LilyPond

The music typesetter

Usage

The LilyPond development team

This file explains how to execute the programs distributed with LilyPond version 2.21.1. In addition, it suggests some "best practices" for efficient usage.

For more information about how this manual fits with the other documentation, or to read this manual in other formats, see Section "Manuals" in *General Information*.

If you are missing any manuals, the complete documentation can be found at `http://lilypond.org/`.

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For LilyPond version 2.21.1

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1 Running `lilypond`

This chapter details the technicalities of running LilyPond.

1.1 Normal usage

Most users run LilyPond through a GUI; if you have not done so already, please read the Section "Tutorial" in *Learning Manual*. If you use an alternate editor to write LilyPond files, see the documentation for that program.

1.2 Command-line usage

This section contains extra information about using LilyPond on the command-line. This may be desirable to pass extra options to the program. In addition, there are certain extra 'helper' programs (such as `midi2ly`) which are only available on the command-line.

By 'command-line', we mean the command line in the operating system. Windows users might be more familiar with the terms 'DOS shell' or 'command shell'. MacOS X users might be more familiar with the terms 'terminal' or 'console'. Some additional setup is required for MacOS X users; please see Section "MacOS X" in *General Information*.

Describing how to use this part of an operating system is outside the scope of this manual; please consult other documentation on this topic if you are unfamiliar with the command-line.

Invoking `lilypond`

The `lilypond` executable may be called as follows from the command line.

```
lilypond [option]... file...
```

When invoked with a filename that has no extension, the `.ly` extension is tried first. To read input from stdin, use a dash (`-`) for *file*.

When `filename.ly` is processed it produces `filename.pdf` as output by default. Several files can be specified; they are each processed independently.[1]

If `filename.ly` contains more than one `\book` block, the rest of the scores is output in numbered files, starting with `filename-1.pdf`. In addition, the value of `output-suffix` is inserted between the basename and the number. For example, if `filename.ly` contains

```
#(define output-suffix "violin")
\score { ... }
#(define output-suffix "cello")
\score { ... }
```

LilyPond outputs `filename-violin.pdf` and `filename-cello-1.pdf`.

Using LilyPond with standard shell features

Since LilyPond is a command line application, features of the 'shell' used for calling LilyPond can also be put to good use.

For example,

```
lilypond *.ly
```

processes all LilyPond files in the current directory.

Redirecting the console output (e.g., to a file) may also be useful:

```
lilypond file.ly 1> stdout.txt
lilypond file.ly 2> stderr.txt
```

[1] The status of GUILE is not reset after processing a `.ly` file, so be careful not to change any system defaults from within Scheme.

```
lilypond file.ly &> all.txt
```

The above commands divert 'normal' output, 'errors' only, or 'everything', respectively, to text files. Consult the documentation for your particular shell, Command (Windows), Terminal or Console applications (MacOS X) to check whether output redirection is supported or if the syntax is different.

The following example searches and processes all input files in the current directory and all directories below it recursively. The output files are located in the same directory that the command was run in, rather than in the same directories as the original input files.

```
find . -name '*.ly' -exec lilypond '{}' \;
```

This should also work for MacOS X users.

A Windows user would run

```
forfiles /s /M *.ly /c "cmd /c lilypond @file"
```

entering these commands in a `command prompt` usually found under `Start > Accessories > Command Prompt`, or by typing in the search window 'command prompt'.

Alternatively, an explicit path to the top-level of your folder containing all the sub-folders that have input files in them can be stated using the `/p` option;

```
forfiles /s /p C:\Documents\MyScores /M *.ly /c "cmd /c lilypond @file"
```

If there are spaces in the path to the top-level folder, then the whole path needs to be inside double quotes;

```
forfiles /s /p "C:\Documents\My Scores" /M *.ly /c "cmd /c lilypond @file"
```

Basic command line options for LilyPond

The following options are supported.

`-d`, `--define-default=`*var*[`=`*val*]
: See [Advanced command line options for LilyPond], page 5.

`-e`, `--evaluate=`*expr*
: Evaluate the Scheme *expr* before parsing any `.ly` files. Multiple `-e` options may be given, they are evaluated sequentially.

  The expression is evaluated in the `guile-user` module, so if you want to use a definition like `(define-public a 42)` as *expr*, use

  ```
  lilypond -e '(define-public a 42)'
  ```

  on the command-line, and include

  ```
  #(use-modules (guile-user))
  ```

  at the top of the `.ly` file.

  > **Note:** Windows users must use double quotes instead of single quotes.

`-E`, `--eps` Generate EPS files.
: This option is equivalent to setting LilyPond's command line options `--ps`, `-dbackend=eps`, and `-daux-files='#f'`.

`-f`, `--format=`*format*
: The format of the (main) output file or files. Possible values for *format* are `ps`, `pdf`, or `png`.

  Example: `lilypond -fpng foo.ly`

  For `svg` and `eps` formats use the `-dbackend` option. See [Advanced command line options for LilyPond], page 5.

`-h`, `--help`
: Show a summary of usage.

`-H`, `--header=`*field*
: Dump a header field to file `BASENAME.`*field*.

  As an example, let's assume that you have an input file `foo.ly` containing

  ```
  \header { title = "bar" }
  \score { c1 }
  ```

  The command

  ```
  lilypond -H title foo.ly
  ```

  then creates a plain text file `foo.title` containing the string `bar`.

`-i`, `--init=`*file*
: Set init file to *file* (default: `init.ly`).

`-I`, `--include=`*directory*
: Append *directory* to the search path for input files with relative paths. By default, only the current working directory gets searched.

  Multiple `-I` options may be given. The search starts in the current working directory, and if the file to be included is not found the search continues in the directory given by the first `-I` option, then the directory in the second `-I` option, and so on.

  > **Note:** Using the tilde character (`~`) with the `-I` switch may produce unexpected results in some shells.
  >
  > Windows users need to include a trailing slash for the directory's path.

`-j`, `--jail=`*user*`,`*group*`,`*jail*`,`*dir*
: [This option is only available if your operating system supports the `chroot` functionality. In particular, Windows doesn't support it.]

  Run `lilypond` in a chroot jail.

  The `--jail` option provides a more flexible alternative to `-dsafe`, when LilyPond formatting is being provided via a web server, or whenever LilyPond executes commands sent by external sources (see [Advanced command line options for LilyPond], page 5).

  It works by changing the root of `lilypond` to *jail* just before starting the actual compilation process. The user and group are then changed to match those provided, and the current directory is changed to *dir*. This setup guarantees that it is not possible (at least in theory) to escape from the jail. Note that for `--jail` to work, `lilypond` must be run as root, which is usually accomplished in a safe way using `sudo`.

  Setting up a jail can be a relatively complex matter, as we must be sure that LilyPond is able to find whatever it needs to compile the source *inside* the jail itself. A typical chroot jail comprises the following steps:

  Setting up a separate filesystem
  : A separate filesystem should be created for LilyPond, so that it can be mounted with safe options such as `noexec`, `nodev`, and `nosuid`. In this way, it is impossible to run executables or to write directly to a device from LilyPond. If you do not want to create a separate partition, just create a file of reasonable size and use it to mount a loop device. A

separate filesystem also guarantees that LilyPond cannot write more space than it is allowed.

Setting up a separate user
: A separate user and group (say, `lily/lily`) with low privileges should be used to run LilyPond inside the jail. There should be a single directory writable by this user, which should be passed in *dir*.

Preparing the jail
: LilyPond needs to read a number of files while running. All these files are to be copied into the jail, under the same path they appear in the real root filesystem. The entire content of the LilyPond installation (e.g., `/usr/share/lilypond`) should be copied.

  If problems arise, the simplest way to trace them down is to run LilyPond using `strace`, which allows you to determine which files are missing.

Running LilyPond
: In a jail mounted with `noexec` it is impossible to execute any external program. Therefore LilyPond must be run with a backend that does not require any such program. As we have already mentioned, it must be run with superuser privileges (which, of course, it loses immediately), possibly using `sudo`. It is also good practice to limit the number of seconds of CPU time LilyPond can use (e.g., using `ulimit -t`), and, if your operating system supports it, the amount of memory that can be allocated. Also see [LilyPond in chroot jail], page 12.

`-l`, `--loglevel=`*level*
: Set the verbosity of the console output to *level*. Possible values are:

  `NONE` No output at all, not even error messages.

  `ERROR` Only error messages, no warnings or progress messages.

  `WARN` Warnings and error messages, no progress.

  `BASIC_PROGRESS`
  : Basic progress messages (success), warnings and errors.

  `PROGRESS` All progress messages, warnings and errors.

  `INFO` Progress messages, warnings, errors and further execution information. This is the default.

  `DEBUG` All possible messages, including verbose debug output.

`-o`, `--output=`*file*
`-o`, `--output=`*folder*
: Set the default output file to *file* or, if a folder with that name exists, direct the output to *folder*, taking the file name from the input file. The appropriate suffix is added (e.g., `.pdf` for PDF) in both cases.

`-O`, `--pspdfopt=`*key*
: Set the PS/PDF output optimization to *key*. Possible values are:

  `size` Generate a very small PS/EPS/PDF document. This is the default.

  Using this value is equivalent to setting LilyPond's Scheme command line options `-dmusic-font-encodings='#f'` and `-dgs-never-embed-fonts='#f'`.

`TeX` Produce files that are optimized for inclusion in pdfTeX, luatex, or XeTeX documents.

Using this value is equivalent to setting LilyPond's Scheme command line options `-dmusic-font-encodings='#t'` and `-dgs-never-embed-fonts='#f'`.

`TeX-GS` If you want to include more than one PDF generated by LilyPond in a TeX document, use this option and postprocess the PDF generated by TeX with Ghostscript.

Using this value is equivalent to setting LilyPond's Scheme command line options `-dmusic-font-encodings='#t'` and `-dgs-never-embed-fonts='#t'`.

`--ps` Generate PostScript. This option is equivalent to `-fps`.

`--png` Generate pictures of each page, in PNG format. This option is equivalent to `-fpng`.

The resolution of the image may be set to *N* DPI with

```
-dresolution=N
```

`--pdf` Generate PDF. This is the default, being equivalent to `-fpdf`.

`-s`, `--silent`
Show no progress, only error messages. This is equivalent to `-lERROR`.

`-v`, `--version`
Show version information.

`-V`, `--verbose`
Be verbose: show full paths of all files read, give timing information, etc. It is equivalent to `-lDEBUG`.

`-w`, `--warranty`
Show the warranty with which GNU LilyPond comes. (It comes with **NO WARRANTY**!)

Advanced command line options for LilyPond

Option `-d` is the command-line interface to LilyPond's Scheme function `ly:set-option`. This means that all options listed here can also be set within `.ly` files.

`-d`, `--define-default=`*option-name*[`=`*value*]
`-d`, `--define-default=no-`*option-name*
Set the equivalent internal Scheme symbol *option-name* to *value*. For example, the command-line option

```
-dbackend=svg
```

is equivalent to

```
#(ly:set-option 'backend 'svg)
```

in a LilyPond input file.

If *value* is not supplied, use `#t` as the value (which might produce strange results if the expected *value* type is not boolean). The prefix `no-` may be added to *option-name* to switch 'off' an option, providing `#f` as the value. For example,

```
-dpoint-and-click='#f'
```

is the same as

```
-dno-point-and-click
```

[Note that the '#' character introduces a comment in many shells. For this reason it is recommended to always quote expressions that contain it.]

The following table lists all supported option names together with its values. Within Scheme code, option values can be read using function `ly:get-option`.

`anti-alias-factor` *num*
: Render at a higher resolution (using factor *num*) and scale down the result to prevent 'jaggies' in PNG images. Default: `1.0`.

`aux-files` *bool*
: If *bool* is `#t`, create `.tex`, `.texi`, and `.count` files when used with the `eps` backend option. Default: `#t`.

`backend` *symbol*
: Use *symbol* as the backend for LilyPond output. Possible values are:

  `ps` This is the default setting. PostScript files include TTF, Type1, and OTF fonts. No 'subsetting' of these fonts is done. Be aware that using 'oriental' character sets like Japanese can lead to very large file sizes.

  For PDF output, the `ps` backend is used, too; the resulting PS data is post-processed by Ghostscript's `ps2pdf` script, which also does font subsetting by default.

  `eps` Used as the default by the `lilypond-book` command. This dumps every page as both a single file with all pages and fonts included and as separate encapsulated PostScript files for each page but without fonts included.

  `null` Do not output a printed score. This has the same effect as `-dno-print-pages`.

  `scm` This dumps out the raw, internal Scheme-based drawing commands.

  `svg` Scalable Vector Graphics. A single SVG file is created for every page of output. Music glyphs are encoded as vector graphics, but text fonts are *not* embedded in the SVG files. Any SVG viewer will therefore need the relevant text fonts to be available to it for proper rendering of both text and lyrics. It is recommended to not use font 'lists' or 'aliases' in case an SVG viewer is unable to handle them. When using *Web Open Font Format* (WOFF) files the additional `-dsvg-woff` switch is required.

`check-internal-types` *bool*
: If *bool* is `#t`, check every property assignment for types. Default: `#f`.

`clip-systems` *bool*
: If *bool* is `#t`, extract music fragments out of a score. This requires that the `clip-regions` function has been defined within the `\layout` block. See Section "Extracting fragments of music" in *Notation Reference*. No fragments are extracted though if used with the `-dno-print-pages` option. Default: `#f`.

`crop` *bool* If *bool* is `#t`, fit all the music and headers, without margins, into a 'single-page' output file. Default: `#f`.

`datadir` Prefix for data files. This is a read-only option; setting it has no effect.

`debug-gc` *bool*
: If *bool* is `#t`, dump memory debugging statistics. Default: `#f`.

`debug-gc-assert-parsed-dead` *bool*
: For memory debugging: If *bool* is `#t`, ensure that all references to parsed objects are dead. This is an internal option, and is switched on automatically for `-ddebug-gc`. Default: `#f`.

`debug-lexer` *bool*
: If *bool* is `#t`, debug the flex lexer. Default: `#f`.

`debug-page-breaking-scoring` *bool*
: If *bool* is `#t`, dump scores for many different page breaking configurations. Default: `#f`.

`debug-parser` *bool*
: If *bool* is `#t`, debug the bison parser. Default: `#f`.

`debug-property-callbacks` *bool*
: If *bool* is `#t`, debug cyclic callback chains. Default: `#f`.

`debug-skylines` *bool*
: If *bool* is `#t`, debug skylines. Default: `#f`.

`delete-intermediate-files` *bool*
: If *bool* is `#t`, delete the unusable, intermediate `.ps` files created during compilation. Default: `#t`.

`dump-cpu-profile` *bool*
: If *bool* is `#t`, dump (system-dependent) timing information. Default: `#f`.

`dump-profile` *bool*
: If *bool* is `#t`, dump memory and time information for each file. Default: `#f`.

