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## LyX — An Open Source Document Processor

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### Abstract

LyX — the so-called front-end to L<sup>A</sup>T<sub>E</sub>X, which is itself a front-end to T<sub>E</sub>X — tries to optimize something that L<sup>A</sup>T<sub>E</sub>X doesn't attempt: to make a high quality layout system like (L<sup>A</sup>)T<sub>E</sub>X accessible to users who are relatively uninterested in serious typographical questions. LyX is not a word processor, but a document processor, because it takes care of many of the formatting details itself, details that the user need not be bothered with. All LyX features described here apply to the current official version LyX 1.1.6fix4. The significantly expanded version 1.2 is expected this summer.

### 1 History

Drawing on the principles of the traditional printed word, Donald Knuth<sup>1</sup> developed a system that enabled users to prepare professional technical publications. Knuth called the first version of this system  $\tau\epsilon\chi$ , which has since come to be written T<sub>E</sub>X and pronounced “tech”.

A graphical user interface is in principle not essential for L<sup>A</sup>T<sub>E</sub>X; however, in today's “all-things-bright-and-beautiful” world, the absence of a GUI makes L<sup>A</sup>T<sub>E</sub>X less accessible to the masses. This lack of a GUI was recognized in 1994/95 as the opportunity to create one; it began as a master's thesis and was first called Lyrik, then LyriX, and finally LyX. From the beginning, the main goal so that the user would be freed from having to delve into the details of (L<sup>A</sup>)T<sub>E</sub>X usage. It remains to be seen whether (L<sup>A</sup>)T<sub>E</sub>X can be left completely out of the discussion, because all other program environments sit on top of T<sub>E</sub>X. To understand the LyX philosophy, however, understanding (L<sup>A</sup>)T<sub>E</sub>X is unimportant, especially for the user who specifically chose LyX for the distance it places between itself and (L<sup>A</sup>)T<sub>E</sub>X. In addition to LyX there are other GUIs, such as  *$\epsilon$ :doc*<sup>2</sup> or *TeXMacs*.<sup>3</sup>

### 2 WYSIWYG versus WYSIWYM

A buzzword of the 1990s in software development was WYSIWYG (What You See is What You Get), which enabled the user to exert quick control over a document. On the one hand this requirement presented considerable problems for the software

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<sup>1</sup> <http://www-cs-faculty.stanford.edu/~knuth/>

<sup>2</sup> <http://members.magnet.at/hfbuch/edoc/>

<sup>3</sup> <http://www.texmacs.org/>



## 4 The LyX-Layout

Frequently, the largest problem for LyX beginners is the realization that the layout shown in the LyX window will not be identical to the final layout produced by L<sup>A</sup>T<sub>E</sub>X. In following the philosophy, LyX endeavors to achieve as many similarities to the final layout as possible. Each of the LyX layout commands translates into one or more L<sup>A</sup>T<sub>E</sub>X layout commands, but what appears in the LyX window is merely a rough approximation of the final product. For example, for the paragraph layout option called `Title`, the associated LyX commands are as follows:

---

```
# LyX Title-Layout
Style Title
  Margin Static
  LatexType Command
  InTitle 1
  LatexName title
  ParSkip 0.4
  ItemSep 0
  TopSep 0
  BottomSep 1
  ParSep 1
  Align Center
  AlignPossible Center
  LabelType No_Label
# standard font definition
Font
  Family Sans
  Series Bold
  Size Largest
EndFont
End #title
```

---

The L<sup>A</sup>T<sub>E</sub>X Name `title` produces the direct connection with L<sup>A</sup>T<sub>E</sub>X, in that it determines what should happen with the text that is shown in the LyX window. It is also possible for the user to design a completely new layout; for example, the following L<sup>A</sup>T<sub>E</sub>X code is generated from a user-defined paragraph layout with a gray background. Internally, the LyX layout command will be named `myStandardColor`, and it will correspond to the user-defined L<sup>A</sup>T<sub>E</sub>X layout command `cmnipage`.

