Better typesetting with LaTeX

A user's guide

Jack Walton

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Newcastle University

Introduction

Who's who?

Who am I?

- 3rd year PhD student, MSP
- 4 years of LaTeX experience

Who are you? (hopefully)

- Familiar with basics of LaTeX already
- Interested in learning more thoroughly

Plan

- Workshop runs until 1230
- 3 hours is too long for me to talk
- Teaching will be interspersed with activities
- Follow slides on your PC, many items are hyperlinked
- Need to stay until 1230 for Angela to scan cards for attendance

Resources

- First point of call: stack exchange
- The not so short introduction to LaTeX 2ε
- More Math into LaTeX 4th edition (hard copies available at library)
- CTAN: comprehensive TeX Archive Network
- You should be aware of: official university guidelines

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Packages: a few favourites

\usepackage{booktabs}

What does it do?

Enhances default table.

Typical LaTeX table:

Item		
Animal	Sold	Price ($)
Gnat	per gram	13.65
	each	0.01
Gnu	stuffed	92.50
Emu	stuffed	33.33

Table 1: Default LaTeX table.

\usepackage{booktabs}

```
\begin{tabular}{|l|l|r|}
 \hline
 \multicolumn{2}{|c|}{Item} & \\\cline{1-2}
 Animal          & Sold       & Price (\$) \\\hline
 Gnat            & per gram   & 13.65      \\
                 & each       & 0.01       \\
 Gnu             & stuffed    & 92.50      \\
 Emu             & stuffed    & 33.33      \\\hline
\end{tabular}
\caption{Default \LaTeX\ table.}
```

\usepackage{booktabs}

Booktabs table:

Item		
Animal	Sold	Price ($)
Gnat	per gram	13.65
	each	0.01
Gnu	stuffed	92.50
Emu	stuffed	33.33

Table 2: Booktabs improves table spacing.

\usepackage{booktabs}

```
\begin{tabular}{llr}
 \toprule
 \multicolumn{2}{c}{Item} & \\\cmidrule{1-2}
 Animal       & Sold      & Price (\$) \\\midrule
 Gnat         & per gram & 13.65      \\
              & each     & 0.01       \\
 Gnu          & stuffed  & 92.50      \\
 Emu          & stuffed  & 33.33      \\
 \bottomrule
\end{tabular}
\caption{Booktabs improves table spacing.}
```

\usepackage{pgfplotstable}

What does it do?

Reads data from input (e.g. a .csv file) and generates code for tabular. Can round numbers to desired precision and print in different formatting styles.

```
Element ,       Number ,        Mass
H ,             1 ,             1.00794
He ,            2 ,             4.00260
Li ,            3 ,             6.94100
Be ,            4 ,             9.01218
```

\usepackage{pgfplotstable}

pgfplotstable:

	Atomic	
Element	Number	Mass
H	1	1.00794
He	2	4.00260
Li	3	6.94100
Be	4	9.01218

Table 3: pgfplotstable can read input files.

\usepackage{pgfplotstable}

```
\pgfplotstabletypeset[col sep=comma,
 string type,

 every head row/.style={
  before row={\toprule
              & \multicolumn{2}{c}{Atomic}
              \\ \cmidrule{2-3}},
  after row={\midrule}},

 every last row/.style={after row=\bottomrule}
]{elements.csv}
\caption{pgfplotstable can read input files.}
```

\usepackage{pgfplotstable}

pgfplotstable can format numbers as desired:

	Atomic	
Element	Number	Mass
H	1	1.008
He	2	4.003
Li	3	6.941
Be	4	9.012

Table 4: pgfplotstable understands precision and rounding.

\usepackage{pgfplotstable}

```
\pgfplotstabletypeset[col sep=comma,
 columns/Number/.style={string type},
 columns/Element/.style={string type},
 columns/Mass/.style={fixed zerofill,
                      precision=3},
 ⋮
 ⋮   (As in earlier example)
 ⋮
 \caption{pgfplotstable understands precision
          and rounding.}
```

Even *more* table generators

In addition to pgfplotstable there are various other table generators:

- xtable (R users)
- pandas.DataFrame.to_latex (Python users)
- Excel2LaTeX (Excel users)

\usepackage{cleveref}

What does it do?

