Writing your papers and thesis more effectively

LaTeX, vector graphics, reference management and version control

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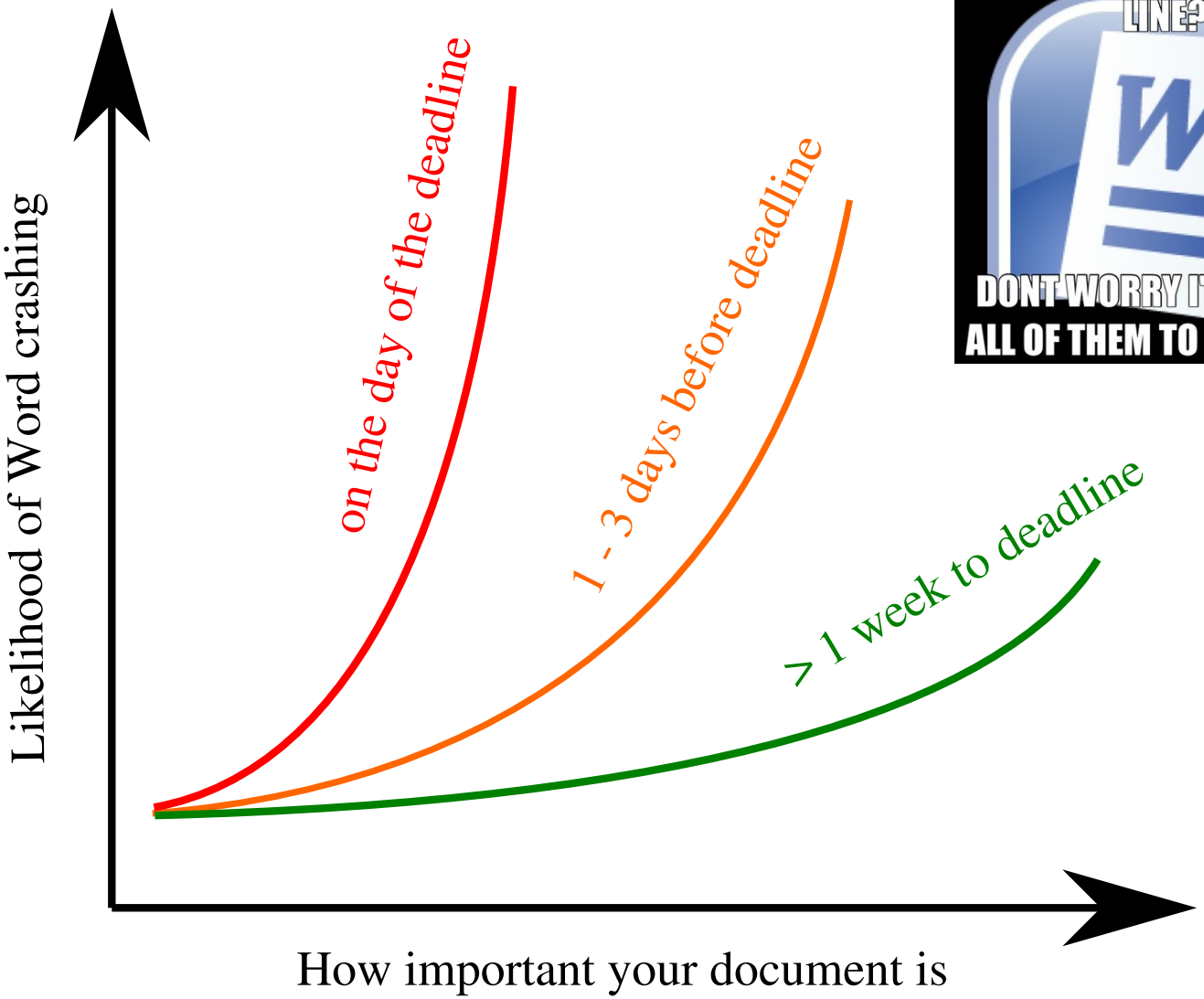
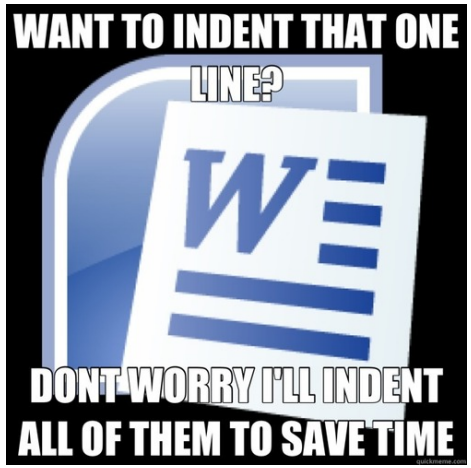
Outline