---

```
# Standard color-style definition
Style myStandardColor
  Margin Static
  LatexType Environment
  LatexName cmnipage
  ParIndent MM
  ParSkip 0.4
  Align Block
  AlignPossible Block, Left, Right, Center
  LabelType No_Label
# standard font definition
Font
  color blue
  family typewriter
EndFont
Preamble
```

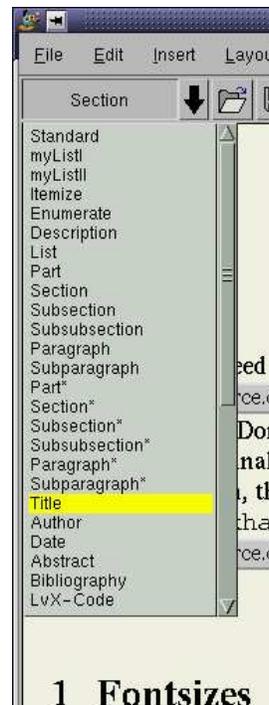


Figure 4: The LyX-Layout Menu

```
\usepackage{color,calc}
\definecolor{myColor}{rgb}{0.9,0.9,0.9}% rgb
\newenvironment{cmnipage}{%

[ .... ]

\end{lrbox}%
\colorbox{myColor}{myColor}%
{\usebox{\@tempboxa}}%
}%
EndPreamble
End # myStandardColor
```

---

## 5 The Start

By today's standards, the LyX graphical interface appears somewhat spartan, but it contains all the essential elements that are for the most part present in all text processors. The buttons of the main LyX window can be modified to reflect the individual preferences of the user. Some additional icons are already provided in the standard system, and further ones may be created by the user and then made available to the LyX community.

LyX has no formatting properties of its own, since it is built entirely on top of L<sup>A</sup>T<sub>E</sub>X. LyX can therefore only begin its work after a L<sup>A</sup>T<sub>E</sub>X document class has been chosen. The number of these classes is limited because they define only the most basic

formatting properties. Some of the document classes supported from LyX are as follows:

- article
  - standard, amsart,<sup>5</sup> cv, docbook (SGML), dtk,<sup>6</sup> egs,<sup>7</sup> ejour2,<sup>8</sup> elsart,<sup>9</sup> exam, Hebrew, IEEEtran, llncs,<sup>10</sup> Komascript, revtex, siamltex, ltugboat
- book
  - standard, amsart, docbook (SGML), Komascript
- report
  - standard, Broadway,<sup>11</sup> Komascript
- letter
  - standard, (g-Brief) english/french/german, Komascript
- seminar
- slide
- APA style (American Psychological Association)
- CD-Box Cover

The default document class in LyX is article. The user is also free to design completely new LyX-Layouts, taking advantage of the fact that LyX is an open system. Many universities have created their own classes for theses and dissertations.<sup>12</sup> In order to make a new L<sup>A</sup>T<sub>E</sub>X document class available for LyX, a corresponding LyX layout must first be created.

## 6 Text parameters

As with every document preparation system, there are also some globally effective parameters in L<sup>A</sup>T<sub>E</sub>X applications. These can be set in the document GUI (figure 5), which holds a lot of different parameters.

## 7 The Formula Generator

We have already mentioned the outstanding capability of T<sub>E</sub>X to produce mathematical formulas. LyX supports this capability in a graphical mode which almost achieves WYSIWYG quality, as seen in figure 6, which is the screenshot of the following equation:

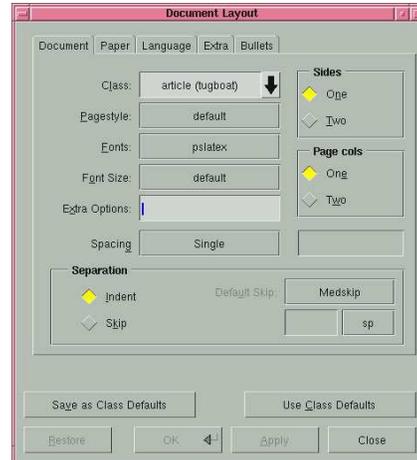


Figure 5: The Document GUI

$$\alpha = \arg(z) = \begin{cases} 0 & (a < 0 \wedge b = 0) \\ \pi & (a < 0 \wedge b < 0) \\ \arctan \frac{\operatorname{Im}(z)}{\operatorname{Re}(z)} & (a \in \mathbb{R} \wedge b > 0) \\ \arctan \frac{\operatorname{Im}(z)}{\operatorname{Re}(z)} & (a \in \mathbb{R} \wedge b < 0) \end{cases} \quad (\#)$$