`dump-signatures` *bool*
: If *bool* is `#t`, dump output signatures of each system. Used for regression testing. Default: `#f`.

`embed-source-code` *bool*
: If *bool* is `#t`, embed the LilyPond source files inside the generated PDF document. Default: `#f`.

`eps-box-padding` *num*
: Pad left edge of the output EPS bounding box by *num* millimeters. Default: `#f` (meaning no bounding box padding).

`font-export-dir` *string*
: Set directory for exporting fonts as PostScript files to *string*. Default: `#f` (meaning current directory).

`gs-load-fonts` *bool*
: If *bool* is `#t`, load fonts via Ghostscript. This option makes LilyPond's output files contain only references to all fonts, which must be resolved to real fonts in a post-processing step by Ghostscript. Default: `#f`.

`gs-load-lily-fonts` *bool*
: If *bool* is `#t`, load LilyPond fonts via Ghostscript. This option makes LilyPond's output files contain only references to its music fonts, which must be resolved to real fonts in a post-processing step by Ghostscript. All other fonts are still output as usual. Default: `#f`.

`gs-never-embed-fonts` *bool*
: If *bool* is `#t`, make Ghostscript embed only TrueType fonts and no other font format. Default: `#f`.

`gui` *bool* If *bool* is `#t`, make LilyPond run silently and redirect all output to a log file. Default: `#f`.

Note to Windows users: By default, `lilypond.exe` outputs all progress information to the command window, while `lilypond-windows.exe` does not and returns a prompt, with no progress information, immediately at the command line. The `-dgui` option can be used in this case to redirect output to a log file.

`help` *bool* If *bool* is `#t`, show this help. Default: `#f`.

`include-book-title-preview` *bool*
If *bool* is `#t`, include book titles in preview images. Default: `#t`.

`include-eps-fonts` *bool*
If *bool* is `#t`, include fonts in separate-system EPS files. Default: `#t`.

`include-settings` *string*
Include file *string* for global settings, which is included before the score is processed. Default: `#f` (meaning no global settings file).

`job-count` *num*
Process in parallel, using *num* jobs. Default: `#f` (meaning no parallel processing).

`log-file` *string*
Redirect output to the log file *`string`*`.log`. Default: `#f` (meaning no log file).

`max-markup-depth` *num*
Set maximum depth for the markup tree to value *num*. If a markup has more levels, assume it will not terminate on its own, print a warning, and return a null markup instead. Default: `1024`.

`midi-extension` *string*
Set the default file extension for MIDI output files to *`.string`*. Default: `"midi"`.

`music-strings-to-paths` *bool*
If *bool* is `#t`, convert text strings to paths when glyphs belong to a music font. Default: `#f`.

`paper-size` *extra-quoted-string*
Set default paper size to *extra-quoted-string*. Note that the string must be enclosed in escaped double quotes. Default: `"\"a4\""`.

`pixmap-format` *symbol*
Set Ghostscript's output format for pixel images to *symbol*. Default: `png16m`.

`point-and-click` *bool*
If *bool* is `#t`, add 'point & click' links to PDF and SVG output. See Section 4.1 [Point and click], page 42. Default: `#t`.

`preview` *bool*
If *bool* is `#t`, create preview images in addition to normal output. Default: `#f`.

This option is supported by all backends (`pdf`, `png`, `ps`, `eps`, and `svg`) except `scm`. For input file name *file* and backend *format*, it generates an output file having the name *`file`*`.preview.`*`format`*, containing the titles and the first system of music. If `\book` or `\bookpart` blocks are used, the titles of `\book`, `\bookpart` or `\score` will appear in the output, including the first system of every `\score` block if the `\paper` variable `print-all-headers` is set to `#t`.

To suppress the usual output, use the `-dprint-pages` or `-dno-print-pages` options according to your requirements.

`print-pages` *bool*
: If *bool* is `#t`, generate full pages. Default: `#t`.

  Option `-dno-print-pages` is useful in combination with `-dpreview` or `-dcrop`.

`profile-property-accesses` *bool*
: If *bool* is `#t`, keep statistics of `get_property()` function calls. Default: `#f`.

`protected-scheme-parsing` *bool*
: If *bool* is `#t`, continue when errors in inline Scheme code are caught in the parser. If set to `#f`, halt on errors and print a stack trace. Default: `#t`.

`read-file-list` *string*
: Use file *`string`* that contains a list of input files to be processed. Default: `#f` (meaning no input list file).

`relative-includes` *bool*
: When processing an `\include` command, look for the included file relative to the current file if *bool* is `#t`. If set to `#f`, look for the file relative to the root file. Default: `#f`.

`resolution` *num*
: Set resolution for generating `PNG` pixmaps to *num* dpi. Default: `101`.

`safe` *bool* If *bool* is `#t`, do not trust the `.ly` input. Default: `#f`.

  When LilyPond formatting is available through a web server, either the `-dsafe` or the `--jail` option **MUST** be passed. The `-dsafe` option prevents inline Scheme code from wreaking havoc, e.g.,

```
% too dangerous to write correctly
#(s ystem "rm -rf /")
% malicious but not destructive
{ c4^$(ly:gulp-file "/etc/passwd") }
```

  The `-dsafe` option works by evaluating in-line Scheme expressions in a special safe module. This is derived from GUILE's `safe-r5rs` module, but also adds a number of functions of the LilyPond API which are listed in `scm/safe-lily.scm`.

  In addition, safe mode disallows `\include` directives and disables the use of backslashes in TEX strings. It is also not possible to import LilyPond variables into Scheme while in safe mode.

  Option `-dsafe` does *not* detect resource overuse, so it is still possible to make the program hang indefinitely, for example by feeding cyclic data structures into the backend. Therefore, if using LilyPond on a publicly accessible webserver, the process should be limited in both CPU and memory usage.

  Safe mode will prevent many useful LilyPond snippets from being compiled.

  Option `--jail` is an even more secure alternative, but requires more work to set up. See [Basic command line options for LilyPond], page 2.

`separate-log-files` *bool*
: For input files `file1.ly`, `file2.ly`, ..., output log data to files `file1.log`, `file2.log`, ..., if *bool* is `#t`. Default: `#f`.

`show-available-fonts` *bool*
: If *bool* is `#t`, list available font names as delivered by the fontconfig library. Appended to this list LilyPond displays the configuration settings of fontconfig itself. Default: `#f`.

`strict-infinity-checking` *bool*
: If *bool* is `#t`, make `lilypond` abort on encountering `Inf` and `NaN` floating point exceptions. Default: `#f`.

`strip-output-dir` *bool*
: If *bool* is `#t`, don't use the directory part from input file paths while constructing output file names. Default: `#t`.

`strokeadjust` *bool*
: If *bool* is `#t`, force PostScript stroke adjustment. This option is mostly relevant when a PDF is generated from PostScript output (stroke adjustment is usually enabled automatically for low-resolution bitmap devices). Without this option, PDF previewers tend to produce widely inconsistent stem widths at resolutions typical for screen display. However, the option does not noticeably affect print quality and causes large file size increases in PDF files. Default: `#f`.

`svg-woff` *bool*
: This option is required when using Web Open Font Format (WOFF) font files with the `svg` backend. If *bool* is `#t`, a single SVG file is created for every page of output. Apart from LilyPond's own music glyphs, no other font information will be included. Any SVG viewer will therefore require the fonts be available to it for the proper rendering of both text and lyrics. It is also recommended not to use any font 'aliases' or 'lists' in case the SVG viewer cannot handle them. Default: `#f`.

`verbose`
: Verbosity level. This is a read-only option; setting it has no effect.

`warning-as-error` *bool*
: If *bool* is `#t`, change all warning and 'programming error' messages into errors. Default: `#f`.

Environment variables

`lilypond` recognizes the following environment variables:

`LILYPOND_DATADIR`
: This specifies a directory where locale messages and data files are looked up by default, overriding locations defined either at compile-time or computed dynamically at run-time (see [Relocation], page 11). The directory should contain subdirectories called `ly`, `ps`, `tex`, etc.

`LILYPOND_LOCALEDIR`
: Specify the directory where locale-specific files are located. This overrides the value derived from `LILYPOND_DATADIR`.

`LILYPOND_RELOCDIR`
: Specify the directory where relocation files are located. This overrides the value derived from the location of the `lilypond` binary.

`LANG`
: The language for LilyPond data sent to `stdout` and `stderr`, for example progress reports, warning messages, or debug output. Example: `LANG=de`.

`LILYPOND_LOGLEVEL`
: The default loglevel. If LilyPond is called without an explicit loglevel (i.e., no `--loglevel` command line option), this value is used.

`LILYPOND_GC_YIELD`
: A variable, as a percentage, that tunes memory management behavior. A higher values means the program uses more memory, a smaller value means more CPU time is used. The default value is `70`.

Relocation

Most programs in the Unix world use default directories for its data that are determined at configure time before compilation. LilyPond is no exception; for example, a typical installation puts the `lilypond` binary into `/usr/bin` and all files specific to LilyPond into subdirectories of `/usr/share/lilypond/2.21.0/` (assuming that the current version is 2.21.0).

While this approach works fine for manual compilation and platforms that come with standardized package managers, it can cause issues where such managers are not common or not used by default. Typical examples of such platforms are Windows and MacOS, where users expect that application bundles can be installed anywhere.

The common solution to this problem is relocation support: Instead of using hard-coded paths to data files, locations of the necessary support files are computed at run time *relative to the executed binary*.

Relocation files

There's actually a second mechanism for run-time configuration: LilyPond heavily relies on external programs and libraries, in particular the 'FontConfig' and 'GUILE' libraries to find system fonts and handle Scheme files, respectively, and the `gs` program to convert PS data to PDF files. All of them must be configured also to locate its relevant data files. To do that, the `lilypond` program parses all files in a directory called `relocate` (if it exists; see below where this directory is searched for) to manipulate environment variables, which in turn control those external libraries and programs. The format of such relocation files is simple; each line has the syntax

```
command key=value
```

and empty lines get ignored.

The *command* directive is one of the following.

`set` Uncondionally set environment variable *key* to *value*. This overrides a previously set value.

`set?` Set environment variable *key* to *value* only if *key* isn't defined yet. In other words, it doesn't override a previously set value.

`setdir` If *value* is a directory, unconditionally set environent variable *key* to *value*. Otherwise, emit a warning.

`setfile` If *value* is a file, unconditionally set environent variable *key* to *value*. Otherwise, emit a warning.

`prependdir`
Prepend directory *value* to the list of directories in environment variable *key*. If *key* doesn't exist it gets created.

Environment variables (marked with a leading dollar sign) are allowed in *value* and get expanded before the directive is executed.

Here are two examples of relocation file entries, taken from GUB (see Section "Grand Unified Builder (GUB)" in *Contributor's Guide*).

```
set? FONTCONFIG_FILE=$INSTALLER_PREFIX/etc/fonts/fonts.conf
prependdir GUILE_LOAD_PATH=$INSTALLER_PREFIX/share/guile/1.8
```

Multiple lines setting the same environment variable should be avoided in relocation files since the parsing order of files in the `relocate` directory is arbitrary.

Relocation algorithm

LilyPond uses the following algorithm to find its data files.

1. Compute the directory where the currently executed `lilypond` binary is located. Let's call this `bindir`. Set (internal) environment variable `INSTALLER_PREFIX` to *`bindir/..`* (i.e., the parent directory of `bindir`).
2. Check environment variable `LILYPOND_DATADIR`. If it is set, use its value for LilyPond's data directory, `datadir`. Otherwise use either `$INSTALLER_PREFIX/share/lilypond/`*`version`* (with *version* being the current LilyPond version) or `$INSTALLER_PREFIX/share/lilypond/current`.
3. Check environment variable `LILYPOND_LOCALEDIR`. If it is set, use its value for LilyPond's locale data directory, `localedir`. Otherwise use `$INSTALLER_PREFIX/share/locale`.
4. Check environment variable `LILYPOND_RELOCDIR`. If it is set, use its value for the directory of LilyPond's relocation files, `relocdir`. Otherwise use `$INSTALLER_PREFIX/etc/relocate`.
5. If `datadir` doesn't exist, use a compile-time value instead. Ditto for `localedir` (but not for `relocdir`, since it doesn't make sense to have that).
6. If `relocdir` exists, process all files in this directory as described in [Relocation files], page 11.

LilyPond in chroot jail

Setting up the server to run LilyPond in a chroot jail is a complicated task. The steps are listed below. Examples in the steps are from Ubuntu GNU/Linux, and may require the use of `sudo` as appropriate.

- Install the necessary packages: LilyPond, Ghostscript, and ImageMagick.
- Create a new user by the name of `lily`:

  ```
  adduser lily
  ```

  This will create a new group for the `lily` user as well, and a home folder, `/home/lily`
- In the home folder of the `lily` user create a file to use as a separate filesystem:

  ```
  dd if=/dev/zero of=/home/lily/loopfile bs=1k count= 200000
  ```

  This example creates a 200MB file for use as the jail filesystem.
- Create a loop device, make a file system and mount it, then create a folder that can be written by the `lily` user:

  ```
  mkdir /mnt/lilyloop
  losetup /dev/loop0 /home/lily/loopfile
  mkfs -t ext3 /dev/loop0 200000
  mount -t ext3 /dev/loop0 /mnt/lilyloop
  mkdir /mnt/lilyloop/lilyhome
  chown lily /mnt/lilyloop/lilyhome
  ```
- In the configuration of the servers, the JAIL will be `/mnt/lilyloop` and the DIR will be `/lilyhome`.
- Create a big directory tree in the jail by copying the necessary files, as shown in the sample script below.

