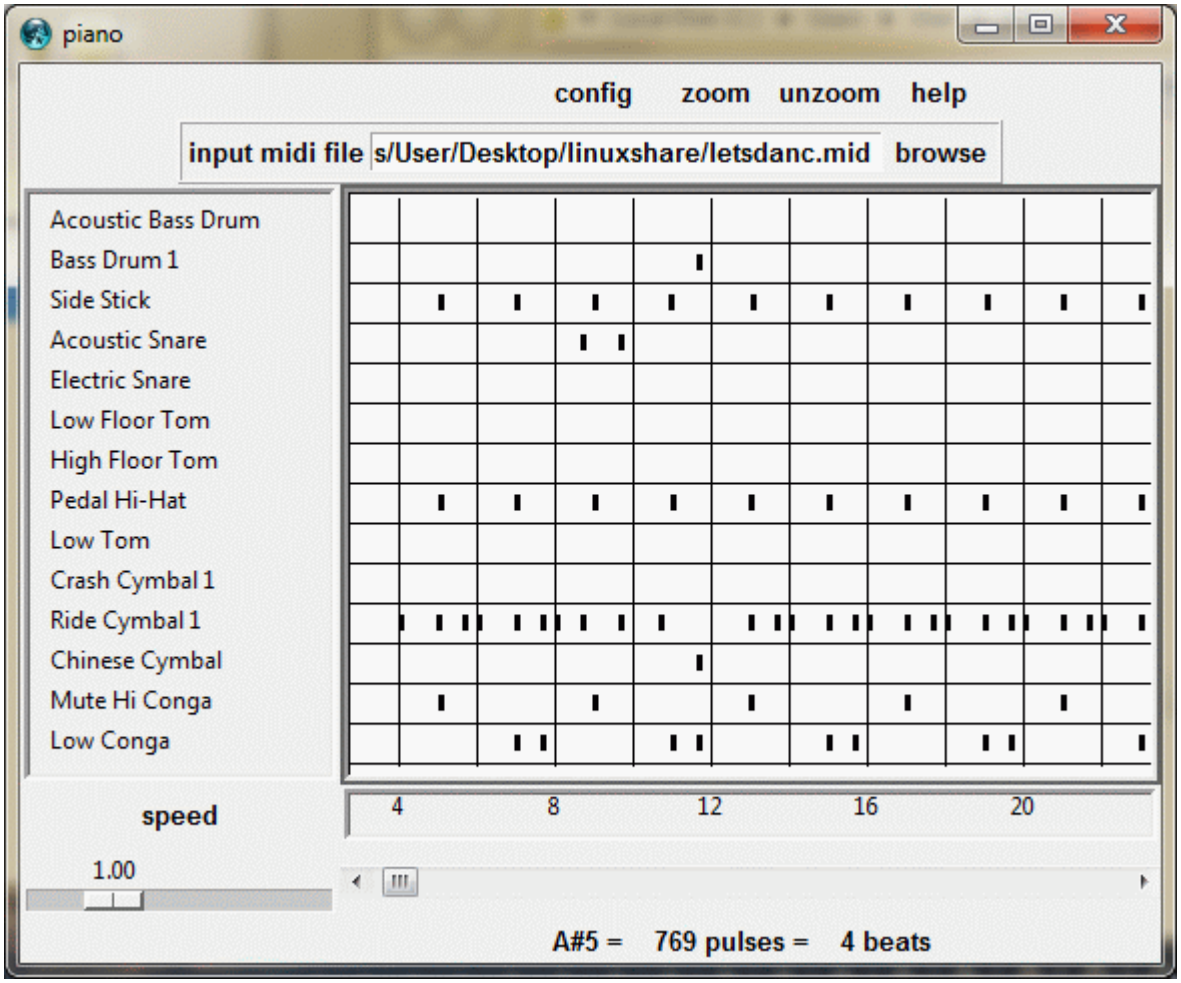
The analysis of chords is a challenging problem in musicology. Another action feature **unique chords** (which may be of questionable value) creates a textual histogram of all chords in the exposed portion of the MIDI file. This is presented as a table in a separate window illustrated below.



The chords were creating by from all coincident notes after combining all tracks. Provided the chord last for more than 0.2 beats it is included in the table. The chords are generated starting from the lowest note and going up in pitch. The maximum number of notes in the chord may be altered using the scale widget. The table lists the chord's notes and the number of times this chord was encountered in the exposed section of the MIDI file. Pressing, the **chordlist** button regenerates the table.

The **chordclasses** computes the chords from pitch classes only. (In other words octave position is ignored.)