Figure 6: LyX in Mathmode

tion:

$$a = \arg(z) = \begin{cases} 0 & (a < 0 \wedge b = 0) \\ \pi & (a < 0 \wedge b < 0) \\ \arctan \frac{\operatorname{Im}(z)}{\operatorname{Re}(z)} & (a \in \mathbb{R} \wedge b > 0) \\ \arctan \frac{\operatorname{Im}(z)}{\operatorname{Re}(z)} & (a \in \mathbb{R} \wedge b < 0) \end{cases}$$

In contrast to the relatively easy-to-use math editor in WinWord, there exists in L<sup>A</sup>T<sub>E</sub>X considerably more possibilities for vertical and horizontal positioning. The WinWord math editor, though, has more menu choices than the LyX math panel, shown in figure 7.

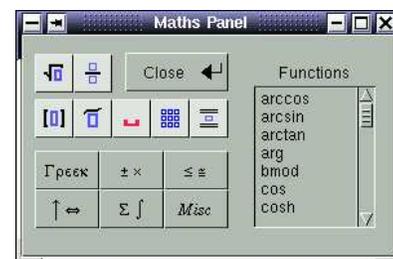


Figure 7: LyX Math-Panel

<sup>5</sup> American Mathematical Society

<sup>6</sup> The journal of the German T<sub>E</sub>X Users Group

<sup>7</sup> European Geophysical Society

<sup>8</sup> Journal of Geodesy

<sup>9</sup> Elsevier Journal

<sup>10</sup> Lecture Notes in Computer Science (Springer)

<sup>11</sup> Special class for writers

<sup>12</sup> Especially in the United States

### 8 Floats

Figures and tables can be integrated into so-called floats and logically arranged on the page. In addition to the standard types of floats such as figures and tables, there is also a predefined type of float for an algorithm. In the LyX-Layout they appear in an open or collapsed layout (figure 8).

`float:figure`

Figure 8: Figure-Float in a collapsed state

The American Mathematical Society's *ams-math*-package offers extensive functions within the context of mathematical formulas, which the upcoming version of LyX will support.<sup>13</sup>

### 8 Floats

Figures and tables can be integrated into so-called floating objects, or floats, that TeX can logically arrange on the page. In addition to the standard types of floats such as figures and tables, there is also a predefined type of float for an algorithm. In the LyX-Layout they appear in an open or collapsed layout (figure 8).

Of course, the user is not restricted to the existing types of floats but may instead create new ones. For all types of floats there are corresponding *Listof* commands (figure 9), each of which will produce a list of all floats of that type, at whatever location in the document the command is issued.

GUI environment. A recurring theme is also the design, so that the user is spared having to know LaTeX.

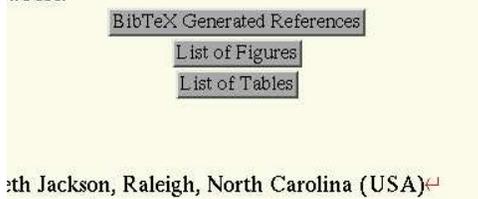


Figure 9: Inserting List of Figures and List of Tables

### 9 Figures and Tables

Normally figures and tables are contained within floating objects, since their positioning is essential to the layout of the document. However, it is also possible to insert them directly into the text. All graphical objects must be in either PostScript (.ps) or encapsulated PostScript (.eps) format. LyX

<sup>13</sup> See also <http://www.perce.de/lyx/Equations.pdf>

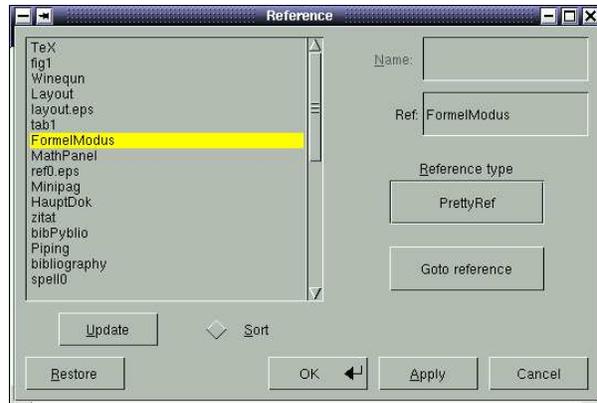


Figure 10: Menu to insert References

supports some graphic conversion via an external program like *convert* from the *imagemagic* package. Version 1.2 will have much better support for the graphics import.