  You can use `sed` to create the necessary copy commands for a given executable:

  ```
  for i in "/usr/local/lilypond/usr/bin/lilypond" "/bin/sh" "/usr/bin/;  \
    do ldd $i | sed 's/.*=> \/\(.*\/\)\([^(]*\).*/mkdir -p \1 \&\&  \
      cp -L \/\1\2 \1\2/' | sed 's/\t\/\(.*\/\)\(.*\) (.*)$/mkdir -p  \
        \1 \&\& cp -L \/\1\2 \1\2/' | sed '/.*=>.*/d'; done
  ```

Example script for 32-bit Ubuntu 8.04

```
#!/bin/sh
## defaults set here

username=lily
home=/home
loopdevice=/dev/loop0
jaildir=/mnt/lilyloop
# the prefix (without the leading slash!)
lilyprefix=usr/local
# the directory where lilypond is installed on the system
lilydir=/$lilyprefix/lilypond/

userhome=$home/$username
loopfile=$userhome/loopfile
adduser $username
dd if=/dev/zero of=$loopfile bs=1k count=200000
mkdir $jaildir
losetup $loopdevice $loopfile
mkfs -t ext3 $loopdevice 200000
mount -t ext3 $loopdevice $jaildir
mkdir $jaildir/lilyhome
chown $username $jaildir/lilyhome
cd $jaildir

mkdir -p bin usr/bin usr/share usr/lib usr/share/fonts $lilyprefix tmp
chmod a+w tmp

cp -r -L $lilydir $lilyprefix
cp -L /bin/sh /bin/rm bin
cp -L /usr/bin/convert /usr/bin/gs usr/bin
cp -L /usr/share/fonts/truetype usr/share/fonts

# Now the library copying magic
for i in "$lilydir/usr/bin/lilypond" "$lilydir/usr/bin/guile" "/bin/sh"  \
  "/bin/rm" "/usr/bin/gs" "/usr/bin/convert"; do ldd $i | sed 's/.*=>  \
    \/\(.*\/\)\([^(]*\).*/mkdir -p \1 \&\& cp -L \/\1\2 \1\2/' | sed  \
      's/\t\/\(.*\/\)\(.*\) (.*)$/mkdir -p \1 \&\& cp -L \/\1\2 \1\2/'  \
        | sed '/.*=>.*/d'; done | sh -s

# The shared files for Ghostscript...
      cp -L -r /usr/share/ghostscript usr/share
# The shared files for ImageMagick
      cp -L -r /usr/lib/ImageMagick* usr/lib

### Now, assuming that you have test.ly in /mnt/lilyloop/lilyhome,
### you should be able to run:
### Note that /$lilyprefix/bin/lilypond is a script, which sets the
### LD_LIBRARY_PATH - this is crucial
      /$lilyprefix/bin/lilypond -jlily,lily,/mnt/lilyloop,/lilyhome test.ly
```

1.3 Error messages

Different error messages can appear while compiling a file:

Warning Something looks suspect. If you are requesting something out of the ordinary then you will understand the message, and can ignore it. However, warnings usually indicate that something is wrong with the input file.

Error Something is definitely wrong. The current processing step (parsing, interpreting, or formatting) will be finished, but the next step will be skipped.

Fatal error
Something is definitely wrong, and LilyPond cannot continue. This happens rarely. The most usual cause is misinstalled fonts.

Scheme error
Errors that occur while executing Scheme code are caught by the Scheme interpreter. If running with the verbose option (`-V` or `--verbose`) then a call trace of the offending function call is printed.

Programming error
There was some internal inconsistency. These error messages are intended to help the programmers and debuggers. Usually, they can be ignored. Sometimes, they come in such big quantities that they obscure other output.

Aborted (core dumped)
This signals a serious programming error that caused the program to crash. Such errors are considered critical. If you stumble on one, send a bug-report.

If warnings and errors can be linked to some part of the input file, then error messages have the following form

```
filename:lineno:columnno: message
offending input line
```

A line-break is inserted in the offending line to indicate the column where the error was found. For example,

```
test.ly:2:19: error: not a duration: 5
  { c'4 e'
           5 g' }
```

These locations are LilyPond's best guess about where the warning or error occurred, but (by their very nature) warnings and errors occur when something unexpected happens. If you can't see an error in the indicated line of your input file, try checking one or two lines above the indicated position.

Please note that diagnostics can be triggered at any point during the many stages of processing. For example if there are parts of the input that are processed multiple times (i.e. in midi and layout output), or if the same music variable is used in multiple contexts the same message may appear several times. Diagnostics produced at a 'late' stage (i.e bar checks) might also be issued multiple times.

More information about errors is given in Section 1.4 [Common errors], page 14.

1.4 Common errors

The error conditions described below occur often, yet the cause is not obvious or easily found. Once seen and understood, they are easily handled.

Music runs off the page

Music running off the page over the right margin or appearing unduly compressed is almost always due to entering an incorrect duration on a note, causing the final note in a measure to extend over the bar line. It is not invalid if the final note in a measure does not end on the automatically entered bar line, as the note is simply assumed to carry over into the next measure. But if a long sequence of such carry-over measures occurs the music can appear compressed or may flow off the page because automatic line breaks can be inserted only at the end of complete measures, i.e., where all notes end before or at the end of the measure.

> **Note:** An incorrect duration can cause line breaks to be inhibited, leading to a line of highly compressed music or music which flows off the page.
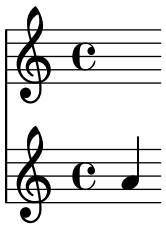
The incorrect duration can be found easily if bar checks are used, see Section "Bar and bar number checks" in *Notation Reference*.

If you actually intend to have a series of such carry-over measures you will need to insert an invisible bar line where you want the line to break. For details, see Section "Bar lines" in *Notation Reference*.

An extra staff appears
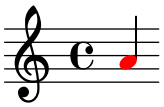
If contexts are not created explicitly with `\new` or `\context`, they will be silently created as soon as a command is encountered which cannot be applied to an existing context. In simple scores the automatic creation of contexts is useful, and most of the examples in the LilyPond manuals take advantage of this simplification. But occasionally the silent creation of contexts can give rise to unexpected new staves or scores. For example, it might be expected that the following code would cause all note heads within the following staff to be colored red, but in fact it results in two staves with the note heads remaining the default black in the lower staff.

```
\override Staff.NoteHead.color = #red
\new Staff { a' }
```



This is because a `Staff` context does not exist when the override is processed, so one is implicitly created and the override is applied to it, but then the `\new Staff` command creates another, separate, staff into which the notes are placed. The correct code to color all note heads red is

```
\new Staff {
  \override Staff.NoteHead.color = #red
  a'
}
```



Error message Unbound variable %

This error message will appear at the bottom of the console output or log file together with a "GUILE signalled an error . . ." message every time a Scheme routine is called which (invalidly) contains a *LilyPond* rather than a *Scheme* comment.

LilyPond comments begin with a percent sign, (%), and must not be used within Scheme routines. Scheme comments begin with a semi-colon, (;).

Error message FT_Get_Glyph_Name

This error messages appears in the console output or log file if an input file contains a non-ASCII character and was not saved in UTF-8 encoding. For details, see Section "Text encoding" in *Notation Reference*.

Warning staff affinities should only decrease

This warning can appear if there are no staves in the printed output, for example if there are just a `ChordName` context and a `Lyrics` context as in a lead sheet. The warning messages can be avoided by making one of the contexts behave as a staff by inserting

```
\override VerticalAxisGroup.staff-affinity = ##f
```

at its start. For details, see "Spacing of non-staff lines" in Section "Flexible vertical spacing within systems" in *Notation Reference*.

Error message unexpected \new

A `\score` block must contain a *single* music expression. If instead it contains several `\new Staff`, `\new StaffGroup` or similar contexts introduced with `\new` without them being enclosed in either curly brackets, `{ ... }`, or double angle brackets, `<< ... >>`, like this:
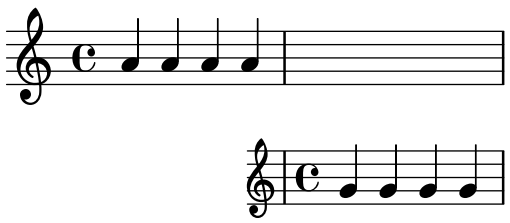
```
\score {
  % Invalid! Generates error: syntax error, unexpected \new
  \new Staff { ... }
  \new Staff { ... }
}
```

the error message will be produced.

To avoid the error, enclose all the `\new` statements in curly or double angle brackets.

Using curly brackets will introduce the `\new` statements sequentially:

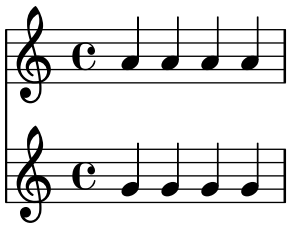
```
\score {
  {
    \new Staff { a' a' a' a' }
    \new Staff { g' g' g' g' }
  }
}
```



but more likely you should be using double angle brackets so the new staves are introduced in parallel, i.e. simultaneously:

```
\score {
```

```
  <<
    \new Staff { a' a' a' a' }
    \new Staff { g' g' g' g' }
  >>
}
```



Warning this voice needs a \voiceXx or \shiftXx setting

If notes from two different voices with stems in the same direction occur at the same musical moment, but the voices have no voice-specific shifts specified, the warning message '`warning: this voice needs a \voiceXx or \shiftXx setting`' will appear when compiling the LilyPond file. This warning will appear even when the notes have no visible stems, e.g. whole notes, if the stems for shorter notes at the same pitch would be in the same direction.

Remember that the stem direction depends on the position of the note on the staff unless the stem direction is specified, for example by using `\voiceOne`, etc. In this case the warning will appear only when the stems happen to be in the same direction, i.e. when the notes are in the same half of the staff.

By placing the notes in voices with stem directions and shifts specified, for example by using `\voiceOne`, etc., these warnings may be avoided.

Notes in higher numbered voices, `\voiceThree` etc., are automatically shifted to avoid clashing note columns. This causes a visible shift for notes with stems, but whole notes are not visibly shifted unless an actual clash of the note heads occurs, or when the voices cross over from their natural order (when `\voiceThree` is higher than `\voiceOne`, etc.)

See also

Section "Explicitly instantiating voices" in *Learning Manual*, Section "Real music example" in *Learning Manual*, Section "Single-staff polyphony" in *Notation Reference*, Section "Collision resolution" in *Notation Reference*.

2 Updating files with `convert-ly`

As LilyPond is improved, the syntax (input language) of some commands and functions can change. This can result in unexpected errors, warnings or even wrong output when input files, previously created for older versions of LilyPond are then used with later versions.

To help with this the `convert-ly` command can be used to upgrade these older input files to use the newer syntax.

2.1 Why does the syntax change?

Often, syntax changes are made to make the input simpler to both read and write, but occasionally the changes are made to accommodate new features or enhancements to existing functions.

To illustrate this here is a real example:

All `\paper` and `\layout` property names were supposed to be written in the form `first-second-third`. However, in LilyPond version 2.11.60, it was noticed that the `printallheaders` property did not follow this convention. Should this property be left alone (confusing new users with an inconsistent format)? Or should it be changed (annoying old users with existing LilyPond input files)?

The decision was made to change the name of the property to `print-all-headers`, and by using the `convert-ly` command the old users had a way to automatically update their existing input files.

However, the `convert-ly` command cannot always be used to manage all syntax changes. In versions of LilyPond before 2.4.2, accents and non-English characters were entered using standard LaTeX notation. For example the French word for 'Christmas' was entered as `No\"el`. But in LilyPond 2.6 onwards, the special ë must be entered directly as a UTF-8 character. The `convert-ly` command cannot change LaTeX special characters into UTF-8 characters, so older LilyPond input files have to edited manually.

The conversion rules of the `convert-ly` command work using text pattern-matching and replacement (rather than 'understanding' the context of what it is changing within a given input file). This has several consequences:

- The reliability of the conversion depends on the quality of each applied rule set and on the complexity of the respective change. Sometimes conversions may require additional, manual fixes, so the original input files should be kept for comparison just in case.
- Only conversions to newer syntax changes are possible: there are no rule sets to go back to older versions of LilyPond. So the input file should only be upgraded when older versions of LilyPond are no longer being maintained. Again, the original input files should be kept just in case; perhaps using version control systems (i.e. Git) to help with maintaining multiple versions of your input files.
- LilyPond is quite robust when processing 'creatively' placed or omitted whitespace, but the rules used by `convert-ly` often make some stylistic assumptions. Therefore following the input style as used in the LilyPond manuals is advised for painless upgrades, particularly as the examples in the manuals themselves are all upgraded using the `convert-ly` command.

2.2 Invoking `convert-ly`

The `convert-ly` command uses the `\version` number in the input file to detect older versions. In most cases, to upgrade your input file it is sufficient just to run;

```
convert-ly -e myfile.ly
```

in the directory containing the input file. This will upgrade `myfile.ly` in-place and preserve the original file by renaming it `myfile.ly~`. The `\version` number in the upgraded input file, along with any required syntax updates, is also changed.

When run, the convert-ly command will output the version numbers of which conversions have been made to. If no version numbers are listed in the output for the file, it is already up to date and using the latest LilyPond syntax.

> **Note:** For each new version of LilyPond, a new convert-ly command is created, however not every version of LilyPond will need syntax changes for its input files from the version before. This means that the convert-ly command will only convert input files up to the latest syntax change it has and this, in turn, may mean that the \version number left in the upgraded input file is sometimes earlier than the version of convert-ly command itself.

To convert all input files in a single directory use;

```
convert-ly -e *.ly
```

Linux and MacOS X users can both use the appropriate terminal application, but MacOS X users can also execute this command directly under the menu entry Compile > Update syntax.

A Windows user would run the command;

```
convert-ly.py -e *.ly
```

entering these commands in a command prompt usually found under Start > Accessories > Command Prompt or for version 8 users, by typing in the search window 'command prompt'.

To convert all input files that reside in different sets of subdirectories;

```
find . -name '*.ly' -exec convert-ly -e '{}' \;
```

This example searches and converts all input files in the current directory and all directories below it recursively. The converted files will be located in the same directory along with their renamed originals. This should also work for MacOS X users, although only via the terminal app.

Windows user would use;

```
forfiles /s /M *.ly /c "cmd /c convert-ly.py -e @file"
```

Alternatively, an explicit path to the top-level of your folder containing all the sub-folders that have input files in them can be stated using the /p option;

```
forfiles /s /p C:\Documents\MyScores /M *.ly /c "cmd /c convert-ly.py -e @file"
```

If there are spaces in the path to the top-level folder, then the whole path needs to be inside double quotes;

```
forfiles /s /p "C:\Documents\My Scores" /M *.ly /c "cmd /c convert-ly.py -e @file"
```

2.3 Command line options for convert-ly

The program is invoked as follows:

```
convert-ly [option]... filename...
```

The following options can be given:

`-d, --diff-version-update`
: increase the \version string only if the file has actually been changed. In that case, the version header will correspond to the version after the last actual change. An unstable version number will be rounded up to the next stable version number unless that would exceed the target version number. Without this option, the version will instead reflect the last *attempted* conversion.

`-e, --edit`
: Apply the conversions direct to the input file, modifying it in-place. The original file is renamed as `myfile.ly~`. This backup file may be a hidden file on some operating systems. Alternatively, if you want to specify a different name for the upgraded file without using the `-e` options default `~` appended to the old input file, the output can be redirected instead;

```
convert-ly myfile.ly > mynewfile.ly
```

Windows user would use;

```
convert-ly.py myfile.ly > mynewfile.ly
```

`-b, --backup-numbered`
: When used with the '`-e`' option, number the backup files so that no previous version is overwritten. The backup files may be hidden on some operating systems.

`-f, --from=`*`from-patchlevel`*
: Set the version to convert from. If this is not set, `convert-ly` will guess this, on the basis of `\version` strings in the file. E.g. `--from=2.10.25`

`-h, --help`
: Print usage help.

`-l` *`loglevel`*`, --loglevel=`*`loglevel`*
: Set the output verbosity to *loglevel*. Possible values, in upper case, are `PROGRESS` (the default), `NONE`, `WARNING`, `ERROR` and `DEBUG`.

`-n, --no-version`
: Normally, `convert-ly` adds a `\version` indicator to the output. Specifying this option suppresses this.