Midi menu / drum events - Piano roll representation of drum events

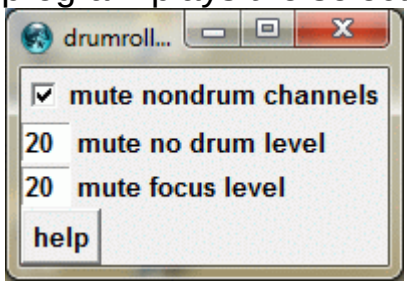


Clicking on this menu item will display a window similar to above. The tool was designed for playing and analyzing MIDI drum sequences. You can find some free sequences on the internet on sites. For example, www.grooovemonkee.com Also see The Best Free Midi Drum Loops....

Besides the ability to zoom into any area of the MIDI file and playing the exposed area at your own tempo, the tool also allows you to play just an individual drum line.

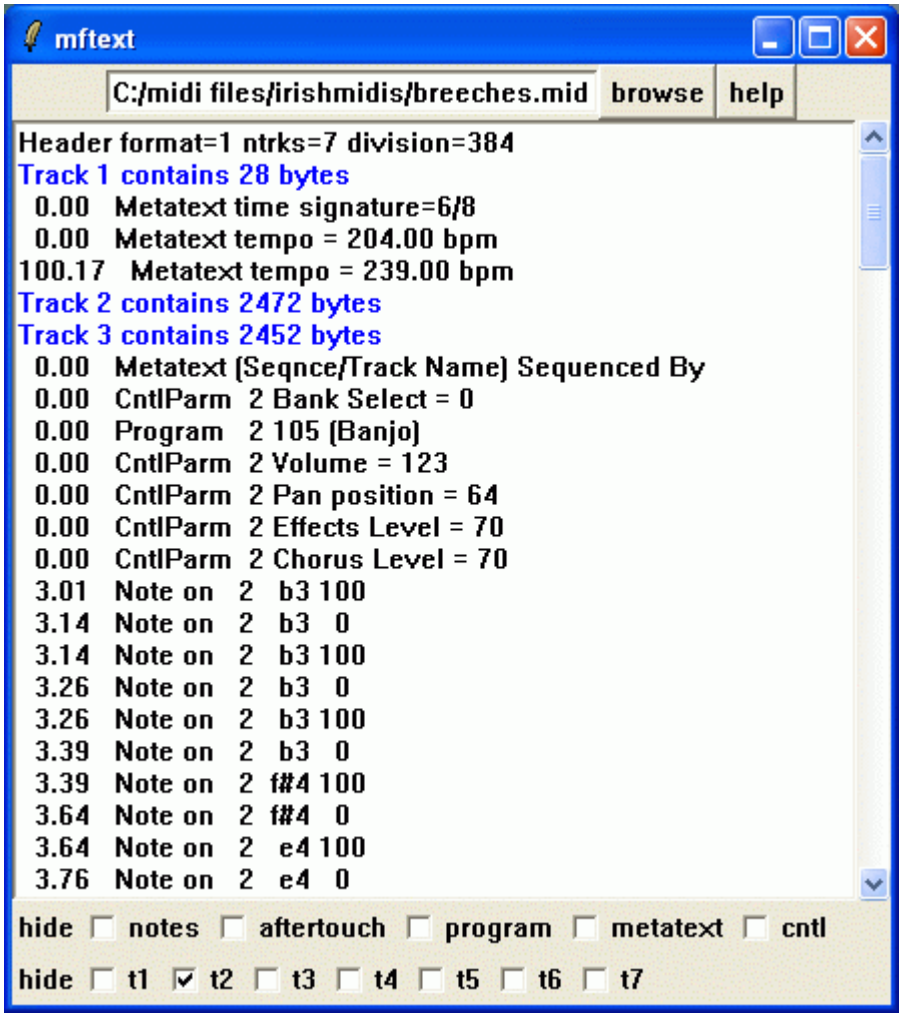
To do this, hover the mouse on one of the drum labels so that it turns blue and then left click.

The config button allows you to configure the way the program plays the selected portion.



Suppose that the midi file contains a combination of drums and melodic instruments. When you play the file, the melodic instruments drown out the most of the percussion instruments. If you check the box, 'mute nondrum channel' then the melodic instruments will be restricted to a loudness (velocity) of 30 (set by the 'mute no drum level), and you should have no difficulty hearing the percussion. The 'mute focus level' sets the level the other percussion instruments play when you attempt to play an individual percussion line.

Midi menu/ Mftext - Textual Representation of a MIDI file



Clicking **midi menu/mftext** will display a window similar to above showing a textual representation of a MIDI file. In order for this to work you need the latest version of midi2abc (2.80 or higher). The output is somewhat similar to mftext. Time is indicated in beat units. The channel number is usually indicated after the MIDI command.