### 10 Cross-References

L<sup>A</sup>T<sub>E</sub>X provides several ways to include cross-references to a different location in a document, but since these methods are similar to those found in other document preparation packages, we mention them only briefly. The L<sup>A</sup>T<sub>E</sub>X package *hyperref* supports creating cross-references as a link into a pdf-file. This type of cross-reference must be placed in the L<sup>A</sup>T<sub>E</sub>X preamble (see section 17), since the current version of LyX only supports the *prettyref* package. A cross-reference using the *prettyref* package is created by selecting the type of reference from a menu of available references, as shown in figure 10. The upcoming LyX version 1.2 should contain a complete integration of the *hyperref* package.

A cross-reference must refer to a label that has been entered at some point in the document. The user can insert a label at any point in the document and choose any text for the name of the label. In a long document, the number of labels could easily exceed 100 or more; in this case, LyX provides a nice feature: it automatically adds the type of the cross-reference (for example, “sec” for section like `sec:minipages`) before the cross-reference in the text. LyX can display the labels in order of their appearance in the text or in alphabetical order.

### 11 Minipages

Within L<sup>A</sup>T<sub>E</sub>X, minipages are essential for handling difficult layout issues and are therefore also supported directly within LyX.

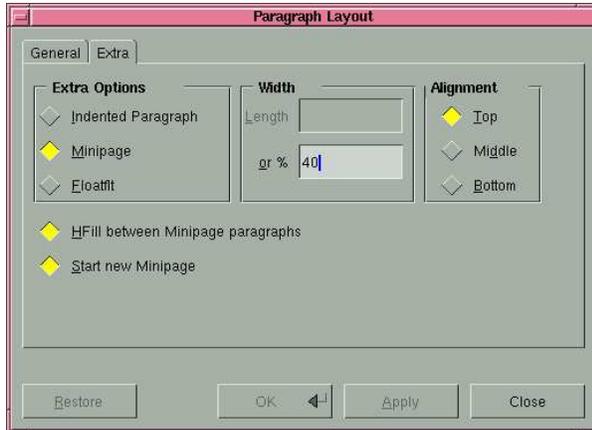


Figure 11: Paragraph layout for Minipages

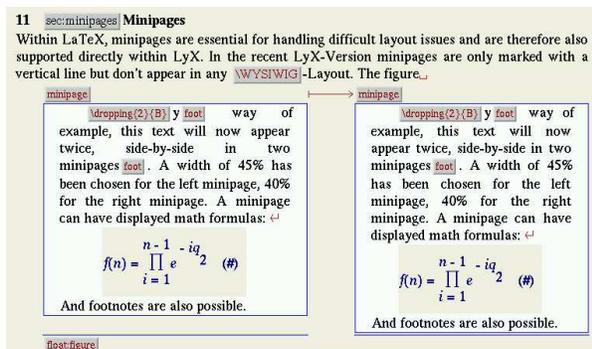


Figure 12: Minipages in the upcoming version 1.2

A minipage is set up using the menu found in Layout  $\triangleright$  Paragraph format  $\triangleright$  Extras, which is being changed for LyX version 1.2 to make certain options for minipages more straightforward and give LyX more support (figure 12). Figure 11 shows this menu as it appears in the current version of LyX.

## 12 Multi-Part Documents

When writing a book, there is a danger of losing the overview of the work, especially when more than a hundred pages must be organized. For this situation LyX offers the ability to break a long unwieldy work into separate, more manageable documents.

The structure of the main document might look like that shown in figure 13. It contains only the details of the chapters and sections (e.g., table of contents or index) that are to be inserted, as well as information about the manner in which the pages are to be numbered. It is not necessary for the main document to contain any text whatsoever.

LyX automatically opens all the required sub-documents, if they are not yet open, whenever the



Figure 13: The main structure of a multipart document

main document is first translated (e.g., to create a pdf, PostScript, or dvi file) or when one sub-document attempts to cross-reference a location in another sub-document. LyX creates a common list of all labels from the various sub-documents to facilitate cross-references between the sub-documents.

## 13 Bibliography

LyX supervises the entire process of creating a bibliography: it runs the BIBTEX program when it is needed, without bothering the user with the details. The insertion of a literature citation is done by making a selection from a menu containing all the entries in the bibliographical database (figure 14), or by typing the keyword for this entry. The upcoming 1.2 version of LyX will give full *natbib*-support.