Formats cross-references automatically

See Figure 1.

Figure 1: TEX the Lion.

\usepackage{cleveref}

```
% Reference as Figure 1, instead of fig. 1
\usepackage[capitalise,noabbrev]{cleveref}
See \cref{fig:lion}.

\begin{figure}
 \centering
 \includegraphics[width=0.4\textwidth]{Lion.png}
 \caption{\TeX\ the Lion.}
 \label{fig:lion}
\end{figure}
```

A few others

- hyperref
- tikz
- standalone
- fancyhdr
- multirow
- ifdraft
- titlesec
- microtype
- natbib
- biblatex
- geometry
- todonotes

Activity / break

Here we take a 10 minute activity break

- Look through master's thesis or publication and see what you could improve with these new packages
- Investigate hyperlinked packages
- Ask me questions

Custom commands

Macros

Used to simplify repetitive and/or complex formatting

```
\newcommand{\name}[# of parameters]{definition}
```

Simple commands

The set of real numbers are usually represented by a blackboard captital r: $\mathbb{R}$.

```
\newcommand{\R}{\mathbb{R}}
```

```
The set of real numbers are usually represented
by a blackboard captital r: $\R$.
```

Commands with parameters

Other numerical systems have similar notations. The complex numbers $\mathbb{C}$, the rational numbers $\mathbb{Q}$ and the integer numbers $\mathbb{Z}$.

```
\newcommand{\bb}[1]{\mathbb{#1}}

Other numerical systems have similar notations.
The complex numbers $\bb{C}$, the rational
numbers $\bb{Q}$ and the integer numbers
$\bb{Z}$.
```

Commands with optional parameters

```
\newcommand{\name}[# params][default #1]{def.}
```

We make a new command to save time writing expressions of the form $(x+y)^2$ and $(a+b)^4$.

```
\newcommand{\plusbinomial}[3][2]{(#2 + #3)^#1}
```

```
We make a new command to save time writing
expressions of the form $\plusbinomial{x}{y}$
and $\plusbinomial[4]{a}{b}$.
```

Managing a bibliography

Bibtex

Bibtex can be used to manage bibliographies. (Biblatex is a more sophisticated alternative.)

- Bibtex entries stored in a .bib file
- Recommend maintaining a single centralised .bib file for duration of thesis.

Bibtex

A list of entry types which Bibtex understands can be found here.

```
@book{knuth84,
  title="The texbook",
  author="{Donald Ervin} Knuth and Duane Bibby",
  volume="3",
  year="1984",
  publisher="Addison-Wesley Reading"
}
```

Bibtex

Reference as \cite{knuth84}.

Include bibliography with

```
\bibliography{references}
\bibliographystyle{plain}
```

\usepackage{natbib}

- natbib can be used to implement author-year citations.
- Introduces commands \citep and \citet, to cite in parenthesis or text.
- \citep* and \citet* print full author list
- Multiple citations can be made as \citep{paper1, paper2}