`-s, --show-rules`
: Show all known conversions and exit.

`-t, --to=`*`to-patchlevel`*
: Explicitly set which `\version` to convert to, otherwise the default is the most current value. It must be higher than the starting version.

```
convert-ly --to=2.14.1 myfile.ly
```

To upgrade LilyPond fragments in texinfo files, use

```
convert-ly --from=... --to=... --no-version *.itely
```

To see the changes in the LilyPond syntax between two versions, use

```
convert-ly --from=... --to=... -s
```

2.4 Problems running `convert-ly`

When running convert-ly in a Command Prompt window under Windows on a file which has spaces in the filename or in the path to it, it is necessary to surround the entire input file name with three (!) sets of double quotes:

```
convert-ly """D:/My Scores/Ode.ly""" > "D:/My Scores/new Ode.ly"
```

If the simple `convert-ly -e *.ly` command fails because the expanded command line becomes too long, the `convert-ly` command may be placed in a loop instead. This example for UNIX will upgrade all `.ly` files in the current directory

```
for f in *.ly; do convert-ly -e $f; done;
```

In the Windows Command Prompt window the corresponding command is

```
for %x in (*.ly) do convert-ly -e """%x"""
```

Not all language changes are handled. Only one output option can be specified. Automatically updating scheme and LilyPond scheme interfaces is quite unlikely; be prepared to tweak scheme code manually.

2.5 Manual conversions

In theory, a program like convert-ly could handle any syntax change. After all, a computer program interprets the old version and the new version, so another computer program can translate one file into another[1].

However, the LilyPond project has limited resources: not all conversions are performed automatically. Below is a list of known problems.

```
1.6->2.0:
 Doesn't always convert figured bass correctly, specifically things like {<
>}.  Mats' comment on working around this:
   To be able to run convert-ly
   on it, I first replaced all occurrences of '{<' to some dummy like '{#'
   and similarly I replaced '>}' with '&}'.  After the conversion, I could
   then change back from '{ #' to '{ <' and from '& }' to '> }'.
 Doesn't convert all text markup correctly.  In the old markup syntax,
 it was possible to group a number of markup commands together within
parentheses, e.g.
   -#'((bold italic) "string")
   This will incorrectly be converted into
   -\markup{{\bold italic} "string"}
   instead of the correct
   -\markup{\bold \italic "string"}
2.0->2.2:
 Doesn't handle \partCombine
 Doesn't do \addlyrics => \lyricsto, this breaks some scores with multiple
stanzas.
2.0->2.4:
 \magnify isn't changed to \fontsize.
    - \magnify #m => \fontsize #f, where f = 6ln(m)/ln(2)
 remove-tag isn't changed.
    - \applyMusic #(remove-tag '. . .) => \keepWithTag #'. . .
 first-page-number isn't changed.
    - first-page-number no => print-first-page-number = ##f
 Line breaks in header strings aren't converted.
    - \\\\  as line break in \header strings => \markup \center-align <
      "First Line" "Second Line" >
 Crescendo and decrescendo terminators aren't converted.
    - \rced => \!
    - \rc => \!
2.2->2.4:
 \turnOff (used in \set Staff.VoltaBracket = \turnOff) is not properly
converted.
2.4.2->2.5.9
 \markup{ \center-align <{ ... }> } should be converted to:
```

[1] At least, this is possible in any LilyPond file which does not contain scheme. If there is scheme in the file, then the LilyPond file contains a Turing-complete language, and we run into problems with the famous "Halting Problem" in computer science.

```
 \markup{ \center-align {\line { ... }} }
 but now, \line is missing.
2.4->2.6
 Special LaTeX characters such as $~$ in text are not converted to UTF8.
2.8
 \score{} must now begin with a music expression.  Anything else
 (particularly \header{}) must come after the music.
```

2.6 Writing code to support multiple versions

In some cases, especially when writing *library* code it is desirable to support multiple LilyPond versions across breaking syntax changes. To do this alternative portions of code can be wrapped into conditional expressions depending on the currently executed LilyPond version. The Scheme function `ly:version?` expects a comparison operator *op* and a reference version *ver* passed as a list of integers with up to three elements. Missing elements are ignored so `'(2 20)` is equivalent to *any* version of the 2.20 line of versions. Constructs like the following are possible:

```
#(cond
  ((ly:version? > '(2 20))
   (ly:message "This is code to run for LilyPond after 2.20"))
  ((ly:version? = '(2 19 57))
   (ly:message "This will only be executed with LilyPond 2.19.57"))
  (else (ly:message "This will be executed in any other version")))
```

Usually this will be integrated in library functions to allow alternative syntax to be used, but it is also possible to use the comparison directly within the music like in the following example:

```
{
  c' d' e' f'
  #(if (ly:version? = '(2 21))
       #{ \override NoteHead.color = #red #}
       #{ \override NoteHead.color = #blue #})
  g' a' b' c''
}
```

Note: This function has been introduced in LilyPond 2.19.57, so it is not possible to compare with versions earlier than that.

3 Running `lilypond-book`

If you want to add pictures of music to a document, you can simply do it the way you would do with other types of pictures. The pictures are created separately, yielding PostScript output or PNG images, and those are included into a LaTeX or HTML document.

`lilypond-book` provides a way to automate this process: This program extracts snippets of music from your document, runs `lilypond` on them, and outputs the document with pictures substituted for the music. The line width and font size definitions for the music are adjusted to match the layout of your document.

This is a separate program from `lilypond` itself, and is run on the command line; for more information, see Section 1.2 [Command-line usage], page 1. If you have trouble running `lilypond-book` on Windows or Mac OS X using the command line, then see either Section "Windows" in *General Information* or Section "MacOS X" in *General Information*.

This procedure may be applied to LaTeX, HTML, Texinfo or DocBook documents.

3.1 An example of a musicological document

Some texts contain music examples. These texts are musicological treatises, songbooks, or manuals like this. Such texts can be made by hand, simply by importing a PostScript figure into the word processor. However, there is an automated procedure to reduce the amount of work involved in HTML, LaTeX, Texinfo and DocBook documents.

A script called `lilypond-book` will extract the music fragments, format them, and put back the resulting notation. Here we show a small example for use with LaTeX. The example also contains explanatory text, so we will not comment on it further.

Input

```
\documentclass[a4paper]{article}

\begin{document}

Documents for \verb+lilypond-book+ may freely mix music and text.
For example,

\begin{lilypond}
\relative {
  c'2 e2 \tuplet 3/2 { f8 a b } a2 e4
}
\end{lilypond}

Options are put in brackets.

\begin{lilypond}[fragment,quote,staffsize=26,verbatim]
  c'4 f16
\end{lilypond}

Larger examples can be put into a separate file, and introduced with
\verb+\lilypondfile+.

\lilypondfile[quote,noindent]{screech-and-boink.ly}

(If needed, replace @file{screech-and-boink.ly} by any @file{.ly} file
```

```
you put in the same directory as this file.)

\end{document}
```

Processing

Save the code above to a file called `lilybook.lytex`, then in a terminal run

```
lilypond-book --output=out --pdf lilybook.lytex
lilypond-book (GNU LilyPond) 2.21.1
Reading lilybook.lytex...
...lots of stuff deleted...
Compiling lilybook.tex...
cd out
pdflatex lilybook
...lots of stuff deleted...
xpdf lilybook
(replace xpdf by your favorite PDF viewer)
```
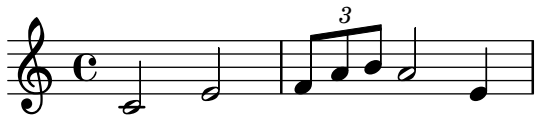
Running `lilypond-book` and `latex` creates a lot of temporary files, which would clutter up the working directory. To remedy this, use the `--output=dir` option. It will create the files in a separate subdirectory `dir`.

Finally the result of the LaTeX example shown above.[1] This finishes the tutorial section.

[1] This tutorial is processed with Texinfo, so the example gives slightly different results in layout.

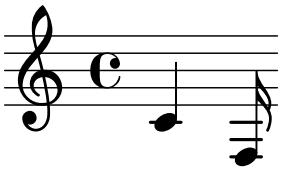
Output

Documents for lilypond-book may freely mix music and text. For example,

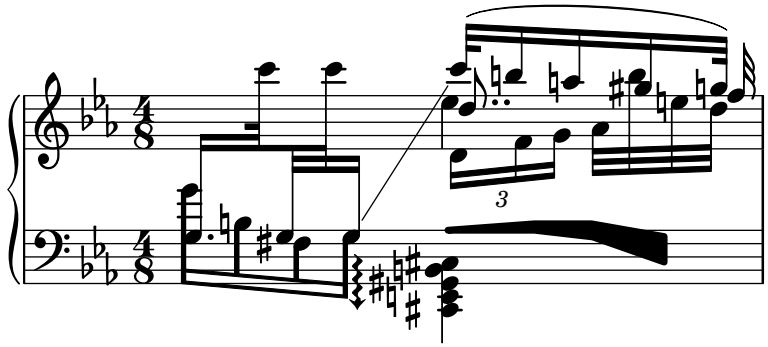


Options are put in brackets.

```
c'4 f16
```



Larger examples can be put into a separate file, and introduced with \lilypondfile.
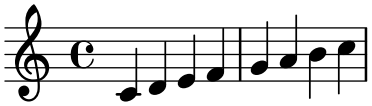


If a tagline is required, either default or custom, then the entire snippet must be enclosed in a \book { } construct.

```
\book{
  \header{
    title = "A scale in LilyPond"
  }

  \relative {
    c' d e f g a b c
  }
}
```

A scale in LilyPond



Music engraving by LilyPond 2.21.1—www.lilypond.org

3.2 Integrating music and text

Here we explain how to integrate LilyPond with various output formats.

3.2.1 LaTeX

LaTeX is the de-facto standard for publishing layouts in the exact sciences. It is built on top of the TeX typesetting engine, providing the best typography available anywhere.

See *The Not So Short Introduction to LaTeX* (`http://www.ctan.org/tex-archive/info/lshort/english/`) for an overview on how to use LaTeX.

`lilypond-book` provides the following commands and environments to include music in LaTeX files:

- the `\lilypond{...}` command, where you can directly enter short lilypond code
- the `\begin{lilypond}...\end{lilypond}` environment, where you can directly enter longer lilypond code
- the `\lilypondfile{...}` command to insert a lilypond file
- the `\musicxmlfile{...}` command to insert a MusicXML file, which will be processed by `musicxml2ly` and `lilypond`.

In the input file, music is specified with any of the following commands:

```
\begin{lilypond}[options,go,here]
  YOUR LILYPOND CODE
\end{lilypond}

\lilypond[options,go,here]{ YOUR LILYPOND CODE }

\lilypondfile[options,go,here]{filename}
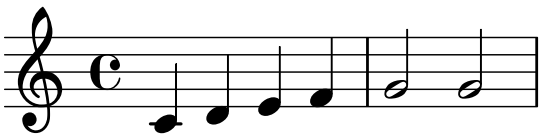
\musicxmlfile[options,go,here]{filename}
```

Additionally, `\lilypondversion` displays the current version of lilypond. Running `lilypond-book` yields a file that can be further processed with LaTeX.

We show some examples here. The `lilypond` environment

```
\begin{lilypond}[quote,fragment,staffsize=26]
  c' d' e' f' g'2 g'2
\end{lilypond}
```

produces



The short version

```
\lilypond[quote,fragment,staffsize=11]{<c' e' g'>}
```

produces



Currently, you cannot include `{` or `}` within `\lilypond{}`, so this command is only useful with the `fragment` option.

The default line width of the music will be adjusted by examining the commands in the document preamble, the part of the document before `\begin{document}`. The `lilypond-book` command sends these to LaTeX to find out how wide the text is. The line width for the music fragments is then adjusted to the text width. Note that this heuristic algorithm can fail easily; in such cases it is necessary to use the `line-width` music fragment option.

Each snippet will call the following macros if they have been defined by the user:

- `\preLilyPondExample` called before the music,
- `\postLilyPondExample` called after the music,
- `\betweenLilyPondSystem[1]` is called between systems if `lilypond-book` has split the snippet into several PostScript files. It must be defined as taking one parameter and will be passed the number of files already included in this snippet. The default is to simply insert a `\linebreak`.

Selected Snippets

Sometimes it is useful to display music elements (such as ties and slurs) as if they continued after the end of the fragment. This can be done by breaking the staff and suppressing inclusion of the rest of the LilyPond output.

In LaTeX, define `\betweenLilyPondSystem` in such a way that inclusion of other systems is terminated once the required number of systems are included. Since `\betweenLilyPondSystem` is first called *after* the first system, including only the first system is trivial.

```
\def\betweenLilyPondSystem#1{\endinput}

\begin{lilypond}[fragment]
  c'1\( e'( c'~ \break c' d) e f\)
\end{lilypond}
```

If a greater number of systems is requested, a TeX conditional must be used before the `\endinput`. In this example, replace '2' by the number of systems you want in the output.

```
\def\betweenLilyPondSystem#1{
    \ifnum#1<2\else\expandafter\endinput\fi
}
```

(Since `\endinput` immediately stops the processing of the current input file we need `\expandafter` to delay the call of `\endinput` after executing `\fi` so that the `\if-\fi` clause is balanced.)

Remember that the definition of `\betweenLilyPondSystem` is effective until TeX quits the current group (such as the LaTeX environment) or is overridden by another definition (which is, in most cases, for the rest of the document). To reset your definition, write

```
\let\betweenLilyPondSystem\undefined
```

in your LaTeX source.

This may be simplified by defining a TeX macro

```
\def\onlyFirstNSystems#1{
    \def\betweenLilyPondSystem##1{%
      \ifnum##1<#1\else\expandafter\endinput\fi}
}
```

and then saying only how many systems you want before each fragment,

```
\onlyFirstNSystems{3}
\begin{lilypond}...\end{lilypond}
\onlyFirstNSystems{1}
\begin{lilypond}...\end{lilypond}
```

See also

There are specific `lilypond-book` command line options and other details to know when processing LaTeX documents, see Section 3.4 [Invoking lilypond-book], page 34.

3.2.2 Texinfo

Texinfo is the standard format for documentation of the GNU project. An example of a Texinfo document is this manual. The HTML, PDF, and Info versions of the manual are made from the Texinfo document.

`lilypond-book` provides the following commands and environments to include music into Texinfo files:

- the `@lilypond{...}` command, where you can directly enter short lilypond code
- the `@lilypond...@end lilypond` environment, where you can directly enter longer lilypond code
- the `@lilypondfile{...}` command to insert a lilypond file
- the `@musicxmlfile{...}` command to insert a MusicXML file, which will be processed by `musicxml2ly` and `lilypond`.