There are also several programs which make the maintaining of the database easier. In LyX, then, one only needs to choose from the database the correct entry from which LyX should make the citation. It is also possible to work with a separate citation-database program that supports input/output redirection (“piping”); Pybliographer,

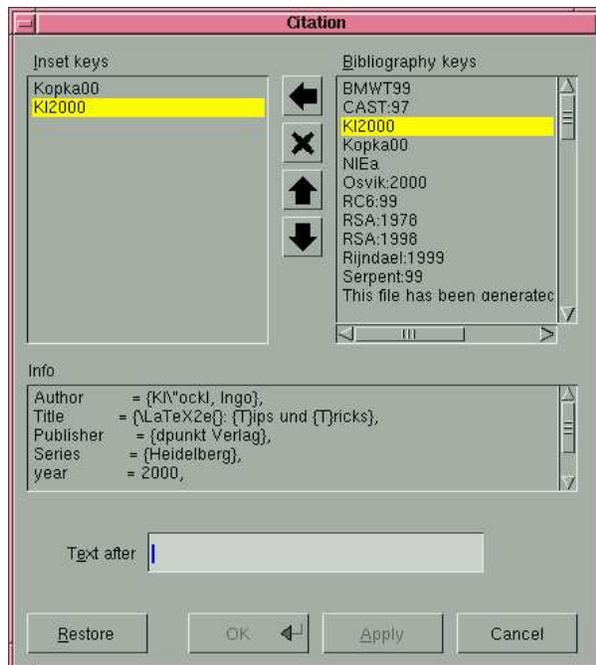


Figure 14: The citation-menu

for example, is such a program. “Piping” enables the program to directly insert a citation into the text through the so-called LyX server. This capability is found in several current BIBTEX programs, such as TKBIBTEX<sup>14</sup> and Sixpack.<sup>15</sup> Instead of using an external literature database, it is also possible to work with the bibliography facility that is directly supported within LyX. The citation keys must be entered within the document that is currently being edited, as shown in figure 15.

However, this procedure is not recommended, because these citations cannot be reused in the straightforward way that a database can be reused. Such citations can only be inserted into other documents using the “cut-and-paste” method, which requires that the user always have the name of the old document handy.

## 14 Spellcheck

Since LyX doesn’t include its own spellchecker, the user is free to employ any spellchecker that is started from the command line, such as the ispell program. The operation of the spellchecker is illustrated in figure 16; since there is nothing novel about LyX’s use of the spellchecker, we will not go into further detail.