Bibtex

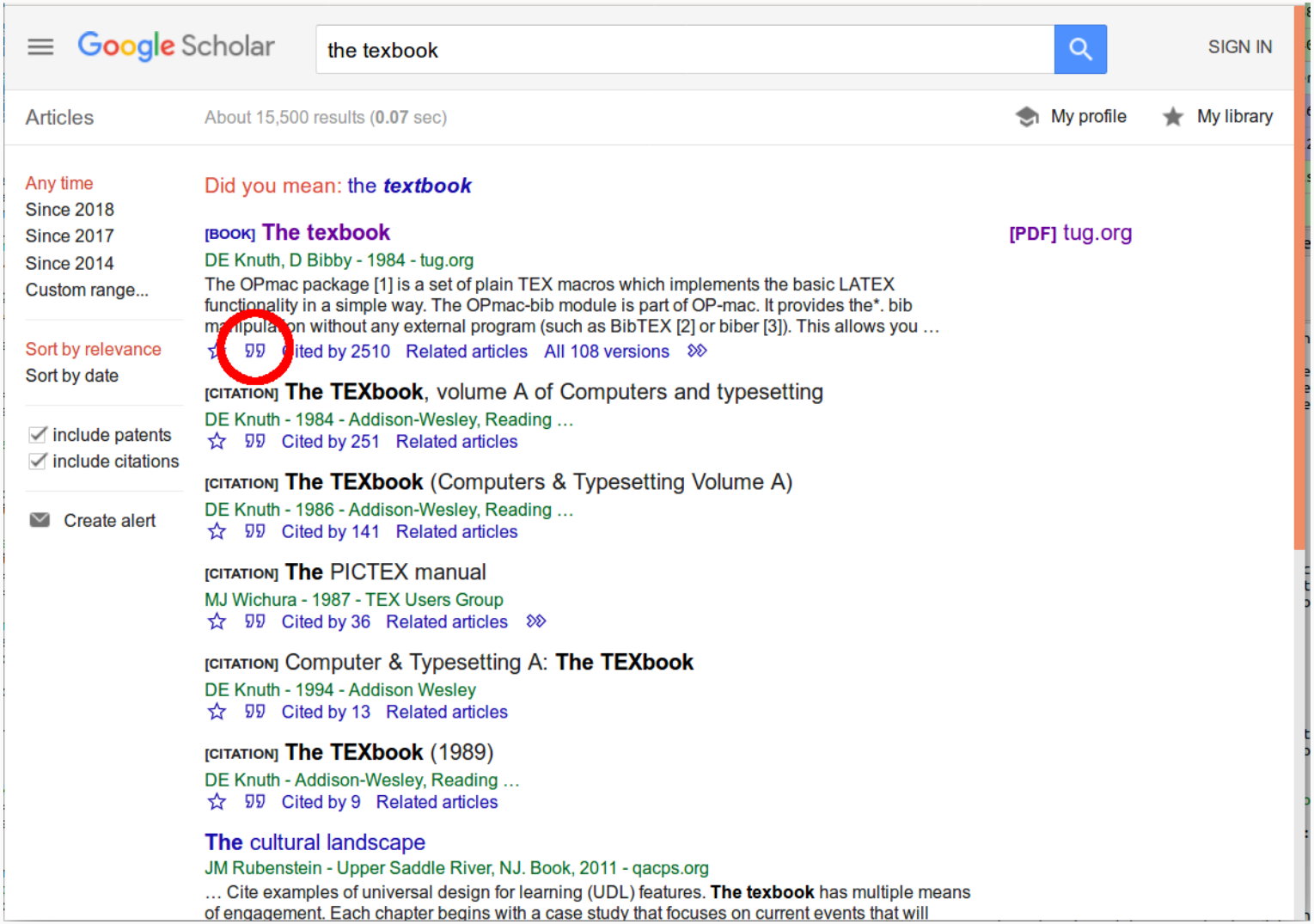
BibTeX adds extra complexity to the processing of your manuscript. You will have to run LaTeX a number of times.

1. pdflatex thesis.tex
2. bibtex thesis.aux
3. pdflatex thesis.tex
4. pdflatex thesis.tex

May create a Makefile to simplify compilation. I'd recommend using latexmk.

