This document lists changes and new features in LilyPond version 2.24.0 since 2.22.

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 https://lilypond.org/.

This document has been placed in the public domain.
For LilyPond version 2.24.0
**Note:** LilyPond releases can contain syntax changes, which may require modifications in your existing files written for older versions so that they work in the new version. To upgrade files, it is **strongly recommended** to use the convert-ly tool distributed with LilyPond, which is described in Section “Updating files with convert-ly” in *Application Usage*. `convert-ly` can perform almost all syntax updates automatically. Frescobaldi users can run `convert-ly` directly from Frescobaldi using “Tools > Update with convert-ly...”. Other editing environments with LilyPond support may provide a way to run `convert-ly` graphically.
Major changes in LilyPond

- LilyPond now requires Guile 2.2. Even if you are not writing Scheme code yourself, you may be using libraries that contain a non-trivial amount of customizations. If they do not work with LilyPond version 2.24.0, please report this to the library’s developers. If you are a library developer, see [Notes on Guile 2.2], page 21, below.

- The infrastructure for creating the official binaries has been completely rewritten, incident with the switch to Guile 2.2. As of this release, we provide 64-bit binaries for macOS and Windows. Also, all packages are made available as simple archives that can be extracted to any “installation” location. To uninstall, simply delete that directory. We also discontinued the limited editor that was installed on macOS and Windows, LilyPad, and recommend switching to an external solution instead, such as the popular editor Frescobaldi (https://frescobaldi.org), or one of the others listed in Section “Easier editing” in General Information. For more information, please refer to the detailed instructions in Section “Installing” in Learning Manual.

The version of Ghostscript that ships in the official binaries no longer includes its own fonts, to reduce download size. LilyPond does not need them (it has its own set of default fonts). This does mean, however, that code such as /Arial findfont in \markup \postscript no longer works. We recommend using normal \markup syntax to print glyphs.

Known issues in LilyPond 2.24.0

On Windows, compiling very large scores (several hundreds of pages) can result in crashes.¹ We hope to address this in a future 2.24.x release.

Notes for source compilation and packagers

This section is aimed at enthusiasts compiling LilyPond from source and packagers preparing LilyPond for distribution. If you are not part of either group, you can skip over this section.

- As mentioned above, LilyPond now requires Guile 2.2. If needed for distribution reasons, it can also be compiled with Guile 3.0 by passing GUILE_FLAVOR=guile-3.0 to the configure script. However, this is not yet recommended nor officially supported.

- The Scheme code evaluator in Guile 2.2 is slower than in Guile 1.x. To offset most of the performance penalty, we recommend compiling the .scm files into bytecode by first running make bytecode during compilation and then make install-bytecode in addition to make install.

- Starting with this stable release, LilyPond’s build system does not install text fonts anymore. Please provide them as separate packages while paying attention to the fonts’ license and notice files.

¹ Note that very large scores could already crash in LilyPond 2.22 due to restrictions imposed by the 32-bit architecture.
New for musical notation

Pitches improvements

- Support for alternate accidentals was improved. Through the `alterationGlyphs` property of staff-like contexts, accidental glyphs may be set for all grobs at once (refer to Section “Alternate accidental glyphs” in Notation Reference).

![Example Music Notation]

- Ottava brackets may apply to a single voice instead of the entire staff. This used to require workarounds.

```latex
\layout {
  \context {  
    \Staff 
    \remove Ottava_spanner_engraver  
  } 
  \context {  
    \Voice 
    \consists Ottava_spanner_engraver  
  } 
}
```

![Example Music Notation]

Rhythm improvements

- The new `\section` command inserts a double bar line that interacts gracefully with repeat bar lines. A passage can be named with the new `\sectionLabel` command.

```latex
\fixed c' {  
  f1  
  \break  
  \section  
  \sectionLabel "Trio"  
  \repeat volta 2 {  
    b1  
  } 
}
```

