

What Is New in L^AT_EX?

IV. WYSIWYG L^AT_EX

G. Grätzer

Leslie Lamport Is Alive and Well and Lives on the West Coast

But were he not, he would turn in his grave, because, as he wrote in [5]:

“The function of typographic design is to help the reader understand the author’s ideas. For a document to be easy to read, its visual structure must reflect its logical structure. Quotations and computer programs, being logically distinct structural elements, should be distinguished visually from one another.... Since L^AT_EX can’t understand your prose, you must explicitly indicate the logical structure by typing special commands.... As you are writing your document, you should be concerned with its logical structure, not its visual appearance.”

So L^AT_EX and WYSIWYG are the polar opposites. How can I write about WYSIWYG L^AT_EX?

WYSIWYG vs. L^AT_EX

When you work with a word processor, you see your document on the computer display as it will look printed with its various fonts, font sizes, font shapes and weights, and so on. WYSIWYG: What You See Is What You Get. The following example, typed in Word (in Times font), has bold and italics:

It is **not** unusual for a continuous function to exhibit *pathological* properties.

This is how it looks on the monitor; this is how it looks when printed.

To get the *same text* (in CM font) in L^AT_EX, type:

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It is `\textbf{not}` unusual for a continuous function to exhibit `\textit{pathological}` properties.

`\textbf` and `\textit` are L^AT_EX *markup commands*. In the document you type (called the *source file*), all characters appear in the same font. To indicate how you want the typeset text to be shaped, add markup commands.

In order to typeset math, you need *math markup commands*. As a simple example, take the formula $\frac{a^2+b}{c}$. To mark up this formula in L^AT_EX, type `\frac{a^{2}+b}{c}`

L^AT_EX Front Ends

L^AT_EX is really superior in typesetting high-quality mathematics; to help produce the necessary source file, many L^AT_EX front ends have been developed. They show you a table of Greek letters, you click on ϵ , and the code for it, `\varepsilon`, is written in the source file. Symbol tables and command completion ease the burden of remembering the hundreds of L^AT_EX commands. Today most mathematicians work in front ends, for instance, *WinEdt* for Windows and *TeXShop* for the Mac.

Already in the 1980s there was *Leo* (from ABK Software in Boulder, CO); it was capable of presenting `\alpha` in the source code as α on the monitor. It used the DOS operating system; even today, there are Windows users who still use *Leo* in a DOS compatibility box in Windows XP.

In 1992 MacKichan Software, Inc., announced *Scientific Word*, the first visual front end for L^AT_EX; see my review [1], written in 1993. *Scientific Word* is not WYSIWYG but WYSIWYM: What You See Is What You Mean. Sections, theorems, symbols are properly visually represented, but this representation is not identical to the L^AT_EX output. I hope to review

Scientific Word again when Version 6 is unveiled later this year.

LyX, an Open Source WYSIWYM Front End

At the beginning there was *Lyrics* (using .lyx documents), released in mid-1995 by Matthias Ettrich, soon renamed *LyX*. Version 1.0 was released in 1999. A major update, Version 2.0, has just been released. The fifteen-year development witnessed huge changes.

Getting Started with LyX

Google “LyX”; the LyX home page is the top hit. Go to the home page, click on download, and follow the on-screen instructions for Windows, Mac, or Linux; it is easy. Then start LyX, choose Help, and select Tutorial. The LyX team put together a short and instructive tutorial; you learn the basic features by fixing up—*lyxifying*—a sample file `example_raw.lyx`.

There is only one problem: `example_raw.lyx` is very difficult to find. (Google `example_raw.lyx`, and you see how many people have had the same problem.) On a Windows computer, try searching for it and get no hit. Find it in

Program Files\LyX2.0\Resources\examples
On the Mac, Control Click on the LyX application, and choose

Show Package Contents

Open the Contents folder, then the Resources folder, finally the examples folder, and you find the file.

Work through the tutorial and then graduate to the third item on the Help menu: the *LyX User's Guide*. Many open source projects find excellent programmers. Few find talented people who can provide good documentation. LyX is one of them. This guide is well written and clear.

The guide is continued in the fourth item on the Help menu, *Additional LyX Features*, in the fifth item on the Help menu, *Embedded Objects* (the title is not very user friendly, but the content is down to earth, explaining figures, tables, etc.), and in the sixth item, *Math*, math is explained; especially useful is Chapter 18, describing the use of the AMS multiline formulas. There are nine more manuals listed in Help.

A Taste of LyX

In a short article such as this, I can give but the briefest introduction to a complex application such as LyX. But I can give you some examples of how it works. So open LyX, and in the File menu choose New for a new document. In the View menu, choose Toolbars and select View/Update, Extra, Math, and Math Panels. You then have two toolbars at the top of the window, two math toolbars at the bottom. Hovering over the icons of the four toolbars, little floating text boxes appear explaining

what they do. For good measure, under Toolbars, choose Other Toolbars and select Greek.

Since you want to do math, you will want to use the AMS document class `amsart`. In the Document menu, choose Settings. . . . A new window comes up. Here the Document class is a drop-down menu; choose `article (AMS)`. Close the window. Save the document.