The checkbuttons on the bottom allow you to elide specified tracks or specified MIDI commands. For example in the above sample, all the MIDI commands in track 2 were hidden. This is useful when you are viewing a fairly complex MIDI file. If you are eliding a mixture of tracks and MIDI commands, tcl/tk may get confused and

not elide some of the commands correctly. I do not know how to fix this problem.

Quiting

Whenever you exit from runabc.tcl by clicking on the x on the top right corner of the window (assuming Windows 95/NT), the program creates or updates a file called runabc.ini. This is an ascii file containing all of your settings allowing the program to resume the next time you run it.

Return to top level to download runabc.zip and read the install.html page.

Appendix

Installation

Installation is now a lot easier than before. If you are using the Microsoft Windows platform (XP, Vista, 7 and etc.), download and execute Runabc_2011*_setup.exe which will not only install runabc.exe but also the required support executables in abcMIDI. On other platforms, you will need the source code runabc.tcl and the tcl/tk 8.5 interpreter. Runabc.tcl should work with tcl/tk 8.6, however you may need to change wish8.5 to wish8.6 in the 5th line of the runabc.tcl source code. SumatraPDF and ghostview discussed below are now optional provided you have an internet browser and use abcm2ps to create a xhtml or svg file instead of a postscript file. If you wish to use yaps or abc2ps or other converters then you will need ghostview and SumatraPDF discussed below. The rest of this discussion will assume that you are starting with the source code.

Runabc.tcl is a tcl/tk script which requires a Tcl/Tk environment. To execute runabc.tcl you should have Tcl/Tk 8.5 which you can find at http://www.activestate.com/activetcl. Select the package appropriate for your system and install it. The package without the source code is somewhat over 9 Mbytes on my computer.

If you do not wish to install Tcl/Tk 8.5 there is still another alternative. You can execute runabc.kit which will run on any system where tclkit has been installed. Tclkit has been ported to almost every system and is about 1 megabyte. You can get tclkit from http://code.google.com/p/tclkit/ This may be the preferable approach, if you have an older version of Tcl/Tk on your system and you do not feel comfortable building a new version from source. The link *how to get started* tells you how to setup tclkit on your system. (For Microsoft Windows, you should also associate the .kit extension with tclkit.)

Runabc.tcl should be installed in a folder which has read/write/execution access. Runabc.tcl will create a file runabc.ini which saves the user's settings and states. A folder tmp/ for transferring information to the other executables is also created. If more than one user is using runabc.tcl on a system, each user should have a personal copy of runabc.tcl in their home directory.

Note that even if you are only running runabc.kit or runabc.exe, you may wish to download runabc.zip and unpack it. Besides runabc.tcl, it contains other useful stuff, such as an icon (runabc.ico), *.fmt files for abc*2ps, sample abc files and a description of the latest updates in runhistory.txt. Note that all the files including runabc.tcl are text files which can be viewed with any editor.

You also need the James Allwrights's abcMIDI package consisting of abc2midi, yaps, abc2abc and other programs. James Allwright is no longer supporting this

package and I have made numerous fixes as well as added new features. Executables for the package are available for some platforms; otherwise you will need to build them yourself from the source code.

You can find the latest abcMIDI sources of abcMIDI from my main page http://ifdo.ca/~seymour/runabc/top.html and compile it on your system. Executables for Microsoft Windows can also be found on the same site. Other precompiled versions systems are available on Guido Gonzato's site The abcplus Homepage.

To convert the abc files to postscript files displaying the sheet music, you also need Jeff Moine's abcm2ps package. The executable for the PC is included with abcMIDI executables on my site.

A MIDI player is also handy. They usually come with the operating system or sound card. If you have the capability of playing audio files but no MIDI capability, you could download the TiMidity package. Free SoundFont patches for Timidity may be obtained from Big Soundfont You can find links to other free soundfonts on the web page http://coolsoft.altervista.org/en/virtualmidisynth

Finally you need a Postscript viewer. For Microsoft Windows, I recommend SumatraPDF which is entirely free. You can get it from sumatrapdf. (Sumatra is available from many other sites like CNET if the above link is too slow.) SumatraPDF is actually a pdf file viewer; however, if you also install Ghostview SumatraPDF will also be able to display PostScript files. (This is an undocumented feature.) The Ghostview package with all its fonts is about 6 Megabytes. For Microsoft Windows, you should download the latest version (eg gs902w32.exe). If SumatraPDF returns a message that it cannot read Out.ps, this implies that it could not find the Ghostview package which should be in the Program Files/gs directory. Alternative PostScript viewers that you

can use are gsview or Acrobat. However, each time gsview is started it will ask you pay a $40.00 registration fee.

On Linux, I prefer to use the PostScript viewer called Evince.

You can find many other software packages and abc notated files from Chris Walshaw's, The abc Homepage.

Return to top level to download runabc.zip.