![Example Music Notation]
\begin{itemize}
\item \texttt{\numericTimeSignature} and \texttt{\defaultTimeSignature} now act on all staves at once (more precisely, on all staves in the same Timing context), thus matching the behavior of \texttt{\time}.
\item The \texttt{\rhythm} markup command has been added. It is a simple way to enter rhythms mixed with text, such as in “swing” indications.
\begin{verbatim}
\relative {
  \tempo \markup {Swing
    \hspace #0.4
    \rhythm { 8[ 8 ]} = \rhythm { \tuplet 3/2 { 4 8 } }
  }
  b8 g’ c, d ees d16 ees d c r8
}
\end{verbatim}
\item The \texttt{\enablePolymeter} command is now provided as an input shorthand for moving engravers as is necessary to allow different time signatures in parallel. The code:
\begin{verbatim}
\layout {
  \context {
    \Score
    \remove Timing_translator
    \remove Default_bar_line_engraver
  }
  \context {
    \Staff
    \consists Timing_translator
    \consists Default_bar_line_engraver
  }
}
\end{verbatim}
can thus be shortened as:
\begin{verbatim}
\layout {
  \enablePolymeter
}
\end{verbatim}
Independent of this, \texttt{Default\_bar\_line\_engraver} has been removed.
\item The new option \texttt{\visible\_over\_note\_heads} can be used to make tuplet brackets always appear when their direction is set to be over the note heads. It can be used with the default tuplet bracket visibility style or with \texttt{#'if\_no\_beam}.
\end{itemize}
• Measure counts now take compressed multi-measure rests and alternatives into account.

```
\layout {
  \context {
    \Score
    centerBarNumbers = \#t
    barNumberVisibility = \#all-bar-numbers-visible
  }
}

<<
{ \repeat unfold 3 { c'4 d' e' f' } }
{ \repeat unfold 3 { c'4 d' e' f' } }
>>
```

• Bar numbers may be centered in their measure, as is common in film scores.

```
\bar 
```

• The alignment of bar numbers appearing in the middle or end of a system has been changed to align them on their left edge. This is in keeping with the advice of Elaine Gould (Behind Bars, p. 237), and was mostly the consensus reached in a discussion of the issue by developers. The alignment of bars at the beginning of a system remains unchanged.

• \texttt{\bar \,} creates a short bar line.

```
\bar
```

• The following predefined bar types no longer appear as a single bar line at the end of a line. Annotated bar types (e.g., \texttt{\bar "S-1"}) have been added for that purpose.
• \bar "" is no longer necessary to print the first bar number. It now suffices to set barNumberVisibility to all-bar-numbers-visible, or one of the other visibility settings where the first bar number is visible.

Note that this is a change in behavior for scores that set barNumberVisibility to all-bar-numbers-visible or such and BarNumber.break-visibility to #t without having \bar ".". Now, a bar number is printed at the beginning. This is just the expected behavior (all bar numbers should be visible), but due to slightly unclear documentation, users may have used these settings to print bar numbers in the middle of systems except for the first bar number. In such cases, simply remove \set Score.barNumberVisibility = #all-bar-numbers-visible since \override BarNumber.break-visibility = ##t does the relevant setting alone.

• The \break command now always inserts a break, bypassing all default decisions about break points. For example, it is no longer necessary to insert \bar "" to obtain a mid-measure break.

The new \allowBreak command inserts a possible break point, without forcing it, but bypassing default decisions like \break does.

• The bar line type "-" has been removed. convert-ly converts it to ".". There is a slight difference in horizontal spacing at line breaks.

• automaticBars has been removed. convert-ly converts automaticBars = ##f to measureBarType = #'().

• \defineBarLine now accepts #t in lieu of repeating the mid-line glyph name.

• Bar_engraver used to forbid line breaks between bar lines in all cases, but now it only does so when the forbidBreakBetweenBarLines context property is set to #t, which is the default. The barAlways context property, which previously worked around the lack of forbidBreakBetweenBarLines, has been removed.