In the input file, music is specified with any of the following commands

```
@lilypond[options,go,here]
  YOUR LILYPOND CODE
@end lilypond

@lilypond[options,go,here]{ YOUR LILYPOND CODE }

@lilypondfile[options,go,here]{filename}

@musicxmlfile[options,go,here]{filename}
```
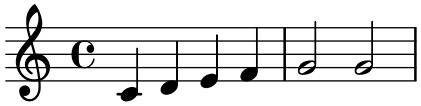
Additionally, `@lilypondversion` displays the current version of lilypond.

When `lilypond-book` is run on it, this results in a Texinfo file (with extension `.texi`) containing `@image` tags for HTML, Info and printed output. `lilypond-book` generates images of the music in EPS and PDF formats for use in the printed output, and in PNG format for use in HTML and Info output.

We show two simple examples here. A `lilypond` environment

```
@lilypond[fragment]
c' d' e' f' g'2 g'
@end lilypond
```

produces



The short version

```
@lilypond[fragment,staffsize=11]{<c' e' g'>}
```

produces



Contrary to LaTeX, `@lilypond{...}` does not generate an in-line image. It always gets a paragraph of its own.

3.2.3 HTML

lilypond-book provides the following commands and environments to include music in HTML files:

- the <lilypond ... /> command, where you can directly enter short lilypond code
- the <lilyond>...</lilypond> environment, where you can directly enter longer lilypond code
- the <lilypondfile>...</lilypondfile> command to insert a lilypond file
- the <musicxmlfile>...</musicxmlfile> command to insert a MusicXML file, which will be processed by musicxml2ly and lilypond.

In the input file, music is specified with any of the following commands:

```
<lilypond options go here>
  YOUR LILYPOND CODE
</lilypond>
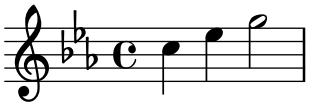
<lilypond options go here: YOUR LILYPOND CODE />

<lilypondfile options go here>filename</lilypondfile>

<musicxmlfile options go here>filename</musicxmlfile>
```

For example, you can write

```
<lilypond fragment relative=2>
\key c \minor c4 es g2
</lilypond>
```

lilypond-book then produces an HTML file with appropriate image tags for the music fragments:



For inline pictures, use <lilypond ... />, where the options are separated by a colon from the music, for example

```
Some music in <lilypond relative=2: a b c/> a line of text.
```

To include separate files, say

```
<lilypondfile option1 option2 ...>filename</lilypondfile>
```

<musicxmlfile> uses the same syntax as <lilypondfile>, but simply references a MusicXML file rather than a LilyPond file.

For a list of options to use with the lilypond or lilypondfile tags, see Section 3.3 [Music fragment options], page 31.

Additionally, <lilypondversion/> displays the current version of lilypond.

3.2.4 DocBook

For inserting LilyPond snippets it is good to keep the conformity of our DocBook document, thus allowing us to use DocBook editors, validation etc. So we don't use custom tags, only specify a convention based on the standard DocBook elements.

Common conventions

For inserting all type of snippets we use the `mediaobject` and `inlinemediaobject` element, so our snippets can be formatted inline or not inline. The snippet formatting options are always provided in the `role` property of the innermost element (see in next sections). Tags are chosen to allow DocBook editors format the content gracefully. The DocBook files to be processed with `lilypond-book` should have the extension `.lyxml`.

Including a LilyPond file

This is the most simple case. We must use the `.ly` extension for the included file, and insert it as a standard `imageobject`, with the following structure:

```
<mediaobject>
  <imageobject>
    <imagedata fileref="music1.ly" role="printfilename" />
  </imageobject>
</mediaobject>
```

Note that you can use `mediaobject` or `inlinemediaobject` as the outermost element as you wish.

Including LilyPond code

Including LilyPond code is possible by using a `programlisting`, where the language is set to `lilypond` with the following structure:

```
<inlinemediaobject>
  <textobject>
    <programlisting language="lilypond" role="fragment verbatim staffsize=16 ragged-rig
\context Staff \with {
  \remove "Time_signature_engraver"
  \remove "Clef_engraver"}
  { c4( fis) }
    </programlisting>
  </textobject>
</inlinemediaobject>
```

As you can see, the outermost element is a `mediaobject` or `inlinemediaobject`, and there is a `textobject` containing the `programlisting` inside.

Processing the DocBook document

Running `lilypond-book` on our `.lyxml` file will create a valid DocBook document to be further processed with `.xml` extension. If you use dblatex (`http://dblatex.sourceforge.net`), it will create a PDF file from this document automatically. For HTML (HTML Help, JavaHelp etc.) generation you can use the official DocBook XSL stylesheets, however, it is possible that you have to make some customization for it.

3.3 Music fragment options

In the following, a 'LilyPond command' refers to any command described in the previous sections which is handled by `lilypond-book` to produce a music snippet. For simplicity, LilyPond commands are only shown in LaTeX syntax.

Note that the option string is parsed from left to right; if an option occurs multiple times, the last one is taken.

The following options are available for LilyPond commands:

`staffsize=`*ht*
: Set staff size to *ht*, which is measured in points.

`ragged-right`
: Produce ragged-right lines with natural spacing, i.e., `ragged-right = ##t` is added to the LilyPond snippet. Single-line snippets will always be typeset by default as ragged-right, unless `noragged-right` is explicitly given.

`noragged-right`
: For single-line snippets, allow the staff length to be stretched to equal that of the line width, i.e., `ragged-right = ##f` is added to the LilyPond snippet.

`line-width`
`line-width=`*size*`\`*unit*
: Set line width to *size*, using *unit* as units. *unit* is one of the following strings: `cm`, `mm`, `in`, or `pt`. This option affects LilyPond output (this is, the staff length of the music snippet), not the text layout.

  If used without an argument, set line width to a default value (as computed with a heuristic algorithm).

  If no `line-width` option is given, `lilypond-book` tries to guess a default for `lilypond` environments which don't use the `ragged-right` option.

`papersize=`*string*
: Where *string* is a paper size defined in `scm/paper.scm` i.e. `a5`, `quarto`, `11x17` etc.

  Values not defined in `scm/paper.scm` will be ignored, a warning will be posted and the snippet will be printed using the default `a4` size.

`notime` Do not print the time signature, and turns off the timing (time signature, bar lines) in the score.

`fragment` Make `lilypond-book` add some boilerplate code so that you can simply enter, say,

```
c'4
```

  without `\layout`, `\score`, etc.

`nofragment`
: Do not add additional code to complete LilyPond code in music snippets. Since this is the default, `nofragment` is redundant normally.

`indent=`*size*`\`*unit*
: Set indentation of the first music system to *size*, using *unit* as units. *unit* is one of the following strings: `cm`, `mm`, `in`, or `pt`. This option affects LilyPond, not the text layout.

`noindent` Set indentation of the first music system to zero. This option affects LilyPond, not the text layout. Since no indentation is the default, `noindent` is redundant normally.

`quote` Reduce line length of a music snippet by 2∗0.4 in and put the output into a quotation block. The value '0.4 in' can be controlled with the `exampleindent` option.

`exampleindent`
: Set the amount by which the `quote` option indents a music snippet.

`relative`
`relative=`*n*
: Use relative octave mode. By default, notes are specified relative to middle C. The optional integer argument specifies the octave of the starting note, where the default `1` is middle C. `relative` option only works when `fragment` option is set, so `fragment` is automatically implied by `relative`, regardless of the presence of any `(no)fragment` option in the source.

LilyPond also uses `lilypond-book` to produce its own documentation. To do that, some more obscure music fragment options are available.

`verbatim` The argument of a LilyPond command is copied to the output file and enclosed in a verbatim block, followed by any text given with the `intertext` option (not implemented yet); then the actual music is displayed. This option does not work well with `\lilypond{}` if it is part of a paragraph.

If `verbatim` is used in a `lilypondfile` command, it is possible to enclose verbatim only a part of the source file. If the source file contain a comment containing '`begin verbatim`' (without quotes), quoting the source in the verbatim block will start after the last occurrence of such a comment; similarly, quoting the source verbatim will stop just before the first occurrence of a comment containing '`end verbatim`', if there is any. In the following source file example, the music will be interpreted in relative mode, but the verbatim quote will not show the `relative` block, i.e.

```
\relative { % begin verbatim
  c'4 e2 g4
  f2 e % end verbatim
}
```

will be printed with a verbatim block like

```
  c4 e2 g4
  f2 e
```

If you would like to translate comments and variable names in verbatim output but not in the sources, you may set the environment variable `LYDOC_LOCALEDIR` to a directory path; the directory should contain a tree of `.mo` message catalogs with `lilypond-doc` as a domain.

`addversion`

(Only for Texinfo output.) Prepend line `\version @w{"@version{}"}` to `verbatim` output.

`texidoc` (Only for Texinfo output.) If `lilypond` is called with the `--header=texidoc` option, and the file to be processed is called `foo.ly`, it creates a file `foo.texidoc` if there is a `texidoc` field in the `\header`. The `texidoc` option makes `lilypond-book` include such files, adding its contents as a documentation block right before the music snippet (but outside the `example` environment generated by a `quote` option).

Assuming the file `foo.ly` contains

```
\header {
  texidoc = "This file demonstrates a single note."
}
{ c'4 }
```

and we have this in our Texinfo document `test.texinfo`

```
@lilypondfile[texidoc]{foo.ly}
```

the following command line gives the expected result

```
lilypond-book --pdf --process="lilypond \
  -dbackend=eps --header=texidoc" test.texinfo
```

Most LilyPond test documents (in the `input` directory of the distribution) are small `.ly` files which look exactly like this.

For localization purpose, if the Texinfo document contains `@documentlanguage` *`LANG`* and `foo.ly` header contains a `texidoc`*`LANG`* field, and if `lilypond` is called with `--header=texidoc`*`LANG`*, then `foo.texidoc`*`LANG`* will be included instead of `foo.texidoc`.

`doctitle` (Only for Texinfo output.) This option works similarly to `texidoc` option: if `lilypond` is called with the `--header=doctitle` option, and the file to be processed is called `foo.ly` and contains a `doctitle` field in the `\header`, it creates a file `foo.doctitle`. When `doctitle` option is used, the contents of `foo.doctitle`, which should be a single line of *text*, is inserted in the Texinfo document as `@lydoctitle` *text*. `@lydoctitle` should be a macro defined in the Texinfo document. The same remark about `texidoc` processing with localized languages also applies to `doctitle`.

`nogettext`
(Only for Texinfo output.) Do not translate comments and variable names in the snippet quoted verbatim.

`printfilename`
If a LilyPond input file is included with `\lilypondfile`, print the file name right before the music snippet. For HTML output, this is a link. Only the base name of the file is printed, i.e. the directory part of the file path is stripped.

3.4 Invoking `lilypond-book`

`lilypond-book` produces a file with one of the following extensions: `.tex`, `.texi`, `.html` or `.xml`, depending on the output format. All of `.tex`, `.texi` and `.xml` files need further processing.

Format-specific instructions

LaTeX

There are two ways of processing your LaTeX document for printing or publishing: getting a PDF file directly with PDFLaTeX, or getting a PostScript file with LaTeX via a DVI to PostScript translator like `dvips`. The first way is simpler and recommended[1], and whichever way you use, you can easily convert between PostScript and PDF with tools, like `ps2pdf` and `pdf2ps` included in Ghostscript package.

To produce a PDF file through PDFLaTeX, use:

```
lilypond-book --pdf yourfile.lytex
pdflatex yourfile.tex
```

To produce PDF output via LaTeX/`dvips`/`ps2pdf`:

```
lilypond-book yourfile.lytex
latex yourfile.tex
dvips -Ppdf yourfile.dvi
ps2pdf yourfile.ps
```

The `.dvi` file created by this process will not contain note heads. This is normal; if you follow the instructions, they will be included in the `.ps` and `.pdf` files.

Running `dvips` may produce some warnings about fonts; these are harmless and may be ignored. If you are running `latex` in twocolumn mode, remember to add `-t landscape` to the `dvips` options.

Environments such as;

```
\begin{lilypond} ... \end{lilypond}
```

are not interpreted by LaTeX. Instead, `lilypond-book` extracts those 'environments' into files of its own and runs LilyPond on them. It then takes the resulting graphics and creates a `.tex` file

[1] Note that PDFLaTeX and LaTeX may not be both usable to compile any LaTeX document, that is why we explain the two ways.

where the \begin{lilypond}...\end{lilypond} macros are then replaced by 'graphics inclusion' commands. It is at this time that LaTeX is run (although LaTeX will have run previously, it will have been, effectively, on an 'empty' document in order to calculate things like \linewidth).

Known issues and warnings

The \pageBreak command will not work within a \begin{lilypond} ... \end{lilypond} environment.

Many \paper block variables will also not work within a \begin{lilypond} ... \end{lilypond} environment. Use \newcommand with \betweenLilyPondSystem in the preamble;

```
\newcommand{\betweenLilyPondSystem}[1]{\vspace{36mm}\linebreak}
```

Texinfo

To produce a Texinfo document (in any output format), follow the normal procedures for Texinfo; this is, either call texi2pdf or texi2dvi or makeinfo, depending on the output format you want to create. See the documentation of Texinfo for further details.

Command line options

lilypond-book accepts the following command line options:

-f *format*
--format=*format*
: Specify the document type to process: html, latex, texi (the default) or docbook. If this option is missing, lilypond-book tries to detect the format automatically, see Section 3.5 [Filename extensions], page 37. Currently, texi is the same as texi-html.

-F *filter*
--filter=*filter*
: Pipe snippets through *filter*. lilypond-book will not –filter and –process at the same time. For example,

```
lilypond-book --filter='convert-ly --from=2.0.0 -' my-book.tely
```

-h
--help
: Print a short help message.

-I *dir*
--include=*dir*
: Add *dir* to the include path. lilypond-book also looks for already compiled snippets in the include path, and does not write them back to the output directory, so in some cases it is necessary to invoke further processing commands such as makeinfo or latex with the same -I *dir* options.

-l *loglevel*
--loglevel=*loglevel*
: Set the output verbosity to *loglevel*. Possible values are NONE, ERROR, WARNING, PROGRESS (default) and DEBUG. If this option is not used, and the environment variable LILYPOND_BOOK_LOGLEVEL is set, its value is used as the loglevel.

-o *dir*
--output=*dir*
: Place generated files in directory *dir*. Running lilypond-book generates lots of small files that LilyPond will process. To avoid all that garbage in the source

directory, use the `--output` command line option, and change to that directory before running `latex` or `makeinfo`.

```
lilypond-book --output=out yourfile.lytex
cd out
...
```

`--skip-lily-check`
: Do not fail if no lilypond output is found. It is used for LilyPond Info documentation without images.

`--skip-png-check`
: Do not fail if no PNG images are found for EPS files. It is used for LilyPond Info documentation without images.

`--lily-output-dir=`*dir*
: Write lily-XXX files to directory *dir*, link into `--output` directory. Use this option to save building time for documents in different directories which share a lot of identical snippets.