1. Bursting the WYSIWYG bubble
2. Introduction to LaTeX2e
   - What is LaTeX
   - Getting started with LaTeX
   - Example
3. How LaTeXworks
4. Good practices
   - Equations
   - Figures
   - table
   - bibTeX

Likelyhood of Word crashing





Can you see beyond the WYSIWYG bubble?

mouth; whenever it is a damp, drizzly November in my soul; whenever I find myself involuntarily pausing before coffin warehouses, and bringing up the rear of every funeral I meet; and especially whenever my hypos get such an upper hand of me, that it requires a strong moral principle to prevent me from deliberately stepping into the street, and methodically knocking people's hats off – then, I account it high time to get to sea as soon as I can. This is my substitute for pistol and ball. With a philosophical flourish Cato throws himself upon his sword; I quietly take to the ship. There is nothing surprising in this. If they but knew it, almost all men in their degree, some time or

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Word vs InDesign vs LaTeX

Ligatures, smallcaps, kerning

grafiet efficiënt fles souffleur fjord

grafiet efficiënt fles souffleur fjord

Ligatures

AAa BB CC DD

AAa BB CC DD

Smallcaps

Tafel AVA *AVA*

Tafel AVA *AVA*

Kerning

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What is LaTeX?

- LaTeXis a document preparation system for the TeXtypesetting program.
- Programmable desktop publishing, which automates most of the typesetting.
- LaTeXproduce beautiful documents, especially mathematics

$$i\hbar\frac{\partial}{\partial t}\Psi(r,t) = \left[\frac{-\hbar^2}{2\mu}\nabla^2 + V(r,t)\right]\Psi(r,t)$$

$$E^2 = (pc)^2 + (m_0c^2)^2$$

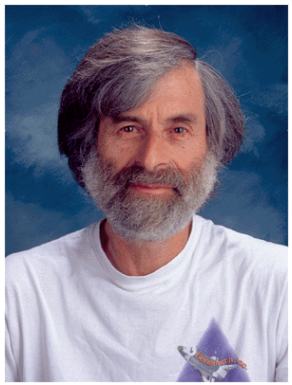
- LaTeXis WYSIWYM (What You See is What You Mean)

History

It all started with Donald Knuth and "The Art of Computer Programming"

- 

  Donald Knuth, 1977, TEX- a computer language used for typesetting math and other technical material

- 

  Leslie Lamport, LATEX- a higher-level method of accessing the power of TEX

LaTeX Pros and Cons

Pros

- It's free and works on Macs, Windows, Unix/Linux.
- LaTeX files are ASCII and are portable.
- The typesetting is better, especially the maths.
- Style changes are neater in LaTeX.

Cons

- Special/Modern Font selection is difficult, but one can use XeTeX.
- LaTeX encourages (almost insists on) structured writing and the separation of style from content. This is not the way that many people (especially non-programmers) are used to working.
- Without a WYSIWYG front end, it's not always easy to find out how to do things.

Getting started with LaTeX

- **Typesetting**
  - TeXLive - full version
  - MiKTeX- Windows (Basic installer)
- **Off-line editors**
  - TeXStudio
  - TeXMakerX
- **Online editors**
  - Overleaf (formerly WriteLaTeX)
  - ShareLaTeX

How LaTeXworks? - The Magic

- You write your document in `plain text` with `commands` that describe its structure and meaning.
- The LaTeXprogram processes your text and commands to produce a beautifully formatted document.

More examples of commands and their output. . .

```
\begin{itemize}
\item Despicable Me
\item Wall-E
\item Tangled
\end{itemize}
```

- Despicable Me
- Wall-E
- Tangled

```
\begin{figure}
\includegraphics{figs/minion}
\end{figure}
```

```
\begin{equation}
\alpha = \beta + 1
\end{equation}
```

$$\alpha = \beta + 1 \qquad (1)$$

Getting Started

- A minimal LaTeX document:

```
\documentclass{article}
\begin{document}
Hello World! % your content goes here...
\end{document}
```

- Commands start with a *backslash* `\`
- Every document starts with a `\documentclass` command.
- The *argument* in curly braces `{` `}` tells LaTeXwhat kind of document we are creating: an `article`.
- A percent sign `%` starts a *comment* — LaTeXwill ignore the rest of the line.

Declarations and Environments

Declaration and commands...

- Are stated once
- Take effect until further notice
- Can optionally be constrained

Eg., `\documentclass` or `\includegraphics`

Environments...