• Due to changes in the internals of \bar, it is no longer supported to use it before creating lower contexts with \new. Such uses will now create an extra staff. This is similar to what happens with commands such as \override Staff… (see Section “An extra staff appears” in Application Usage).

```latex
\{ \bar ".|:\" <<
  \new Staff { c' } \new Staff { c' }
>> \}
```

The solution is to place \bar inside the music for each staff, as is usual with most commands.
New for musical notation

```
\new Staff { \bar ".:.": c' }
\new Staff { \bar ".:.": c' }
>>
```

- The bar type "-span|" creates a mensurstrich.

```
\new Staff { \bar ".:.": c' }
```

- Staff contexts use the new Caesura_ engraver to notate the \caesura command.

```
\new Staff { \bar ".:.": c' }
```

**Expressive mark improvements**

- Events attached to notes (e.g., dynamics or articulations) can be delayed by an arbitrary duration using \after. This simplifies many situations that previously required the use of explicit polyphony and spacer rests.

```
{ \after 2 \turn g'2. a'4 \after 2 < b'1 \after 2. f c'  
  <> < \after 4 > \after 2! d' 
}
```

```
\new Staff { \bar ".:.": c' }
```

- Broken hairpins now have some left padding by default. This is in line with published scores and it fixes some cases where broken hairpins were vertically displaced by the key signature.

```
\relative {
  \key a \major
  c''4\< c c c \break c c c c\! |
}
```

```
\new Staff { \bar ".:.": c' }
```
• The ends of hairpins may now be aligned to the LEFT, CENTER or RIGHT of NoteColumn grobs by overriding the property endpoint-alignments.

• The direction of a trill spanner can now be set with direction indicators like other articulations, i.e. with _\startTrillSpan or ^\startTrillSpan.

• The default appearance of trill spanners has changed to better match classical engraving conventions. They now end before the next note, not over it. If the next note has an accidental, they stop before it. If the next note is the first note of a measure, they stop over the bar line instead.

• The padding by default for fermatas is now larger. This avoids some cases where the fermata was placed too close to dots and other objects.

• The flageolet symbol is now smaller and slightly thicker. This is in line with published scores and makes the recommended workaround to make it smaller (\tweak font-size -3 \flageolet) unnecessary.

• The accent glyph is now a bit smaller. This fixes some cases where a natural sign would vertically displace accents.

• The comma glyph shape, as used in the \breathe command, has been changed to a more common form.
The old glyph remains available under the name ‘raltcomma’:

{\texttt{override BreathingSign.text =}\n \texttt{\markup{\musicglyph{scripts.raltcomma}}}}\n f'2 \texttt{\breathe f'} |

- The new context property breathMarkType selects the mark that \breathe produces from several predefined types.

\texttt{\fixed c' {}\n \texttt{\set breathMarkType = #'tickmark}\n c2 \breathe d2}\n
Repeat improvements

- Repeat alternatives may appear within the repeated section.

\texttt{\repeat volta 3 \{ c'1 \alternative\{ d' e' \} f' \}}

- The volta numbers for repeat alternatives may be set with the \volta command.

\texttt{\repeat volta 3 c'1 \alternative \{ \volta 1 d' \volta 2,3 e' \}}

- The new \repeat segno command automatically notates a variety of da-capo and dal-segno forms.

\texttt{\music = \fixed c' {}\n \texttt{\repeat segno 2 {}\n b1}\n }\n \texttt{\fine}\n\}
\texttt{\score { \music }\n \score { \unfoldRepeats \music \}}
The new \fine command inserts a final bar line that interacts gracefully with repeat bar lines. Used inside \repeat, it also prints Fine and ends the music after unfolding.

```
music = \fixed c' { 
\repeat volta 2 { 
f1 
\volta 2 \fine 
\volta 1 b1 
} 
} 
\score { \music } 
\score { \unfoldRepeats \music }
```

- The \volta command removes music when a repeat is unfolded.
- The \unfolded command adds music when a repeat is unfolded.

**Editorial annotation improvements**

- The new \staffHighlight and \stopStaffHighlight commands can be used to color a musical passage.

- A new grob FingerGlideSpanner is now available, indicating a finger gliding on a string from one to another position. Several appearances are possible, depending on the setting of style. Shown in the image are line, stub-left, stub-right and stub-both.