`--lily-loglevel=`*loglevel*
: Set the output verbosity of the invoked `lilypond` calls to *loglevel*. Possible values are `NONE`, `ERROR`, `WARNING`, `BASIC_PROGRESS`, `PROGRESS`, `INFO` (default) and `DEBUG`. If this option is not used, and the environment variable `LILYPOND_LOGLEVEL` is set, its value is used as the loglevel.

`--info-images-dir=`*dir*
: Format Texinfo output so that Info will look for images of music in *dir*.

`--latex-program=`*prog*
: Run executable `prog` instead of `latex`. This is useful if your document is processed with `xelatex`, for example.

`--left-padding=`*amount*
: Pad EPS boxes by this much. *amount* is measured in millimeters, and is 3.0 by default. This option should be used if the lines of music stick out of the right margin.

  The width of a tightly clipped system can vary, due to notation elements that stick into the left margin, such as bar numbers and instrument names. This option will shorten each line and move each line to the right by the same amount.

`-P` *command*
`--process=`*command*
: Process LilyPond snippets using *command*. The default command is `lilypond`. `lilypond-book` will not `--filter` and `--process` at the same time.

`--pdf` Create PDF files for use with PDFLaTeX.

`--redirect-lilypond-output`
: By default, output is displayed on the terminal. This option redirects all output to log files in the same directory as the source files.

`--use-source-file-names`
: Write snippet output files with the same base name as their source file. This option works only for snippets included with `lilypondfile` and only if directories implied by `--output-dir` and `--lily-output-dir` options are different.

`-V`
`--verbose`
: Be verbose. This is equivalent to `--loglevel=DEBUG`.

`-v`
`--version`
: Print version information.

Known issues and warnings

The Texinfo command `@pagesizes` is not interpreted. Similarly, LaTeX commands that change margins and line widths after the preamble are ignored.

Only the first `\score` of a LilyPond block is processed.

3.5 Filename extensions

You can use any filename extension for the input file, but if you do not use the recommended extension for a particular format you may need to manually specify the output format; for details, see Section 3.4 [Invoking lilypond-book], page 34. Otherwise, `lilypond-book` automatically selects the output format based on the input filename's extension.

extension	output format
`.html`	HTML
`.htmly`	HTML
`.itely`	Texinfo
`.latex`	LaTeX
`.lytex`	LaTeX
`.lyxml`	DocBook
`.tely`	Texinfo
`.tex`	LaTeX
`.texi`	Texinfo
`.texinfo`	Texinfo
`.xml`	HTML

If you use the same filename extension for the input file than the extension `lilypond-book` uses for the output file, and if the input file is in the same directory as `lilypond-book` working directory, you must use `--output` option to make `lilypond-book` running, otherwise it will exit with an error message like "Output would overwrite input file".

3.6 lilypond-book templates

These templates are for use with `lilypond-book`. If you're not familiar with this program, please refer to Chapter 3 [lilypond-book], page 23.

3.6.1 LaTeX

You can include LilyPond fragments in a LaTeX document.

```
\documentclass[]{article}

\begin{document}

Normal LaTeX text.

\begin{lilypond}
\relative {
  a'4 b c d
}
\end{lilypond}
```

```
More LaTeX text, and options in square brackets.

\begin{lilypond}[fragment,relative=2,quote,staffsize=26,verbatim]
d4 c b a
\end{lilypond}
\end{document}
```

3.6.2 Texinfo

You can include LilyPond fragments in Texinfo; in fact, this entire manual is written in Texinfo.

```
\input texinfo @node Top
@top

Texinfo text

@lilypond
\relative {
  a4 b c d
}
@end lilypond

More Texinfo text, and options in brackets.

@lilypond[verbatim,fragment,ragged-right]
d4 c b a
@end lilypond

@bye
```

3.6.3 html

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN">
<!-- header_tag -->
<HTML>
<body>

<p>
Documents for lilypond-book may freely mix music and text.  For
example,
<lilypond>
\relative {
  a'4 b c d
}
</lilypond>
</p>

<p>
Another bit of lilypond, this time with options:

<lilypond fragment quote staffsize=26 verbatim>
a4 b c d
</lilypond>
</p>
```

```
</body>
</html>
```

3.6.4 xelatex

```
\documentclass{article}
\usepackage{ifxetex}
\ifxetex
%xetex specific stuff
\usepackage{xunicode,fontspec,xltxtra}
\setmainfont[Numbers=OldStyle]{Times New Roman}
\setsansfont{Arial}
\else
%This can be empty if you are not going to use pdftex
\usepackage[T1]{fontenc}
\usepackage[utf8]{inputenc}
\usepackage{mathptmx}%Times
\usepackage{helvet}%Helvetica
\fi
%Here you can insert all packages that pdftex also understands
\usepackage[ngerman,finnish,english]{babel}
\usepackage{graphicx}

\begin{document}
\title{A short document with LilyPond and xelatex}
\maketitle

Normal \textbf{font} commands inside the \emph{text} work,
because they \textsf{are supported by \LaTeX{} and XeteX.}
If you want to use specific commands like \verb+\XeTeX+, you
should include them again in a \verb+\ifxetex+ environment.
You can use this to print the \ifxetex \XeTeX{} command \else
XeTeX command \fi which is not known to normal \LaTeX .

In normal text you can easily use LilyPond commands, like this:

\begin{lilypond}
{a2 b c'8 c' c' c'}
\end{lilypond}

\noindent
and so on.

The fonts of snippets set with LilyPond will have to be set from
inside
of the snippet.  For this you should read the AU on how to use
lilypond-book.

\selectlanguage{ngerman}
```

```
Auch Umlaute funktionieren ohne die \LaTeX -Befehle, wie auch alle
anderen
seltsamen Zeichen: __ ______, wenn sie von der Schriftart
unterst__tzt werden.
\end{document}
```

3.7 Sharing the table of contents

These functions already exist in the OrchestralLily package:

```
http://repo.or.cz/w/orchestrallily.git
```

For greater flexibility in text handling, some users prefer to export the table of contents from lilypond and read it into LaTeX.

Exporting the ToC from LilyPond

This assumes that your score has multiple movements in the same lilypond output file.

```
#(define (oly:create-toc-file layout pages)
  (let* ((label-table (ly:output-def-lookup layout 'label-page-table)))
    (if (not (null? label-table))
      (let* ((format-line (lambda (toc-item)
             (let* ((label (car toc-item))
                    (text  (caddr toc-item))
                    (label-page (and (list? label-table)
                                     (assoc label label-table)))
                    (page (and label-page (cdr label-page))))
               (format #f "~a, section, 1, {~a}, ~a" page text label))))
             (formatted-toc-items (map format-line (toc-items)))
             (whole-string (string-join formatted-toc-items ",\n"))
             (output-name (ly:parser-output-name))
             (outfilename (format #f "~a.toc" output-name))
             (outfile (open-output-file outfilename)))
        (if (output-port? outfile)
            (display whole-string outfile)
            (ly:warning (_ "Unable to open output file ~a for the TOC information") outfilename))
        (close-output-port outfile)))))

\paper {
  #(define (page-post-process layout pages) (oly:create-toc-file layout pages))
}
```

Importing the ToC into LaTeX

In LaTeX, the header should include:

```
\usepackage{pdfpages}
\includescore{nameofthescore}
```

where `\includescore` is defined as:

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% \includescore{PossibleExtension}
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

% Read in the TOC entries for a PDF file from the corresponding .toc file.
% This requires some heave latex tweaking, since reading in things from a file
% and inserting it into the arguments of a macro is not (easily) possible

% Solution by Patrick Fimml on #latex on April 18, 2009:
% \readfile{filename}{\variable}
% reads in the contents of the file into \variable (undefined if file
% doesn't exist)
\newread\readfile@f
\def\readfile@line#1{%
{\catcode`\^^M=10\global\read\readfile@f to \readfile@tmp}%
```

```
\edef\do{\noexpand\g@addto@macro{\noexpand#1}{\readfile@tmp}}\do%
\ifeof\readfile@f\else%
\readfile@line{#1}%
\fi%
}
\def\readfile#1#2{%
\openin\readfile@f=#1 %
\ifeof\readfile@f%
\typeout{No TOC file #1 available!}%
\else%
\gdef#2{}%
\readfile@line{#2}%
\fi
\closein\readfile@f%
}%


\newcommand{\includescore}[1]{
\def\oly@fname{\oly@basename\@ifmtarg{#1}{}{_#1}}
\let\oly@addtotoc\undefined
\readfile{\oly@xxxxxxxxx}{\oly@addtotoc}
\ifx\oly@addtotoc\undefined
\includepdf[pages=-]{\oly@fname}
\else
\edef\includeit{\noexpand\includepdf[pages=-,addtotoc={\oly@addtotoc}]
{\oly@fname}}\includeit
\fi
}
```

3.8 Alternative methods of mixing text and music

Other means of mixing text and music (without `lilypond-book`) are discussed in Section 4.4 [LilyPond output in other programs], page 49.

4 External programs

LilyPond can interact with other programs in various ways.

4.1 Point and click

Point and click lets you find notes in the input by clicking on them in the PDF viewer. This makes it easier to find input that causes some error in the sheet music.

4.1.1 Configuring the system

When this functionality is active, LilyPond adds hyperlinks to PDF and SVG files. These hyperlinks are sent to a 'URI helper' or a web-browser, which opens a text-editor with the cursor in the right place.

To make this chain work, you should configure your PDF viewer to follow hyperlinks using the `lilypond-invoke-editor` script supplied with LilyPond.

The program `lilypond-invoke-editor` is a small helper program. It will invoke an editor for the special `textedit` URIs, and run a web browser for others. It looks up the environment variables `EDITOR` and `LYEDITOR` to find out and launch the favorite editor to use. `LYEDITOR` will have priority over `EDITOR`, so we recommend using the former especially if you want to use one editor in the terminal and another editor for LilyPond point and click.

Every editor may have a different syntax to open a file in a specific line and column. For user's convenience, LilyPond comes with ready commands for several editors, listed in `scm/editor.scm`. This means that you can simply write the editor binary name, e.g.:

```
export LYEDITOR=atom
```

and this will invoke

```
atom %(file)s:%(line)s:%(column)s
```

where `%(file)s`, `%(line)s` and `%(column)s` are replaced with the file, line and column respectively.

In order to use an editor not listed in `scm/editor.scm`, you should find its specific syntax and assign the full command to `LYEDITOR`. Here's an example for Visual Studio Code editor:

```
export LYEDITOR="code --goto %(file)s:%(line)s:%(column)s"
```

> **Note:** If you choose Emacs, an extra configuration is needed. You should add the line `(server-start)` to your `~/.emacs` file, otherwise every click on an object in the PDF will open a new Emacs window.

Using Xpdf

For Xpdf on UNIX, the following should be present in `xpdfrc`. On UNIX, this file is found either in `/etc/xpdfrc` or as `$HOME/.xpdfrc`.

```
urlCommand      "lilypond-invoke-editor %s"
```

If you are using Ubuntu, it is likely that the version of Xpdf installed with your system crashes on every PDF file: this state has been persisting for several years and is due to library mismatches. Your best bet is to install a current '`xpdf`' package and the corresponding '`libpoppler`' package from Debian instead. Once you have tested that this works, you might want to use

```
sudo apt-mark hold xpdf
```

in order to keep Ubuntu from overwriting it with the next 'update' of its crashing package.

Using GNOME 2

For using GNOME 2 (and PDF viewers integrated with it), the magic invocation for telling the system about the 'textedit:' URI is;

```
gconftool-2 -t string -s /desktop/gnome/url-handlers/textedit/command "lilypond-invoke-editor %s"
gconftool-2 -s /desktop/gnome/url-handlers/textedit/needs_terminal false -t bool
gconftool-2 -t bool -s /desktop/gnome/url-handlers/textedit/enabled true
```

After that invocation;

```
gnome-open textedit:///etc/issue:1:0:0
```

should call `lilypond-invoke-editor` for opening files.

Using GNOME 3

In GNOME 3, URIs are handled by the 'gvfs' layer rather than by 'gconf'. Create a file in a local directory such as `/tmp` that is called `lilypond-invoke-editor.desktop` and has the contents;

```
[Desktop Entry]
Version=1.0
Name=lilypond-invoke-editor
GenericName=Textedit URI handler
Comment=URI handler for textedit:
Exec=lilypond-invoke-editor %u
Terminal=false
Type=Application
MimeType=x-scheme-handler/textedit;
Categories=Editor
NoDisplay=true
```

and then execute the commands

```
xdg-desktop-menu install ./lilypond-invoke-editor.desktop
xdg-mime default lilypond-invoke-editor.desktop x-scheme-handler/textedit
```

After that invocation;

```
gnome-open textedit:///etc/issue:1:0:0
```

should call `lilypond-invoke-editor` for opening files.

Extra configuration for Evince

If `gnome-open` works, but Evince still refuses to open point and click links due to denied permissions, you might need to change the Apparmor profile of Evince which controls the kind of actions Evince is allowed to perform.

For Ubuntu, the process is to edit the file `/etc/apparmor.d/local/usr.bin.evince` and append the following lines:

```
# For Textedit links
/usr/local/bin/lilypond-invoke-editor Cx -> sanitized_helper,
```

After adding these lines, call

```
sudo apparmor_parser -r -T -W /etc/apparmor.d/usr.bin.evince
```

Now Evince should be able to open point and click links. It is likely that similar configurations will work for other viewers.

Enabling point and click

Point and click functionality is enabled by default when creating PDF or SVG files.

The point and click links enlarge the output files significantly. For reducing the size of these (and PS) files, point and click may be switched off by issuing

```
\pointAndClickOff
```

in a `.ly` file. Point and click may be explicitly enabled with

```
\pointAndClickOn
```

Alternately, you may disable point and click with a command-line option:

```
lilypond -dno-point-and-click file.ly
```

> **Note:** You should always turn off point and click in any LilyPond files to be distributed to avoid including path information about your computer in the PDF file, which can pose a security risk.

Selective point-and-click

For some interactive applications, it may be desirable to only include certain point-and-click items. For example, if somebody wanted to create an application which played audio or video starting from a particular note, it would be awkward if clicking on the note produced the point-and-click location for an accidental or slur which occurred over that note.

This may be controlled by indicating which events to include:

- Hard-coded in the `.ly` file:

```
\pointAndClickTypes #'note-event
\relative {
  c'2\f( f)
}
```

or

```
#(ly:set-option 'point-and-click 'note-event)
\relative {
  c'2\f( f)
}
```

- Command-line:

```
lilypond -dpoint-and-click=note-event   example.ly
```

Multiple events can be included:

- Hard-coded in the `.ly` file:

```
\pointAndClickTypes #'(note-event dynamic-event)
\relative {
  c'2\f( f)
}
```

or

```
#(ly:set-option 'point-and-click '(note-event dynamic-event))
\relative {
  c'2\f( f)
}
```

- Command-line:

```
lilypond \
  -e"(ly:set-option 'point-and-click '(note-event dynamic-event))" \
  example.ly
```

4.2 Text editor support

There is support for different text editors for LilyPond.