Type the title:

A taste of LyX

as you would type it in any word processor. With the cursor in the line, go to the upper left of the window, where you find the “environment drop-down menu”; click on it, and select Title. See how A taste of LyX is now displayed as appropriate for the title of an AMS article.

In the next line, type `by Very Beginner`, choose the Author environment, and watch the transformation.

Now type

My first sentence.

To emphasize “first”: select it, click the toggle emphasis icon (with the exclamation mark), and you see *first*. To make “sentence” bold, select it, and use the usual keyboard command for bold.

Now start doing math. Type:

The Greek letter delta:

There are three ways to get *delta*:

- (1) Click the Insert math mode icon (it looks like this, $\frac{a+b}{c}$; it is in the first toolbar on the top, sixth icon from the right). In the article, you get a little blue box surrounded by four red corners, indicating math mode. Now type `\delta` (with a space following) and the character δ appears surrounded by the red corners of the math mode.
- (2) Click the Greek icon (it looks like this: α ; it is in the second toolbar on the bottom, ninth icon from the left) and a table pops up with all the Greek letters. Click on δ in the table, and in the document you get δ surrounded by the red corners of the math mode.
- (3) In the Greek toolbar, click on δ .

Now type

A fraction with an exponent:

to learn how to get the formula $\frac{a^2+b}{c}$:

- (1) Click on the icon, Insert standard fraction (it looks like this: $\frac{a}{b}$) and you get in math mode two blue boxes, one above and one below a horizontal line.
- (2) In the box above, you want $a^2 + b$; click on the Superscript icon and type a and 2 in the appropriate boxes, escape the superscript mode by pressing the space key, and type + b.
- (3) Type c in the box below the line. By magic, $\frac{a^2+b}{c}$ appears in the document.

All this is so visual and intuitive that it becomes second nature in a very short time. Alternatively, in math mode, you can type the \LaTeX code:

`\frac space a^2 space + b down-arrow c space space space`
to get the fraction.

But the proof of the pudding is in multiline math environments; let me illustrate this with an align environment:

$$\begin{aligned} x^2 + 3 &= y, \\ u &= \frac{a}{b}. \end{aligned}$$

To place this in your LyX document:

- (1) In the Insert menu, choose Math, and then AMS align Environment.
- (2) You get two boxes, the two columns to be aligned. In the first, place $x^2 + 3$ as before, in the second, $=y, .$
- (3) Press Command-Return to start the next line; you get two boxes again—type u in the first and $= \frac{a}{b}.$ in the second. You are done.

If You Done It, It Ain't Bragging

Baseball great “Dizzy” Dean would agree: LyX is not bragging about WYSIWYM, it does indeed deliver. Look at this very recent real-life example, the LyX version of Theorem 1 of [4]:

Theorem 1. *In a semimodular lattice, let*

$$\begin{aligned} C: 0 &= c_0 \prec c_1 \prec \cdots \prec c_n = 1, \\ D: 0 &= d_0 \prec d_1 \prec \cdots \prec d_n = 1. \end{aligned}$$

Then there is a permutation π of the set $\{1, \dots, n\}$ such that $[c_{i-1}, c_i]$ is projective to $[d_{\pi(i)-1}, d_{\pi(i)}]$, for all i .

Compare it with the PDF of the typeset \TeX file:

Theorem 1. *In a semimodular lattice, let*

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The LyX file informs you that this is Theorem 1 and properly displays all the math.

And So Much More...

Go to the LyX site for a listing of the main features and, in the news section, the thirty main new features of Version 2.0. Just to whet your appetite, this is what Version 1.6 already offers: full support for math, including AMS math, table editor, references, index and bibliography (including Bib \TeX), spellchecking, thesaurus, and revision tracking. It provides support for writing documents in many languages (Unicode), including languages such as Arabic, Chinese, Hebrew, and Japanese. It supports version control, \XeTeX and Lua \TeX (see [2]).

Version 2.0 adds advanced search, diff (compare documents), reference styles, multiple indices, better outliner, enhanced table features, colors, search

for DVI/PDF files, experimental XHTML+MathML export, and so many others.

Where We Agree and Where We Part Ways

I agree with the LyX community—those who write the compelling code, those who write the excellent documentation, those who use it every day in their work—that LyX is a first-rate product. Whether it is for you, only you can decide, but you owe it to yourself to give LyX a try.

I view LyX as a \LaTeX front end (although it is clearly more, it is also a front end for DocBook and—soon—for XHTML+MathML), not as the LyX folks promote it: “a document processor that encourages an approach to writing based on the structure of your documents and not simply their appearance.” I would encourage all LyX users (especially those who use mathematical formulas) to be thoroughly familiar with \LaTeX , to use LyX to produce the document, but to export it to \LaTeX for the final touch up. I realize that for many documents (for instance, exams) fine tuning is not necessary.

As examples of fine tuning, let me mention two types of errors in the final submission of manuscripts that the authors can very easily correct—but they are hard to do for the editors: lines that are too long and bad line breaks. An author can eliminate a too-long line by simply rephrasing the sentence or by adding an optional hyphen. A bad line break can also be easily corrected with a nonbreakable space. These are awkward to do in LyX—it would be very easy for the designers of LyX to add a few small features that would facilitate such corrections.

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