<sup>14</sup> <http://www.cat.csiro.au/cmst/staff/pic/tkbibtex.html>

<sup>15</sup> <http://www.santafe.edu/~dirk/sixpack/>

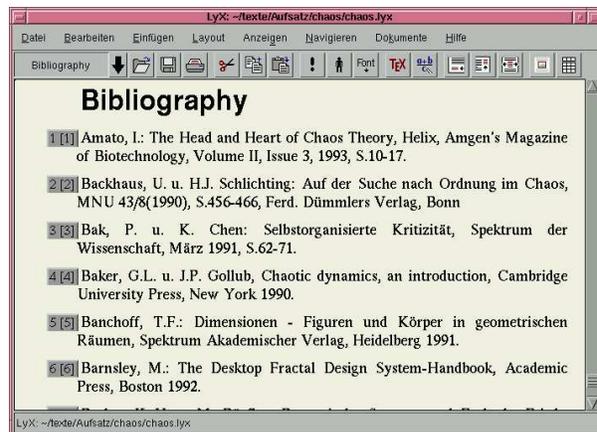


Figure 15: The use of the bibliography layout

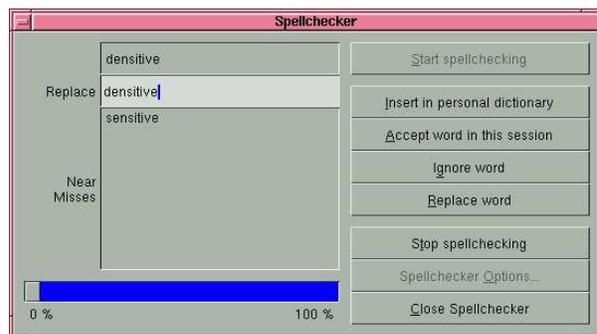


Figure 16: Running the Spellchecker

## 15 Preview and Printing

The print preview process takes place completely outside of the LyX system, as well as outside the realm of L<sup>A</sup>T<sub>E</sub>X and T<sub>E</sub>X. L<sup>A</sup>T<sub>E</sub>X produces a data file in the dvi format, and the xdvi viewer can then be used to preview the document. One drawback of this process, however, is that if a document contains many errors, L<sup>A</sup>T<sub>E</sub>X will be unable to produce a dvi file at all, which in turn makes it more difficult for the user to locate the errors. As an alternative to the dvi output, LyX can also create a PostScript file which can be viewed with the *ghostview* program. This avenue is especially recommended for documents containing special effects such as colors or rotated figures and tables, since the dvi-viewer lacks the capability to display such things. If the option of printing to a file is chosen, then an external shell script can subsequently be used on the file to create a two-sided DIN-A5 output for a book.

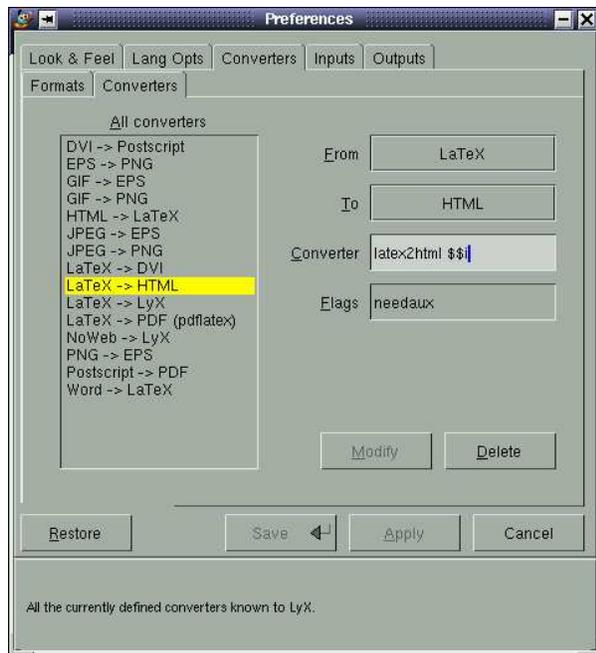


Figure 17: Supported Import/Export formats

## 16 Importing and Exporting

LyX supports many import and export methods directly from the Files▷Import/Export menu, allowing the corresponding external program to be selected by the user. This is especially important for converting a document to HTML, since the programs for doing so differ greatly. Even though LyX has its own file format, it is currently not recognized by any known applications; therefore conversion from LyX to another format is possible only by first converting a LyX file to a TeX file. For this reason, in the list of predefined conversions shown in figure 17, which can be found under Edit▷Preferences▷Converter, LyX doesn't appear on the left-hand side of any of the conversion options.

Frequently, the conversion of a LyX document to PDF format is required. This conversion can be achieved using either the *ps2pdf* program or with the *pdftex* program; both possibilities exist within LyX. A frequently asked question is whether the capability exists to convert to and from Microsoft Word. There is no simple solution to this problem; in extreme cases, such as when complex formulas and extensive tables are present, the RTF format must be used. However, simple text can be successfully converted, both from RTF to TeX, and vice versa. LyX supports the *wvware* program, if it is in-

stalled.<sup>16</sup> The subsequent transfer from TeX to LyX can be accomplished through the *reLyX* import option.

LyX offers direct support of chess diagrams, bitmap graphics such as GIF, JPEG, and xfig files, which are converted with *convert* in the eps-format. In particular, the documentation of chess matches is greatly simplified.

## 17 The LaTeX Preamble

The LaTeX preamble constitutes the actual interface between LyX and LaTeX, because it contains all the (La)TeX-specific definitions. A large part of the LaTeX preamble could be included instead in the LyX text within TeX mode, but this action is not recommended because no insight is gained by doing so.

The LaTeX preamble is an integral part of every TeX file, although in theory it may be left empty if no modifications to the standard document class are desired. For LyX documents, though, at the very least the preamble contains the command describing how LyX should be printed, so that it doesn't appear as LYX. LyX itself tries to manage the preamble itself, so that the user puts only very special commands in the visible part of the preamble.