Emacs mode

Emacs has a `lilypond-mode`, which provides keyword autocompletion, indentation, LilyPond specific parenthesis matching and syntax coloring, handy compile short-cuts and reading LilyPond manuals using Info. If `lilypond-mode` is not installed on your platform, see below.

An Emacs mode for entering music and running LilyPond is contained in the source archive in the `elisp` directory. Do `make install` to install it to *elispdir*. The file `lilypond-init.el` should be placed to *load-path*`/site-start.d/` or appended to your `~/.emacs` or `~/.emacs.el`.

As a user, you may want add your source path (e.g. `~/site-lisp/`) to your *load-path* by appending the following line (as modified) to your `~/.emacs`

```
(setq load-path (append (list (expand-file-name "~/site-lisp")) load-path))
```

Vim mode

For Vim (`http://www.vim.org`), a filetype plugin, indent mode, and syntax-highlighting mode are available to use with LilyPond. To enable all of these features, create (or modify) your `$HOME/.vimrc` to contain these three lines, in order:

```
filetype off
set runtimepath+=/usr/local/share/lilypond/current/vim/
filetype on
syntax on
```

If LilyPond is not installed in the `/usr/local/` directory, change the path appropriately. This topic is discussed in Section "Other sources of information" in *Learning Manual*.

Other editors

Other editors (both text and graphical) support LilyPond, but their special configuration files are not distributed with LilyPond. Consult their documentation for more information. Such editors are listed in Section "Easier editing" in *General Information*.

4.3 Converting from other formats

Music can be entered also by importing it from other formats. This chapter documents the tools included in the distribution to do so. There are other tools that produce LilyPond input, for example GUI sequencers and XML converters. Refer to the website (`http://lilypond.org`) for more details.

These are separate programs from `lilypond` itself, and are run on the command line; see Section 1.2 [Command-line usage], page 1, for more information. If you have MacOS 10.3 or 10.4 and you have trouble running some of these scripts, e.g. `convert-ly`, see Section "MacOS X" in *General Information*.

Known issues and warnings

We unfortunately do not have the resources to maintain these programs; please consider them "as-is". Patches are appreciated, but bug reports will almost certainly not be resolved.

4.3.1 Invoking `midi2ly`

`midi2ly` translates a Type 1 MIDI file to a LilyPond source file.

MIDI (Music Instrument Digital Interface) is a standard for digital instruments: it specifies cabling, a serial protocol and a file format. The MIDI file format is a de facto standard format for exporting music from other programs, so this capability may come in useful when importing files from a program that has a converter for a direct format.

`midi2ly` converts tracks into Section "Staff" in *Internals Reference* and channels into Section "Voice" in *Internals Reference* contexts. Relative mode is used for pitches, durations are only written when necessary.

It is possible to record a MIDI file using a digital keyboard, and then convert it to `.ly`. However, human players are not rhythmically exact enough to make a MIDI to LY conversion trivial. When invoked with quantizing (`-s` and `-d` options) `midi2ly` tries to compensate for these timing errors, but is not very good at this. It is therefore not recommended to use `midi2ly` for human-generated midi files.

It is invoked from the command-line as follows,

```
midi2ly [option]... midi-file
```

Note that by 'command-line', we mean the command line of the operating system. See Section 4.3 [Converting from other formats], page 45, for more information about this.

The following options are supported by `midi2ly`.

`-a, --absolute-pitches`
: Print absolute pitches.

`-d, --duration-quant=`*DUR*
: Quantize note durations on *DUR*.

`-e, --explicit-durations`
: Print explicit durations.

`-h, --help`
: Show summary of usage.

`-k, --key=`*acc*`[:`*minor*`]`
: Set default key. *acc* > 0 sets number of sharps; *acc* < 0 sets number of flats. A minor key is indicated by `:1`.

`-o, --output=`*file*
: Write output to *file*.

`-s, --start-quant=`*DUR*
: Quantize note starts on *DUR*.

`-t, --allow-tuplet=`*DUR*`*`*NUM*`/`*DEN*
: Allow tuplet durations *DUR***NUM*/*DEN*.

`-v, --verbose`
: Be verbose.

`-V, --version`
: Print version number.

`-w, --warranty`
: Show warranty and copyright.

`-x, --text-lyrics`
: Treat every text as a lyric.

Known issues and warnings

Overlapping notes in an arpeggio will not be correctly rendered. The first note will be read and the others will be ignored. Set them all to a single duration and add phrase markings or pedal indicators.

4.3.2 Invoking `musicxml2ly`

MusicXML (`http://www.musicxml.org/`) is an XML dialect for representing music notation.

`musicxml2ly` extracts notes, articulations, score structure and lyrics from 'part-wise' MusicXML files then writes them to a `.ly` file. It is run from the command-line as follows;

```
musicxml2ly [option]... file.xml
```

Note that by 'command-line', we mean the command line of the operating system. See Section 4.3 [Converting from other formats], page 45, for more information about this.

If `-` is used instead of *file.xml*, `musicxml2ly` reads all input directly from the command line.

The following options are supported by `musicxml2ly`:

`-a, --absolute`
: convert pitches in absolute mode.

`--fb --fretboards`
: converts `<frame>` events to a separate FretBoard voice instead of markups.

`-h, --help`
: print usage and a summary of all the available command line options.

`-l, --language=LANG`
: use *LANG* for pitch names, e.g. `deutsch` for note names in German.

`--loglevel=LOGLEVEL`
: Sets the output verbosity to *LOGLEVEL*. Possible values are `NONE`, `ERROR`, `WARNING`, `PROGRESS` (default) and `DEBUG`.

`--lxml`
: use the lxml.etree Python package for XML-parsing; uses less memory and cpu time.

`-m, --midi`
: activate the midi block in the *.ly* file.

`--nb, --no-beaming`
: do not convert beaming information, use LilyPond's automatic beaming instead.

`--nd, --no-articulation-directions`
: do not convert directions (`^`, `_` or `-`) for articulations, dynamics, etc.

`--nrp, --no-rest-positions`
: do not convert exact vertical position of rests.

`--nsb, --no-system-breaks`
: ignore system breaks.

`--npl, --no-page-layout`
: do not convert the exact page layout and breaks (shortcut for `--nsb --npb --npm` options).

`--npb, --no-page-breaks`
: ignore page breaks.

`--npm, --no-page-margins`
: ignore page margins.

`--nsd, --no-stem-directions`
: ignore stem directions from MusicXML, use lilypond's automatic stemming instead.

`-o, --output=FILE`
: set the output filename to *FILE*. If *file* is `-`, the output will be printed to stdout. If not given, *xmlfile.ly* will be used instead.

`-r, --relative`
: convert pitches in relative mode (default).

`--transpose=TOPITCH`
: the interval between pitch `c` and *TOPITCH* to transpose by.

`--sm, --shift-meter=BEATS/BEATTYPE`
: change the length|duration of notes as a function of a given time signature to make the score look faster or slower, (e.g. `4/4` or `2/2`).

`--tc, --tab-clef=TABCLEFNAME`
: switch between two versions of tab clefs (`tab` and `moderntab`).

`--sn --string-numbers=t[rue]/f[alse]`
: deactivate string number stencil with `--string-numbers false`. Default is `true`.

`-v, --verbose`
: be verbose.

`--version`
: show version number and exit.

`-z, --compressed`
: input file is a zip-compressed MusicXML file.

4.3.3 Invoking `abc2ly`

> **Note:** This is not currently supported and may eventually be removed from future versions of LilyPond.

ABC is a fairly simple ASCII based format. It is described at the ABC site:

`http://www.walshaw.plus.com/abc/learn.html`.

`abc2ly` translates from ABC to LilyPond. It is invoked as follows:

`abc2ly [`*option*`]... `*abc-file*

The following options are supported by `abc2ly`:

`-b, --beams=None`
: preserve ABC's notion of beams

`-h, --help`
: this help

`-o, --output=`*file*
: set output filename to *file*.

`-s, --strict`
: be strict about success

`--version`
: print version information.

There is a rudimentary facility for adding LilyPond code to the ABC source file. For example;

```
%%LY voices \set autoBeaming = ##f
```

This will cause the text following the keyword 'voices' to be inserted into the current voice of the LilyPond output file.

Similarly,

```
%%LY slyrics more words
```

will cause the text following the 'slyrics' keyword to be inserted into the current line of lyrics.

Known issues and warnings

The ABC standard is not very 'standard'. For extended features (e.g., polyphonic music) different conventions exist.

Multiple tunes in one file cannot be converted.

ABC synchronizes words and notes at the beginning of a line; `abc2ly` does not.

`abc2ly` ignores the ABC beaming.

4.3.4 Invoking `etf2ly`

> **Note:** This is not currently supported and may eventually be removed from future versions of LilyPond.

ETF (Enigma Transport Format) is a format used by Coda Music Technology's Finale product. `etf2ly` will convert part of an ETF file to a ready-to-use LilyPond file.

It is invoked from the command-line as follows;

```
etf2ly [option]... etf-file
```

Note that by 'command-line', we mean the command line of the operating system. See Section 4.3 [Converting from other formats], page 45, for more information about this.

The following options are supported by `etf2ly`:

`-h, --help`
: this help

`-o, --output=`*FILE*
: set output filename to *FILE*

`--version`
: version information

Known issues and warnings

The list of articulation scripts is incomplete. Empty measures confuse `etf2ly`. Sequences of grace notes are ended improperly.

4.3.5 Other formats

LilyPond itself does not come with support for any other formats, but some external tools can also generate LilyPond files. These are listed in Section "Easier editing" in *General Information*.

4.4 LilyPond output in other programs

This section shows methods to integrate text and music, different than the automated method with `lilypond-book`.

4.4.1 LuaTex

As well as `lilypond-book` to integrate LilyPond output, there is an alternative program that can be used when using LuaTex called lyluatex (`https://github.com/jperon/lyluatex/blob/master/README.en.md`).

4.4.2 OpenOffice and LibreOffice

LilyPond notation can be added to OpenOffice.org and LibreOffice with OOoLilyPond (`http://ooolilypond.sourceforge.net`), an OpenOffice.org extension that converts LilyPond files into images within OpenOffice.org documents. Although this is no longer being developed, it appears to still work with version 4.

4.4.3 Other programs

Other programs that can handle `PNG`, `EPS`, or `PDF` formats should use `lilypond` instead of `lilypond-book`. Each LilyPond output file must be created and inserted separately. Consult the program's own documentation on how to insert files from other sources.

To help reduce the white space around your LilyPond score, use the following options;

```
\paper{
  indent=0\mm
  line-width=120\mm
  oddFooterMarkup=##f
  oddHeaderMarkup=##f
  bookTitleMarkup = ##f
  scoreTitleMarkup = ##f
}

... music ...
```

To produce `EPS` images;

```
lilypond -dbackend=eps -dno-gs-load-fonts -dinclude-eps-fonts myfile.ly
```

To produce `PNG` images;

```
lilypond -dbackend=eps -dno-gs-load-fonts -dinclude-eps-fonts --png myfile.ly
```

For transparent `PNG` images

```
lilypond -dbackend=eps -dno-gs-load-fonts -dinclude-eps-fonts -dpixmap-format=pngalpha --png myfile.ly
```

If you need to quote many fragments from a large score, you can also use the clip systems feature, see Section "Extracting fragments of music" in *Notation Reference*.

4.5 Independent `includes`

Some users have produced files that can be `\included` with LilyPond to produce certain effects and those listed below are part of the LilyPond distribution. Also see Section "Working with input files" in *Notation Reference*.

4.5.1 MIDI articulation

The Articulate (`http://www.nicta.com.au/articulate`) project is an attempt to enhance LilyPond's MIDI output and works by adjusting note lengths (that are not under slurs) according to the articulation markings attached to them. For example, a 'staccato' halves the note value, 'tenuto' gives a note its full duration and so on. See Section "Enhancing MIDI output" in *Notation Reference*.

5 Suggestions for writing files

Now you're ready to begin writing larger LilyPond input files – not just the little examples in the tutorial, but whole pieces. But how should you go about doing it?

As long as LilyPond can understand your input files and produce the output that you want, it doesn't matter what your input files look like. However, there are a few other things to consider when writing LilyPond input files.

- What if you make a mistake? The structure of a LilyPond file can make certain errors easier (or harder) to find.
- What if you want to share your input files with somebody else? In fact, what if you want to alter your own input files in a few years? Some LilyPond input files are understandable at first glance; others may leave you scratching your head for an hour.
- What if you want to upgrade your LilyPond file for use with a later version of LilyPond? The input syntax changes occasionally as LilyPond improves. Most changes can be done automatically with `convert-ly`, but some changes might require manual assistance. LilyPond input files can be structured in order to be easier (or harder) to update.

5.1 General suggestions

Here are a few suggestions that can help to avoid (and fix) the most common problems when typesetting:

- **Always include a `\version` number in your input files** no matter how small they are. This prevents having to remember which version of LilyPond the file was created with and is especially relevant when Chapter 2 [Updating files with convert-ly], page 18, command (which requires the `\version` statement to be present); or if sending your input files to other users (e.g. when asking for help on the mail lists). Note that all of the LilyPond templates contain `\version` numbers.
- **For each line in your input file, write one bar of music**. This will make debugging any problems in your input files much simpler.
- **Include Section "Bar and bar number checks" in** *Notation Reference* **as well as Section "Octave checks" in** *Notation Reference*. Including 'checks' of this type in your input files will help pinpoint mistakes more quickly. How often checks are added will depend on the complexity of the music being typeset. For simple compositions, checks added at a few at strategic points within the music can be enough but for more complex music, with many voices and/or staves, checks may be better placed after every bar.
- **Add comments within input files**. References to musical themes (i.e. 'second theme in violins', 'fourth variation,' etc.), or simply including bar numbers as comments, will make navigating the input file much simpler especically if something needs to be altered later on or if passing on LilyPond input files to another person.
- **Add explicit note durations at the start of 'sections'**. For example, `c4 d e f` instead of just `c d e f` can make rearranging the music later on simpler.
- **Learn to indent and align braces and parallel music**. Many problems are often caused by either 'missing' braces. Clearly indenting 'opening' and 'closing' braces (or `<<` and `>>` indicators) will help avoid such problems. For example;

```
\new Staff {
  \relative {
    r4 g'8 g c8 c4 d |
    e4 r8 |
    % Ossia section
    <<
```

```
        { f8 c c | }
        \new Staff {
          f8 f c |
        }
      >>
      r4 |
    }
  }
```

is much easier to follow than;

```
\new Staff { \relative { r4 g'8 g c4 c8 d | e4 r8
% Ossia section
<< { f8 c c } \new Staff { f8 f c } >> r4 | } }
```

- **Keep music and style separate** by putting overrides in the `\layout` block;

```
\score {
  ...music...
  \layout {
   \override TabStaff.Stemstencil = ##f
 }
}
```

This will not create a new context but it will apply when one is created. Also see Section "Saving typing with variables and functions" in *Learning Manual*, and Section "Style sheets" in *Learning Manual*.