- Have matching begin and end declarations
- Must be constrained

Eg., `\begin{document}` ... `\end{document}`

Arguments

Required arguments...

- Are contained in curly braces
- Must be provided

Eg., `\documentclass{article}`

Optional arguments...

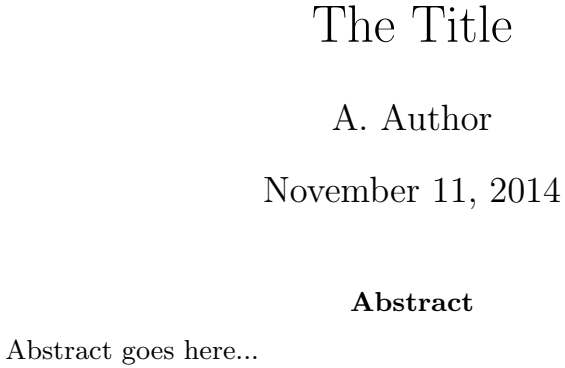
- Are contained in square bracket
- Can be left out, in which case default value is assumed
- Give you more control over the commands

Eg., `\documentclass[12pt]{article}`

Getting started with LaTeX

- Tell LaTeX the \title and \author names in the preamble.
- Then use \maketitle in the document to actually create the title.
- Use the abstract environment to make an abstract.

```
\documentclass{article}

\title{The Title}

\author{A. Author}

\date{\today}

\begin{document}
\maketitle

\begin{abstract}
Abstract goes here...
\end{abstract}

\end{document}
```



Getting started with LaTeX

```
\documentclass{article}
\begin{document}

\section{Introduction}

The problem of \ldots

\section{Method}

We investigate \ldots

\subsection{Sample Preparation}

\subsection{Data Collection}

\section{Results}

\section{Conclusion}

\end{document}
```

1 Introduction

The problem of ...

2 Method

We investigate ...

2.1 Sample Preparation

2.2 Data Collection

3 Results

4 Conclusion

Let's try that . . .

- writeLaTeX is a website for writing documents in LaTeX.
- It 'compiles' your LaTeX automatically to show you the results.

Click here to open the example document in **writeLaTeX**

Or go to this URL: `https://www.overleaf.com/docs/1778557gcvcyt/clone`
For best results, please use Google Chrome or a recent FireFox.

- If you would like to try out the exercise on your machine. Go to `Exercise / paper.tex`

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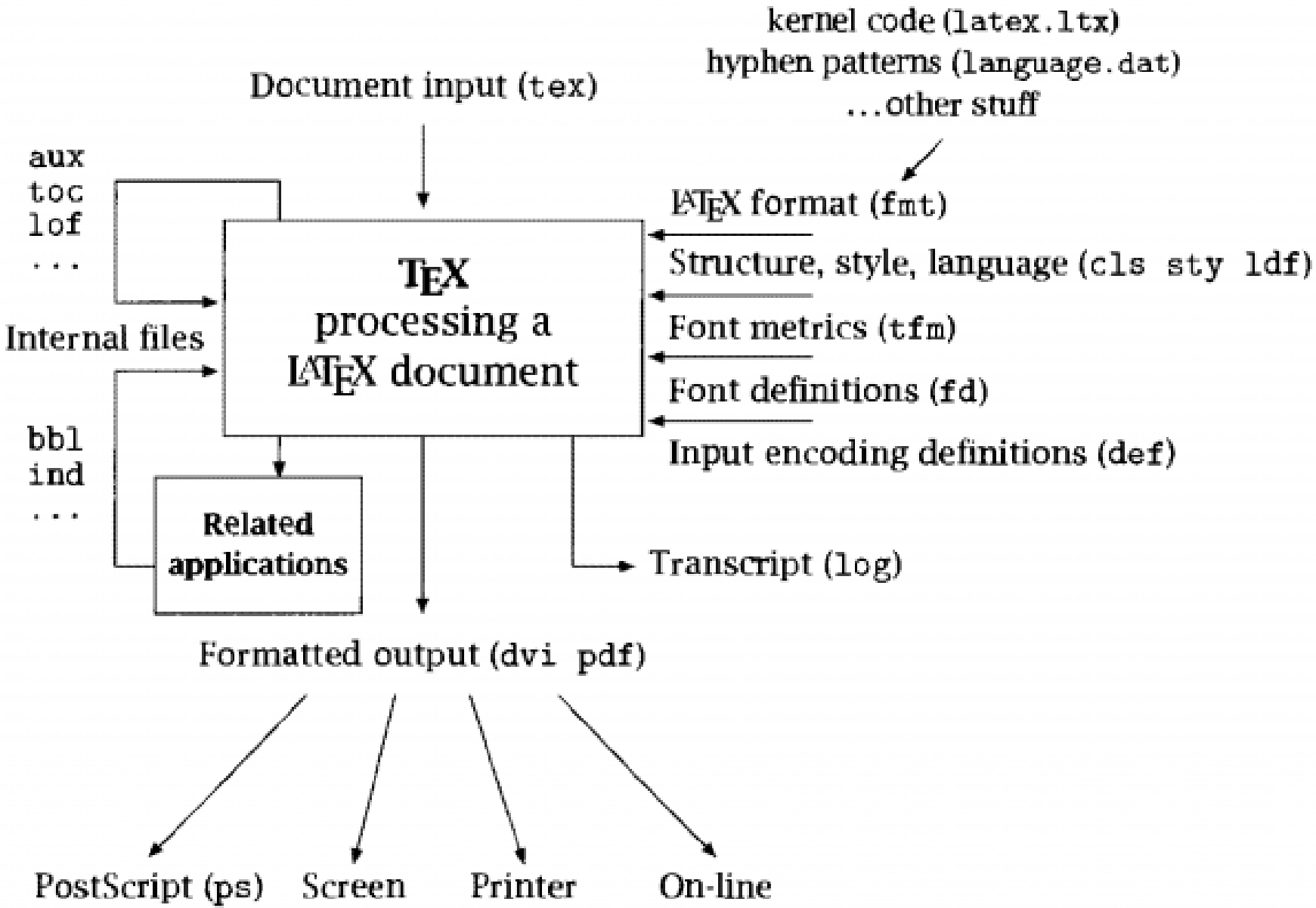
\documentclass{}