Also possible is dashed-line, dotted-line, zigzag, trill, bow and none.
• Balloons now have changeable formatting.

\begin{flushright}
\includegraphics[width=0.2\textwidth]{example1.png}
\end{flushright}

• Parenthesizing chords is supported. Currently, the font size of the parentheses has to be adjusted manually.

\begin{flushright}
\includegraphics[width=0.2\textwidth]{example2.png}
\end{flushright}

• Parenthesizing spanners is supported.

\begin{flushright}
\includegraphics[width=0.2\textwidth]{example3.png}
\end{flushright}

• A “time-based” version of the \parenthesize command was added. It takes a grob path: \parenthesize GrobName or \parenthesize ContextName. GrobName. It acts like a \once \override. This interface complements the already existing form \parenthesize event, in a fashion similar to \footnote.

\begin{verbatim}
{\parenthesize NoteHead c'1 \parenthesize Staff.KeySignature \key g \major \parenthesize Staff.KeySignature \key g \major c'1 }
\end{verbatim}

\begin{flushright}
\includegraphics[width=0.2\textwidth]{example4.png}
\end{flushright}

• Adding the Melody_engraver to the Voice context now works out of the box to change the stem direction of the middle note according to the melody. Previously, this required an additional override to Stem.neutral-direction.

\begin{verbatim}
\new Voice \with { \consists Melody_engraver } \relative c' { \autoBeamOff g8 b a e g b a g | c b d c b e d c | }
\end{verbatim}

\begin{flushright}
\includegraphics[width=0.2\textwidth]{example5.png}
\end{flushright}
The `suspendMelodyDecisions` context property may be used to turn off this behavior temporarily, as `\override Stem.neutral-direction = #DOWN` used to do.

- The new `Mark_tracking_translator` takes over from `Mark_engraver` the decision of when to create a mark. `Mark_engraver` continues to control formatting and vertical placement.

By default, `Mark_engravers` in multiple contexts create a common sequence of marks. If independent sequences are desired, multiple `Mark_tracking_translators` must be used.

**Text improvements**

- New commands `\textMark` and `\textEndMark` are available to add an arbitrary piece of text between notes, called a text mark. These commands improve over the previously existing syntax with the `\mark` command called as `\mark markup` (i.e., `\mark "..."` or `\mark \markup ...`).

```latex
\fixed c' { 
  \textMark "Text mark"
  c16 d e f e d c e d c8
  \textEndMark "Text end mark"
}
```

`\textMark` and `\textEndMark` are now the recommended way to create textual marks. The use of `\mark` for this purpose is still supported, but discouraged (note that the `\mark` command itself is not discouraged, only calling it on a markup argument; `\mark \default` or `\mark \number` is still the recommended and only way to create a rehearsal mark).

The new commands have several differences to `\mark markup`. There can be an arbitrary number of them at a given moment, while there can only be one use of `\mark`. They output grobs of the dedicated `TextMark` type, whereas `\mark` creates a `RehearsalMark` grob regardless of whether it is called for a rehearsal mark or a textual mark; introducing this distinction allows stylesheets to set different layout settings for rehearsal marks and text marks. The alignment set by the new commands is different: `\textMark` always creates a left-aligned mark, and `\textEndMark` creates a right-aligned mark; in contrast, the alignment of a `RehearsalMark` depends on the anchor point of the object it aligns to.

See Section “Text marks” in *Notation Reference* for full details.

- Text variant glyphs for sharp, flat, natural, double sharp, and double flat are now available in the Emmentaler fonts. In markup, they can be easily accessed with standard Unicode values.

```
1 \# 2 \b 3 \h 4 \bb 5 \times 6
```

- It is now possible to control the width and the shape of (some) Emmentaler digits using OpenType features.

```
0123456789 147 147
```
(time signatures)
New for musical notation

• \smallCaps now works on any markup, not just on a bare string.
• The syntax for conditions in markups was made more flexible and user-friendly. It uses the new markup commands \if and \unless. Here are example replacements:

\begin{verbatim}
2.22 syntax 2.24 syntax
\on-the-fly #first-page ... \if \on-first-page ...
\on-the-fly #not-part-first-page ... \unless \on-first-page-of-part ...
\on-the-fly #(on-page n) ... \if \on-page #n ...
\end{verbatim}

• With the new markup list command string-lines it is now possible to split a string at a given character. The default is to split at line break. Surrounding white space gets dropped. The resulting list of markups may be further formatted. This is a very convenient way of entering additional stanzas for songs.