In principle the preamble is nothing more than a simple editor window in which the necessary additional packages are specified, those which aren't automatically loaded by LyX itself. The use of these simple editing functions is not one of LyX's strong points, but instead are vestiges of the past that must be lived with. One could even use the `\input` command to read in the entire preamble as an external file, and employ an external editor to modify it. A text with a complicated layout routinely will have a complicated preamble as a result.

## 18 Error Analysis

LyX runs LaTeX always in batchmode and tries its best to locate any errors that are generated during this process, marking them with an error flag in the spot in the document where they occur. Clicking on the error flag will generate a window (shown in figure 18) detailing the condition that caused the error, enabling the user to analyze and then eliminate the problem. These LaTeX error messages are sometimes very general, so that LyX has problems locating the error and it can only do its best.

<sup>16</sup> <http://www.wvware.com>



Figure 18: Error message

A  $\text{\LaTeX}$  run is similar to the compilation of source code in a programming language; a single error in the code may result in a very large number of error messages. In longer documents, the number of errors can easily reach one hundred or more.

## 19 Navigation

Navigating within an extensive document can be a challenge, so  $\text{\LyX}$  offers help in the form of a document-specific menu. This menu contains the names of all section and subsections, as well as tables and figures, enabling the user to jump to any point in the text with relative ease. Figure 19 shows all sections and all figures of this text, which are all like internal links, so that jumping to any place in the text is easy.

Another navigational tool exists under `Edit > Find and Replace`, which operates in the same manner as in other text editors. In the current version of  $\text{\LyX}$ , the “Find and Replace” utility works only on text that appears on the screen; unfortunately it does not “find and replace” command sequences.

## 20 Documentation

A large problem with open source projects is always the documentation and help, which operate within mailing lists. The volunteers who maintain the documentation are frequently unable to keep up with the frantic pace of the developers, so that the documentation lags behind the currently available version. Furthermore, users will often skip the documentation altogether, preferring instead to send a question directly to the mailing list, a question that most likely has already been asked and answered many times over. Under the  $\text{\LyX}$  menu option `Help` there is a selection of help documents that are themselves  $\text{\LyX}$  files, which may easily be printed. Although the help files cover a considerable amount of material, they suffer from a somewhat uninspired

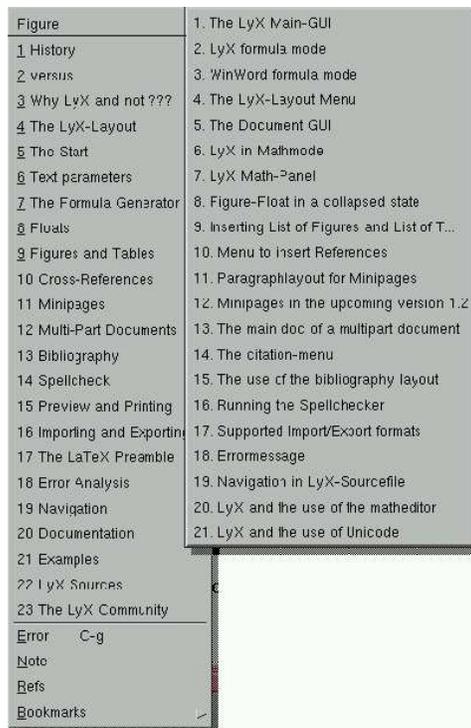


Figure 19: Navigation in a  $\text{\LyX}$ -Sourcefile

organization; for this reason users frequently have problems finding the answer to a question.

The current version of  $\text{\LyX}$  (1.1.6) contains substantial differences from previous versions, yet in a few places the documentation still needs to be brought up to date. This task is being put on hold for the time being, though, while most of the documentation effort is going towards the preparation of upcoming version 1.2.

## 21 Examples

Now that we have completed our whirlwind tour through the basic features of  $\text{\LyX}$ , we present a few examples that will demonstrate the merits of using a typesetting system like  $\text{\TeX}$  in conjunction with a document processor like  $\text{\LyX}$ . The first example (figure 20) shows the extensive use of  $\text{\LyX}$ ’s nearly WYSIWYG-Matheditor.

The next example (figure 21) shows the use of Unicode for Hebrew, Arabic and Russian.  $\text{\LyX}$  also supports Right-To-Left-written languages; however, for some special issues, like search and replace, there are restrictions. More Information about this special topic of  $\text{\LyX}$  is available at <http://www.math.tau.ac.il/~dekelts/lyx/>.