5.2 Typesetting existing music

If you are entering music from an existing score (i.e., typesetting a piece of existing sheet music),

- Enter the manuscript (the physical copy of the music) into LilyPond one system at a time (but still only one bar per line of text), and check each system when you finish it. You may use the `showLastLength` or `showFirstLength` properties to speed up processing – see Section "Skipping corrected music" in *Notation Reference*.
- Define `mBreak = { \break }` and insert `\mBreak` in the input file whenever the manuscript has a line break. This makes it much easier to compare the LilyPond music to the original music. When you are finished proofreading your score, you may define `mBreak = { }` to remove all those line breaks. This will allow LilyPond to place line breaks wherever it feels are best.
- When entering a part for a transposing instrument into a variable, it is recommended that the notes are wrapped in

  ```
  \transpose c natural-pitch {...}
  ```

  (where `natural-pitch` is the open pitch of the instrument) so that the music in the variable is effectively in C. You can transpose it back again when the variable is used, if required, but you might not want to (e.g., when printing a score in concert pitch, converting a trombone part from treble to bass clef, etc.) Mistakes in transpositions are less likely if all the music in variables is at a consistent pitch.

  Also, only ever transpose to/from C. That means that the only other keys you will use are the natural pitches of the instruments - bes for a B-flat trumpet, aes for an A-flat clarinet, etc.

5.3 Large projects

When working on a large project, having a clear structure to your lilypond input files becomes vital.

- **Use a variable for each voice**, with a minimum of structure inside the definition. The structure of the `\score` section is the most likely thing to change; the `violin` definition is extremely unlikely to change in a new version of LilyPond.

```
violin = \relative {
g'4 c'8. e16
}
...
\score {
  \new GrandStaff {
    \new Staff {
      \violin
    }
  }
}
```

- **Separate tweaks from music definitions**. This point was made previously, but for large projects it is absolutely vital. We might need to change the definition of `fthenp`, but then we only need to do this once, and we can still avoid touching anything inside `violin`.

```
fthenp = _\markup{
  \dynamic f \italic \small { 2nd } \hspace #0.1 \dynamic p }
violin = \relative {
g'4\fthenp c'8. e16
}
```

5.4 Troubleshooting

Sooner or later, you will write a file that LilyPond cannot compile. The messages that LilyPond gives may help you find the error, but in many cases you need to do some investigation to determine the source of the problem.

The most powerful tools for this purpose are the single line comment (indicated by `%`) and the block comment (indicated by `%{...%}`). If you don't know where a problem is, start commenting out huge portions of your input file. After you comment out a section, try compiling the file again. If it works, then the problem must exist in the portion you just commented. If it doesn't work, then keep on commenting out material until you have something that works.

In an extreme case, you might end up with only

```
\score {
  <<
    % \melody
    % \harmony
    % \bass
  >>
  \layout{}
}
```

(in other words, a file without any music)

If that happens, don't give up. Uncomment a bit – say, the bass part – and see if it works. If it doesn't work, then comment out all of the bass music (but leave `\bass` in the `\score` uncommented.

```
bass = \relative {
%{
  c'4 c c c
  d d d d
```

```
%}
}
```

Now start slowly uncommenting more and more of the `bass` part until you find the problem line.

Another very useful debugging technique is constructing Section "Tiny examples" in *General Information*.

5.5 Make and Makefiles

Pretty well all the platforms LilyPond can run on support a software facility called `make`. This software reads a special file called a `Makefile` that defines what files depend on what others and what commands you need to give the operating system to produce one file from another. For example the makefile would spell out how to produce `ballad.pdf` and `ballad.midi` from `ballad.ly` by running LilyPond.

There are times when it is a good idea to create a `Makefile` for your project, either for your own convenience or as a courtesy to others who might have access to your source files. This is true for very large projects with many included files and different output options (e.g. full score, parts, conductor's score, piano reduction, etc.), or for projects that require difficult commands to build them (such as `lilypond-book` projects). Makefiles vary greatly in complexity and flexibility, according to the needs and skills of the authors. The program GNU Make comes installed on GNU/Linux distributions and on MacOS X, and it is also available for Windows.

See the **GNU Make Manual** for full details on using `make`, as what follows here gives only a glimpse of what it can do.

The commands to define rules in a makefile differ according to platform; for instance the various forms of GNU/Linux and MacOS use `bash`, while Windows uses `cmd`. Note that on MacOS X, you need to configure the system to use the command-line interpreter. Here are some example makefiles, with versions for both GNU/Linux/MacOS and Windows.

The first example is for an orchestral work in four movements with a directory structure as follows:

```
Symphony/
|-- MIDI/
|-- Makefile
|-- Notes/
|   |-- cello.ily
|   |-- figures.ily
|   |-- horn.ily
|   |-- oboe.ily
|   |-- trioString.ily
|   |-- viola.ily
|   |-- violinOne.ily
|   `-- violinTwo.ily
|-- PDF/
|-- Parts/
|   |-- symphony-cello.ly
|   |-- symphony-horn.ly
|   |-- symphony-oboes.ly
|   |-- symphony-viola.ly
|   |-- symphony-violinOne.ly
|   `-- symphony-violinTwo.ly
|-- Scores/
|   |-- symphony.ly
```

```
|   |-- symphonyI.ly
|   |-- symphonyII.ly
|   |-- symphonyIII.ly
|   `-- symphonyIV.ly
`-- symphonyDefs.ily
```

The `.ly` files in the `Scores` and `Parts` directories get their notes from `.ily` files in the `Notes` directory:

```
%%% top of file "symphony-cello.ly"
\include ../symphonyDefs.ily
\include ../Notes/cello.ily
```

The makefile will have targets of `score` (entire piece in full score), `movements` (individual movements in full score), and `parts` (individual parts for performers). There is also a target `archive` that will create a tarball of the source files, suitable for sharing via web or email. Here is the makefile for GNU/Linux or MacOS X. It should be saved with the name `Makefile` in the top directory of the project:

> **Note:** When a target or pattern rule is defined, the subsequent lines must begin with tabs, not spaces.

```
# the name stem of the output files
piece = symphony
# determine how many processors are present
CPU_CORES=`cat /proc/cpuinfo | grep -m1 "cpu cores" | sed s/".*: "//`
# The command to run lilypond
LILY_CMD = lilypond -ddelete-intermediate-files \
                    -dno-point-and-click -djob-count=$(CPU_CORES)

# The suffixes used in this Makefile.
.SUFFIXES: .ly .ily .pdf .midi

# Input and output files are searched in the directories listed in
# the VPATH variable.  All of them are subdirectories of the current
# directory (given by the GNU make variable `CURDIR').
VPATH = \
  $(CURDIR)/Scores \
  $(CURDIR)/PDF \
  $(CURDIR)/Parts \
  $(CURDIR)/Notes

# The pattern rule to create PDF and MIDI files from a LY input file.
# The .pdf output files are put into the `PDF' subdirectory, and the
# .midi files go into the `MIDI' subdirectory.
%.pdf %.midi: %.ly
        $(LILY_CMD) $<; \           # this line begins with a tab
        if test -f "$*.pdf"; then \
            mv "$*.pdf" PDF/; \
        fi; \
        if test -f "$*.midi"; then \
            mv "$*.midi" MIDI/; \
        fi
```

```
notes = \
  cello.ily \
  horn.ily \
  oboe.ily \
  viola.ily \
  violinOne.ily \
  violinTwo.ily

# The dependencies of the movements.
$(piece)I.pdf: $(piece)I.ly $(notes)
$(piece)II.pdf: $(piece)II.ly $(notes)
$(piece)III.pdf: $(piece)III.ly $(notes)
$(piece)IV.pdf: $(piece)IV.ly $(notes)

# The dependencies of the full score.
$(piece).pdf: $(piece).ly $(notes)

# The dependencies of the parts.
$(piece)-cello.pdf: $(piece)-cello.ly cello.ily
$(piece)-horn.pdf: $(piece)-horn.ly horn.ily
$(piece)-oboes.pdf: $(piece)-oboes.ly oboe.ily
$(piece)-viola.pdf: $(piece)-viola.ly viola.ily
$(piece)-violinOne.pdf: $(piece)-violinOne.ly violinOne.ily
$(piece)-violinTwo.pdf: $(piece)-violinTwo.ly violinTwo.ily

# Type `make score' to generate the full score of all four
# movements as one file.
.PHONY: score
score: $(piece).pdf

# Type `make parts' to generate all parts.
# Type `make foo.pdf' to generate the part for instrument `foo'.
# Example: `make symphony-cello.pdf'.
.PHONY: parts
parts: $(piece)-cello.pdf \
       $(piece)-violinOne.pdf \
       $(piece)-violinTwo.pdf \
       $(piece)-viola.pdf \
       $(piece)-oboes.pdf \
       $(piece)-horn.pdf

# Type `make movements' to generate files for the
# four movements separately.
.PHONY: movements
movements: $(piece)I.pdf \
           $(piece)II.pdf \
           $(piece)III.pdf \
           $(piece)IV.pdf

all: score parts movements

archive:
```

```
        tar -cvvf stamitz.tar \       # this line begins with a tab
        --exclude=*pdf --exclude=*~ \
        --exclude=*midi --exclude=*.tar \
        ../Stamitz/*
```

There are special complications on the Windows platform. After downloading and installing GNU Make for Windows, you must set the correct path in the system's environment variables so that the DOS shell can find the Make program. To do this, right-click on "My Computer," then choose `Properties` and `Advanced`. Click `Environment Variables`, and then in the `System Variables` pane, highlight `Path`, click `edit`, and add the path to the GNU Make executable file, which will look something like this:

```
C:\Program Files\GnuWin32\bin
```

The makefile itself has to be altered to handle different shell commands and to deal with spaces that are present in some default system directories. The `archive` target is eliminated since Windows does not have the `tar` command, and Windows also has a different default extension for midi files.

```
## WINDOWS VERSION
##
piece = symphony
LILY_CMD = lilypond -ddelete-intermediate-files \
                    -dno-point-and-click \
                    -djob-count=$(NUMBER_OF_PROCESSORS)

#get the 8.3 name of CURDIR (workaround for spaces in PATH)
workdir = $(shell for /f "tokens=*" %%b in ("$(CURDIR)") \
          do @echo %%~sb)

.SUFFIXES: .ly .ily .pdf .mid

VPATH = \
  $(workdir)/Scores \
  $(workdir)/PDF \
  $(workdir)/Parts \
  $(workdir)/Notes

%.pdf %.mid: %.ly
        $(LILY_CMD) $<      # this line begins with a tab
        if exist "$*.pdf"  move /Y "$*.pdf"  PDF/ # begin with tab
        if exist "$*.mid" move /Y "$*.mid" MIDI/  # begin with tab

notes = \
  cello.ily \
  figures.ily \
  horn.ily \
  oboe.ily \
  trioString.ily \
  viola.ily \
  violinOne.ily \
  violinTwo.ily

$(piece)I.pdf: $(piece)I.ly $(notes)
$(piece)II.pdf: $(piece)II.ly $(notes)
```

```
$(piece)III.pdf: $(piece)III.ly $(notes)
$(piece)IV.pdf: $(piece)IV.ly $(notes)

$(piece).pdf: $(piece).ly $(notes)

$(piece)-cello.pdf: $(piece)-cello.ly cello.ily
$(piece)-horn.pdf: $(piece)-horn.ly horn.ily
$(piece)-oboes.pdf: $(piece)-oboes.ly oboe.ily
$(piece)-viola.pdf: $(piece)-viola.ly viola.ily
$(piece)-violinOne.pdf: $(piece)-violinOne.ly violinOne.ily
$(piece)-violinTwo.pdf: $(piece)-violinTwo.ly violinTwo.ily

.PHONY: score
score: $(piece).pdf

.PHONY: parts
parts: $(piece)-cello.pdf \
       $(piece)-violinOne.pdf \
       $(piece)-violinTwo.pdf \
       $(piece)-viola.pdf \
       $(piece)-oboes.pdf \
       $(piece)-horn.pdf

.PHONY: movements
movements: $(piece)I.pdf \
           $(piece)II.pdf \
           $(piece)III.pdf \
           $(piece)IV.pdf

all: score parts movements
```

The next Makefile is for a `lilypond-book` document done in LaTeX. This project has an index, which requires that the `latex` command be run twice to update links. Output files are all stored in the `out` directory for .pdf output and in the `htmlout` directory for the html output.

```
SHELL=/bin/sh
FILE=myproject
OUTDIR=out
WEBDIR=htmlout
VIEWER=acroread
BROWSER=firefox
LILYBOOK_PDF=lilypond-book --output=$(OUTDIR) --pdf $(FILE).lytex
LILYBOOK_HTML=lilypond-book --output=$(WEBDIR) $(FILE).lytex
PDF=cd $(OUTDIR) && pdflatex $(FILE)
HTML=cd $(WEBDIR) && latex2html $(FILE)
INDEX=cd $(OUTDIR) && makeindex $(FILE)
PREVIEW=$(VIEWER) $(OUTDIR)/$(FILE).pdf &

all: pdf web keep

pdf:
        $(LILYBOOK_PDF)  # begin with tab
        $(PDF)           # begin with tab
```

```
        $(INDEX)         # begin with tab
        $(PDF)           # begin with tab
        $(PREVIEW)       # begin with tab

web:
        $(LILYBOOK_HTML) # begin with tab
        $(HTML)          # begin with tab
        cp -R $(WEBDIR)/$(FILE)/ ./  # begin with tab
        $(BROWSER) $(FILE)/$(FILE).html &  # begin with tab

keep: pdf
        cp $(OUTDIR)/$(FILE).pdf $(FILE).pdf  # begin with tab

clean:
        rm -rf $(OUTDIR) # begin with tab

web-clean:
        rm -rf $(WEBDIR) # begin with tab

archive:
        tar -cvvf myproject.tar \ # begin this line with tab
        --exclude=out/* \
        --exclude=htmlout/* \
        --exclude=myproject/* \
        --exclude=*midi \
        --exclude=*pdf \
        --exclude=*~ \
        ../MyProject/*
```

TODO: make this thing work on Windows

The previous makefile does not work on Windows. An alternative for Windows users would be to create a simple batch file containing the build commands. This will not keep track of dependencies the way a makefile does, but it at least reduces the build process to a single command. Save the following code as `build.bat` or `build.cmd`. The batch file can be run at the DOS prompt or by simply double-clicking its icon.

```
lilypond-book --output=out --pdf myproject.lytex
cd out
pdflatex myproject
makeindex myproject
pdflatex myproject
cd ..
copy out\myproject.pdf MyProject.pdf
```

See also

This manual: Section 1.2 [Command-line usage], page 1, Chapter 3 [lilypond-book], page 23,

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Version 1.3, 3 November 2008

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