Twinkle, twinkle, little star,
How I wonder what you are!
Up above the world so high,
Like a diamond in the sky.
Twinkle, twinkle, little star,
How I wonder what you are!

• The new markup command \align-on-other translates a markup as if it was aligned to another markup.

\begin{verbatim}
1
12
12345
123
\end{verbatim}

• Two new markup functions \with-dimension and \with-dimension-from are available. They are similar to \with-dimensions and \with-dimensions-from, respectively, modifying only a single dimension (instead of both).
• New markup commands \with-true-dimension and \with-true-dimensions are available. They give the markup the actual extent(s) of its printed ink, which may differ from the default extents for some font glyphs due to text regularity constraints.
Text replacements can now replace strings with any markup, not just with a string.

```
\markup
  \replace #*{"2nd" . ,#{ \markup \concat \ 2 \super nd } #})
"2nd time"
```

2\textsuperscript{nd} time

A new markup command `\with-string-transformer` is available. It interprets a markup with a “string transformer” installed; the transformer is called when the interpretation of the markup requires interpreting a string, and allows to perform modifications on this string, such as changing case.

The `markup->string` function converts a markup into an approximate string representation; it is used for outputting PDF metadata as well as MIDI lyrics and markers. Markup commands can now define a custom method to convert markups created using them into strings, for use by `markup->string`. For example:

```
#(define-markup-command (upcase layout props arg) (string?))
#:as-string (string-upcase arg)
(interpret-markup layout props (string-upcase arg)))
```
New for specialist notation

Fretted string instrument improvements

- The string tunings banjo-double-c and banjo-double-d were added.
- A new grob BendSpanner is now available for TabStaff, indicating a bent string. Apart from the default three styles are possible: 'hold, 'pre-bend and 'pre-bend-hold.

Percussion improvements

- The drum notation style weinberg-drums-style was added. It is based on Norman Weinberg’s standardization work.

Wind instrument improvements

- Additional display details of a \woodwind-diagram can now be specified including the angle of partially-covered-keys and the display of non-graphical trill keys.

\markup {
  \override #'(graphical . #f)
  \override #'(woodwind-diagram-details . ((fill-angle . 90)
    (text-trill-circled . #f)))
  \woodwind-diagram #'flute #'((cc . (one1h))
    (lh . ()))
    (rh . (besT)))
}

Chord notation improvements

- Support for chord grids has been added.
• In ChordNames, multi-measure rests now also cause the “N.C.” symbol to be printed, just like normal rests.

• In figured bass, \_ now creates an empty figure that still takes up space.

\figures  
\begin{verbatim}
<\_ 4> <\_ 5+ 3>
\end{verbatim}
\end{verbatim}

\figbass{8 \_ 4\, 5 \, 3\, 2\, 4\, 6\, 7\, 9\, 3\, 3\, 3\, 3\, 3}

Formatting of figured bass has been improved. In particular, the default size is reduced to a value used by many Urtext editions of Baroque music.

• In figured bass, specially designed glyphs for 6\,, 7\,, and 9\, are now used by default. Similarly, specially designed glyphs for symbols 2\+\,, 4\+\,, and 5\+\, are used by default if plus signs appear after the number.

\figbass{\fa\, 4\, 3\, 6\, 9\, 3\, 3\, 3\, 3\, 3}

Use the new command \figured-bass to access these glyphs in markup.

• In figured bass, brackets can now also be added around accidentals.

\figbass{7 \[ B\, B\] \[ B\, B\]}

Ancient notation improvements

• A new context VaticanaLyrics is available. It is similar to Lyrics, providing a hyphenation style (a single, flush-left hyphen between two syllables) as used in the notational style of Editio Vaticana.

• The predefined commands for Gregorian divisiones are no longer variations on \breathe. \divisioMinima, \divisioMaior, \divisioMaxima, and \virgula are variations on the basic \caesura. \finalis is equivalent to \section. MensuralStaff and VaticanaStaff use Divisio_engraver to interpret the above commands as well as \repeat volta and \fine.