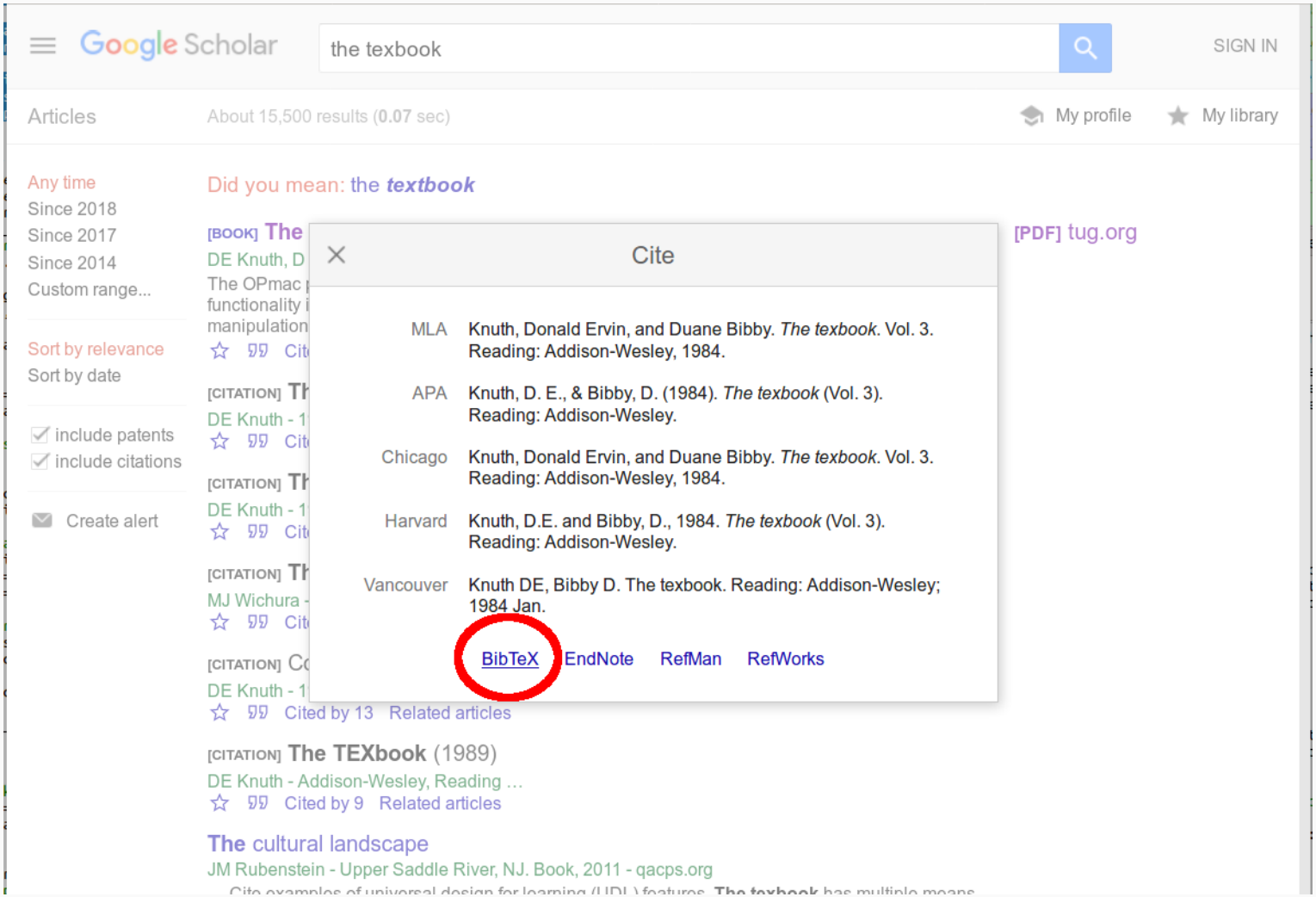
Bibtex

Google scholar can be used to export citations easily.



Bibtex

Google scholar can be used to export citations easily.