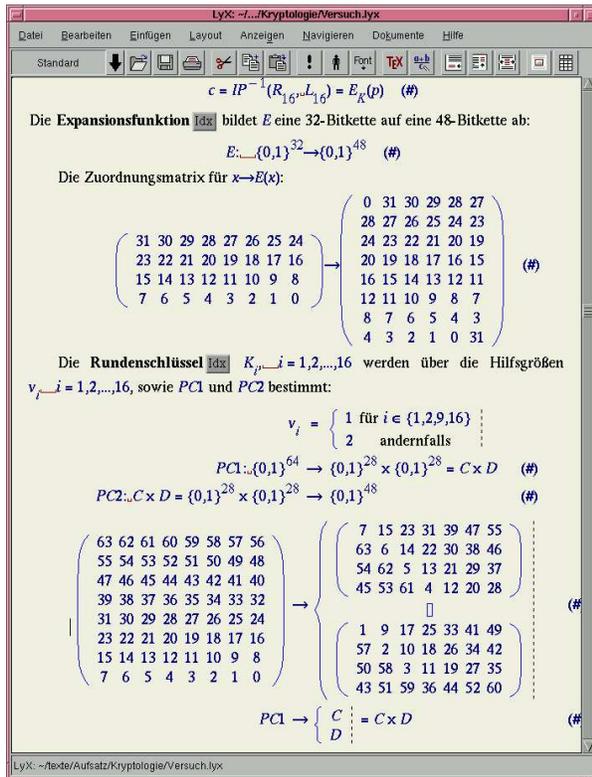


Figure 20: LyX and the use of the matheditor

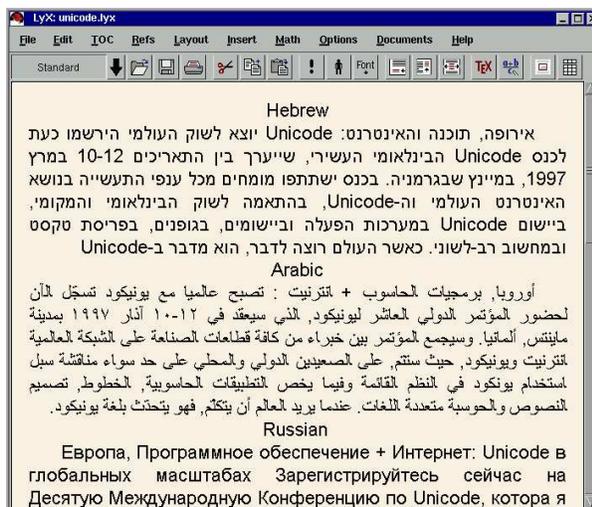


Figure 21: LyX and the use of Unicode

## 22 LyX Sources

The web site <http://www.lyx.org> contains all the essential information for installing LyX on all current operating systems. For OS/2 and Windows machines, an X-server is also needed. All systems must have a fully installed TeX system, which can be freely downloaded from <http://www.ctan.org> or any mirror. Further download sources can be found at <http://www.lyx.org/help/>, in particular for special versions of LyX, like the one for Solaris or Debian.

## 23 The LyX Community

As an open-source project, LyX must rely on the intensive collaborative efforts of users who are in constant communication about the implementation and development of LyX. The LyX homepage, as mentioned before, is at <http://www.lyx.org>. In addition, there are mailing lists for:

**Users:** [lyx-users@lists.lyx.org](mailto:lyx-users@lists.lyx.org)  
(medium volume)

**Developers:** [lyx-devel@lists.lyx.org](mailto:lyx-devel@lists.lyx.org)  
(medium to high volume)

**Documentation team:** [lyx-doc@lists.lyx.org](mailto:lyx-doc@lists.lyx.org)  
(low volume)

Directions on how to register for one of these mailing lists can be found on the LyX homepage. An extensive website with tips and tricks for LyX is located at <http://www.lyx.org/help/>. For all mailing lists there are online archives located at <http://www.mail-archive.com/lyx-???@lists.lyx.org/>, where “???” should be substituted with “devel”, “user”, or “doc”.

A mid-term goal of LyX development is for LyX to have the capability to run in every possible GUI environment. A recurring theme is also the integration of more L<sup>A</sup>T<sub>E</sub>X packages, so that the user is spared having to know about the inner workings of L<sup>A</sup>T<sub>E</sub>X.

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