\new MensuralStaff \fixed c'  
\repeat volta 2 { f2 f }
g1
\section
b1 \fine

\figbass{7 \[ B\, B\] \[ B\, B\]}

• KievanStaff, MensuralStaff, PetrucciStaff, and VaticanaStaff now allow line breaks anywhere, and they no longer create \"\ measure bar lines.

• In GregorianTranscriptionStaff, divisiones are now engraved as BarLine grobs by default. To change them to Divisio grobs, use \EnableGregorianDivisiones.

• GregorianTranscriptionStaff allows a line break after any note and no longer uses Time_signature_engraver.

• GregorianTranscriptionVoice no longer uses Stem_engraver.
World music improvements

- Support for Persian classical music is now available. For this, two accidental glyphs, *sori* and *koron*, have been added to LilyPond.

```latex
\include "persian.ly"

\relative c' {
  \key d \chahargah
  bk'8 a gs fo r g ak g |
  fs ek d c d ef16 d c4 |
}
```
Miscellaneous improvements

- In the Emmentaler font, identical-looking noteheads whose only difference was stem direction have been consolidated into a single glyph. For instance, the glyphs noteheads .u2triangle and noteheads.d2triangle have been replaced by a single glyph, noteheads .s2triangle. Notehead pairs that look visually different depending on the direction remain distinct.

In addition, the stem-attachment property of NoteHead grobs now returns its actual, direction-dependent stem attachment point instead of a hypothetical upwards-stem attachment point.

- Two redundant glyphs in the Emmentaler font have been removed: scripts.trillelement (use scripts.trill_element instead) and scripts.augmentum (use dots.dotvaticana instead).

- Using \paper { bookpart-level-page-numbering = ##t}, it is now possible to make bookparts independent with respect to page numbering. If this is used for all bookparts, each bookpart has its own numbering sequence, starting at 1 by default. It can also be used in an individual bookpart, which is useful to achieve the standard practice of numbers pages in an analytical introduction independently and in roman numerals (the latter is achieved using page-number-type = #'roman-lower).

- A new grob callback function break-alignment-list is now available for returning different values depending on a grob’s break direction. As an example, use it to provide different alignments of a grob depending on whether it is positioned at the beginning, the middle, or the end of a line.

- The new Mark_performer creates MIDI Marker events like Mark_engraver creates printed marks.

- Properties of PaperColumn and NonMusicalPaperColumn (such as NonMusicalPaperColumn.line-break-system-details) can now be overridden mid-music with the usual command \once \override. They used to be a special case requiring the \overrideProperty command.

- The new show-horizontal-skylines and show-vertical-skylines properties allow to display an object’s skylines. This is more flexible than the already existing debug-skylines option because it works for all grobs. While primarily meant for debugging LilyPond, this can be useful when trying to understand spacing decisions or overriding stencils in Scheme.

- The new command \vshape is like \shape, but also shows the control points and polygon for easier tweaking.

\{ a1\vshape #'((0 . 0) (0 . 0.5) (0 . 0.9) (0 . 0.4))%( c'1) \}
• \markup \path now also works in SVG output even if the path does not begin with a moveto or rmoveto command. Also, it now accepts single-letter SVG equivalents (moveto = M, etc.).

• set-default-paper-size and set-paper-size now accept a custom paper size.
  
  #(set-default-paper-size '(cons (* 100 mm) (* 50 mm)))

• lilypond-book supports two new music fragment options paper-width and paper-height to set a custom paper size.

• lilypond-book supports a new snippet option inline for inline music, that is, music snippets like \[ \text{snippet} \] that appear within a paragraph of text.

• The lilypond-book script now allows braces in the argument of the commands \lilypond (for LaTeX) and @lilypond (for Texinfo).

• lilypond-book now appends the current directory as the last entry to search for included files, instead of prepending it to the list of specified include paths. This allows include directories to shadow files from the current directory, and will only be noticed if there are files with the same name in both.