Activity / break

Here we take a 10 minute activity break

- Look through master's thesis or publication and see if marcros could make your life easier
- Set up a central .bib file which you will use for your entire PhD
- Ask me questions

Working with large documents

Structure

A modular structure makes it easier to work with and organise large documents.

```
thesis/
├── thesis.tex
├── chapters
│   ├── chapter_1.tex
│   ├── chapter_2.tex
│   └── chapter_3.tex
├── inputs
│   ├── preamble.sty
│   └── bibtex_style.bst
└── references.bib
```

thesis.tex

```
\documentclass[12pt]{report}
\usepackage{inputs/preamble}
\begin{document}

\include{chapters/chapter_1}
\include{chapters/chapter_2}
\include{chapters/chapter_3}

\bibliography{references}
\bibliographystyle{inputs/bibtex_style}
\end{document}
```

Other files

chapters/chapter_1.tex

```
\chapter{Literature review}
\label{cha:lit_review}
There is a large body of literature \ldots
```

inputs/preamble.sty

```
% Preamble, packages, commands etc.
\usepackage{amsfonts}
\usepackage{amssymb}
\usepackage{amsthm}
```

Compile a single chapter

\includeonly allows the compilation of a single chapter, without messing up references.

```
\documentclass[12pt]{report}
\usepackage{inputs/preamble}
\includeonly{chapters/chapter_2}
\begin{document}

\include{chapters/chapter_1}
\include{chapters/chapter_2}
\include{chapters/chapter_3}
⋮
```

masthesis.sty

- A thesis template (masthesis) for the school can be found on the wiki
- The template is modular and has a structure similar to that highlighted earlier
- Includes extras such as spell check and makefile

Version control

- Version control allows you to track and manage changes in code, and collaborate with others
- Consider using version control to manage thesis
- Sophie Harbrisher (3rd year MSP) and I will be teaching a faculty workshop on version control with git and github

Spell checking

Spell checking .tex files is complicated by latex commands.

For command line users I'd recommend aspell (or ispell or hunspell). Interactive mode:

```
$ aspell -t -c chapters/chapter1.tex
```

Non interactive (list mistakes):

```
$ cat chapters/chapter1.tex | aspell list -t
```

Custom dictionary and commands to ignore can be added with --add-extra-dicts and --conf.

Spell checking

Some IDEs have inbuilt spell checkers:

- Texmaker (checks contents of commands still)
- Texstudio (seems best)
- A good list of editors and their features

Word count

For final submission you need to submit a word count.

Word count is complicated by latex commands.

For command line users i'd recommend detex and wc

```
$ detex -l -e equation,table thesis.tex | wc -w
```

Word count

- Online tool (chapters counted one at at time)
- Texmaker's integrated pdf viewer has wordcount (right click pdf)
- Texstudio (tools $\rightarrow$ analyze text; chapters one at a time)

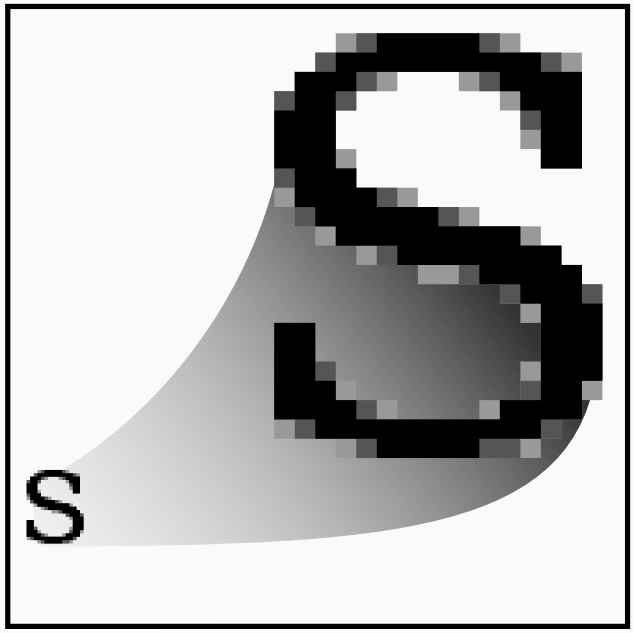
Common mistakes

Binding room

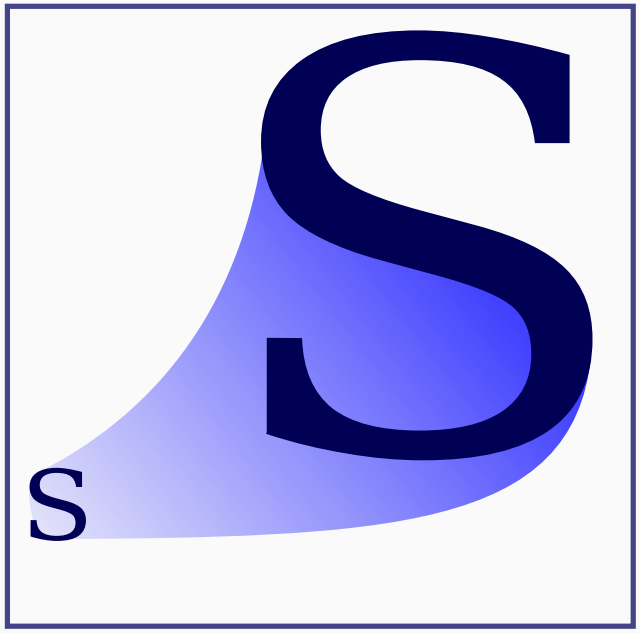
You must allow binding room on the inside margin.

Figures — image format

Use vector graphics where appropriate. (Recommend .pdf)



Raster
.jpeg .gif .png



Vector
.svg

Figures — aspect ratio

Hyphen, en-dash and em-dash (-, –, —)

- The hyphen (-) is used to join words in a compound construction. "A long-term solution"
- An en-dash (--) appears in page ranges. "See pages 1–3"
- An em-dash (---) is typically used as a stand-in for a comma or parenthesis to separate out phrases. "Against all odds, Pete — the unluckiest man alive — won the lottery."

Quotes

LaTeX requires you to use separate markup for opening and closing quotes.

Opening quotes are ``

Closing quotes are ''

Quotes should look “like this” not ”like this”.

Capitalisation in BibTeX

Your BibTeX style will handle most captitalisation. For some words (names, places, ...) capitalisation must be ensured

```
@book{springer57,
   title="Introduction to {R}iemann surfaces",
   author="Springer, George",
   volume="473",
   year="1957",
   publisher="Addison-Wesley Reading"
}
```

Typing maths

Brackets should be large enough to completely enclose all they contain.

$$(\sum_{i=1}^{n-1} i) + n$$

```
(\sum_{i=1}^{n-1} i) + n
```

$$\left(\sum_{i=1}^{n-1} i\right) + n$$

```
\bigg( \sum_{i=1}^{n-1} i \bigg) + n
```

Typing maths

a, b, c, d, e and f	`$a, b, c, d, e \text{ and } f$`
a, b, c, d, e and f	`$a$, $b$, $c$, $d$, $e$ and $f$`
$i = 1, ..., 10$	`$i =1,...,10$`
$i = 1, \ldots, 10$	`$i=1,\ldots,10$`
$sin(x)^2 + cos(x)^2 = 1$	`$sin(x)^2 + cos(x)^2 = 1$`
$\sin(x)^2 + \cos(x)^2 = 1$	`$\sin(x)^2 + \cos(x)^2=1$`

Activity / break

Here we take our final 10 minute activity break

- Look through previous documents you've wrote for common mistakes
- MSP students: download and play around with thesis template (masthesis) on the wiki
- Ask me questions

Conclusion

Perspective

Leslise Lamport, initial developer of LaTeX, was asked what three LaTeX mistakes people should stop making:

1. Worrying too much about formatting and not enough about content.
2. Worrying too much about formatting and not enough about content.
3. Worrying too much about formatting and not enough about content.

Source

Feedback and the future

- Please (please) complete workshop evaluation
- First year running workshops aimed more at MSP students, any feedback would be very informative
- Look out for teaching opportunities if you would like to run a workshop for MSP students

References

Donald Ervin Knuth and Duane Bibby.
***The texbook*, volume 3.**
Addison-Wesley Reading, 1984.