• The new Scheme function universal-color provides an eight-element color palette designed to be unambiguous to people with dichromatism.

  \begin{itemize}
  \item \textbf{black}
  \item \textbf{orange}
  \item \textbf{skyblue}
  \item \textbf{bluegreen}
  \item \textbf{yellow}
  \item \textbf{blue}
  \item \textbf{vermillion}
  \item \textbf{redpurple}
  \end{itemize}

• The -dembed-source-code option now also embeds images added with \epsfile and files included with \verbatim-file.

• The default of the aux-files program option changed to #f. If you are calling LilyPond with the -dbackend=eps argument and need the auxiliary .tex and .texi files, you now have to specify -daux-files explicitly. The formats for lilypond-book images can be set separately for the tall page image (typically PNG for HTML output) and per-system images (typically, EPS or PDF for printed output) with the -d sub-options -dtall-page-formats and -dseparate-page-formats respectively.

• The 'big point' unit (1 bp = 1/72in) is now available by appending \bp to length values.

• Scheme-defined translators usable in both \layout and \midi can now be created with make-translator. Scheme-defined performers usable only in \midi can now be created with make-performer. Those macros work strictly like the previously existing macro make- engraver for creating engravers only usable in \layout.

• Scheme translators can now define a new slot called pre-process-music. It is called on all translators, after all listeners but before all process-music slots. This can be used for processing that depends on all events heard but needs to set context properties before other translators read them.
• Scheme translators can now contain listeners written as

\[
\text{(listeners}
\text{ (event-class engraver event #:once)}
\text{ ...))}
\]

These are never triggered more than once per time step. They emit a warning if they receive two events in the same time step, except if the events are equal.

• The same grob definition can now be used to create grobs of different classes (Item, Spanner, Paper_column, System). As part of this change, the grob types FootnoteItem and FootnoteSpanner were consolidated into a single type Footnote. Similarly, BalloonTextSpanner and BalloonTextItem are unified into BalloonText.

When the grob definition does not mandate a class, engravers should choose what class to create a grob with. For authors of Scheme engravers, this means using either ly: engraver-make-item or ly:engraver-make-spanner. The utility function ly:engraver-make-sticky is provided to support the frequent case of sticky grobs, such as footnotes and balloons. It creates a grob with the same class as another grob and administrates parents and bounds.

• The new command-line option -dcompile-scheme-code, also settable in the LilyPond input with #(ly:set-option 'compile-scheme-code), provides with better diagnostics when running Scheme code leads to an error. Internally, this uses the byte-compiler provided by Guile, instead of the interpreter.

However, due to a limitation in Guile, this currently has the disadvantage of making it impossible to run more than a few thousand Scheme expressions. Also, be aware that the Guile compiler has a few differences to the interpreter. For example, constant parts of quasiquotes are made actual constants more aggressively, making code such as (let ((x 4)) (sort! `(,x 3 2 1))) produce an error because the “cdr” of the quasiquoted list is constant, and it is an error in Scheme to mutate literal data. (In this specific case, the code could avoid the issue by using the non-destructive sort, or by creating a fresh list each time with (list x 3 2 1).)

Furthermore, this option does not currently work on Windows.
Notes on Guile 2.2

This version of LilyPond switches from Guile 1.8 to Guile 2.2. This section lists some of the most common incompatibilities that you could have to deal with in order to upgrade your Scheme code.

A full, detailed log of changes in Guile can be found in the NEWS file (https://git.savannah.gnu.org/cgit/guile.git/tree/NEWS) of the Guile source.

- The format function now requires a boolean or port as the first argument. This argument was optional in Guile 1.8. In order to make the function return the formatted output as a string, like format does without this argument in Guile 1.8, pass #f for this argument, i.e., (format #f "string" arguments ...) instead of (format "string" arguments ...).

- The rules for internal (i.e., non-toplevel) definitions have become stricter. Definitions are no longer allowed in various expression contexts. This is no longer valid, for example:

  (if (not (defined? 'variable))
      (define variable 'value))

The solution in this particular example is:

  (define variable
      (if (not (defined? 'variable))
          'value
          variable))

- Strings now support Unicode characters. Previously, a Unicode character was represented by several characters, and various functions were not tailored for Unicode support.

- Some numeric functions now return exact results in more cases. For instance, (sqrt 4) returns 2.0 in Guile 1.8, but 2 (an integer) in Guile 2.2.