minimal	Is as small as it can get. For debugging purposes.
letter	For writing letters.
article	articles in journals, documentation, invitations, ...
proc	A class for proceedings based on the article class.
report	For longer reports containing several chapters ...
book	For real books.
memoir	For advanced book style.
beamer	For writing presentations

LaTeX Structure - The Magic



Packages

Packages allow you to further customize LaTeX

The command:

```
\usepackage{amsmath}
```

Common packages

Environment	Packages
Maths	amsmath, amsfonts, amssymb
Maths Times Font	mathptx
Figures	graphicx, epsfig
Table	tabularx, booktabs
Pagelayout	geometry
Hyperlinks	hyperref
Algorithms and code	algpseudocode, algorithm, listings
Color	color, xcolor

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Typesetting Caveats

- Quotation marks are a bit tricky: use a backtick `` ` `` on the left and an apostrophe `´` on the right.

```
Single quotes: `text'.

Double quotes: ``text''.
```

Single quotes: ‘text’.

Double quotes: “text”.

- Some common characters have special meanings in LaTeX:

`%`	percent sign (comment)
`#`	hash sign (macro parameter #1)
`&`	ampersand (align)
`$`	dollar sign (in-line math)

- If you just type these, you'll get an error. If you want one to appear in the output, you have to *escape* it by preceding it with a backslash.

```
\$\%\&\#
```

$%&#

Equations, equations everywhere

- Use `\mathit` instead of `\textit` inside math environments.
- Why are dollar signs `$` special? We use them to mark mathematics in text.

```
% not so good:
Let a and b be distinct positive
integers, and let c = a - b + 1.

% much better:
Let $a$ and $b$ be distinct positive
integers, and let $c = a - b + 1$.
```

Let a and b be distinct positive integers, and let c = a - b + 1.

Let a and b be distinct positive integers, and let $c = a - b + 1$.

- Use caret ^ for superscripts and underscore '_' for subscripts.

```
$y = c_2 x^2 + c_1 x + c_0$
```

$y = c_2 x^2 + c_1 x + c_0$

- Use curly braces { and } to group superscripts and subscripts.

```
$F_n = F_n-1 + F_n-2$     % oops!

$F_n = F_{n-1} + F_{n-2}$ % ok!
```

$F_n = F_n - 1 + F_n - 2$

$F_n = F_{n-1} + F_{n-2}$

- Detexify http://detexify.kirelabs.org/classify.html

```
$\Omega = \sum_{k=1}^{n} \omega_k \times \mu$
```

$\Omega = \sum_{k=1}^{n} \omega_k \times \mu$

Never use equation arrays

```
\begin{eqnarray}
E& = & m_0 c^2 \,,\\
E^2& = &(m_0 c^2)^2 + (pc)^2 \,.
\end{eqnarray}
```

$$E = m_0 c^2 , \quad (2)$$
$$E^2 = (m_0 c^2)^2 + (pc)^2 . \quad (3)$$

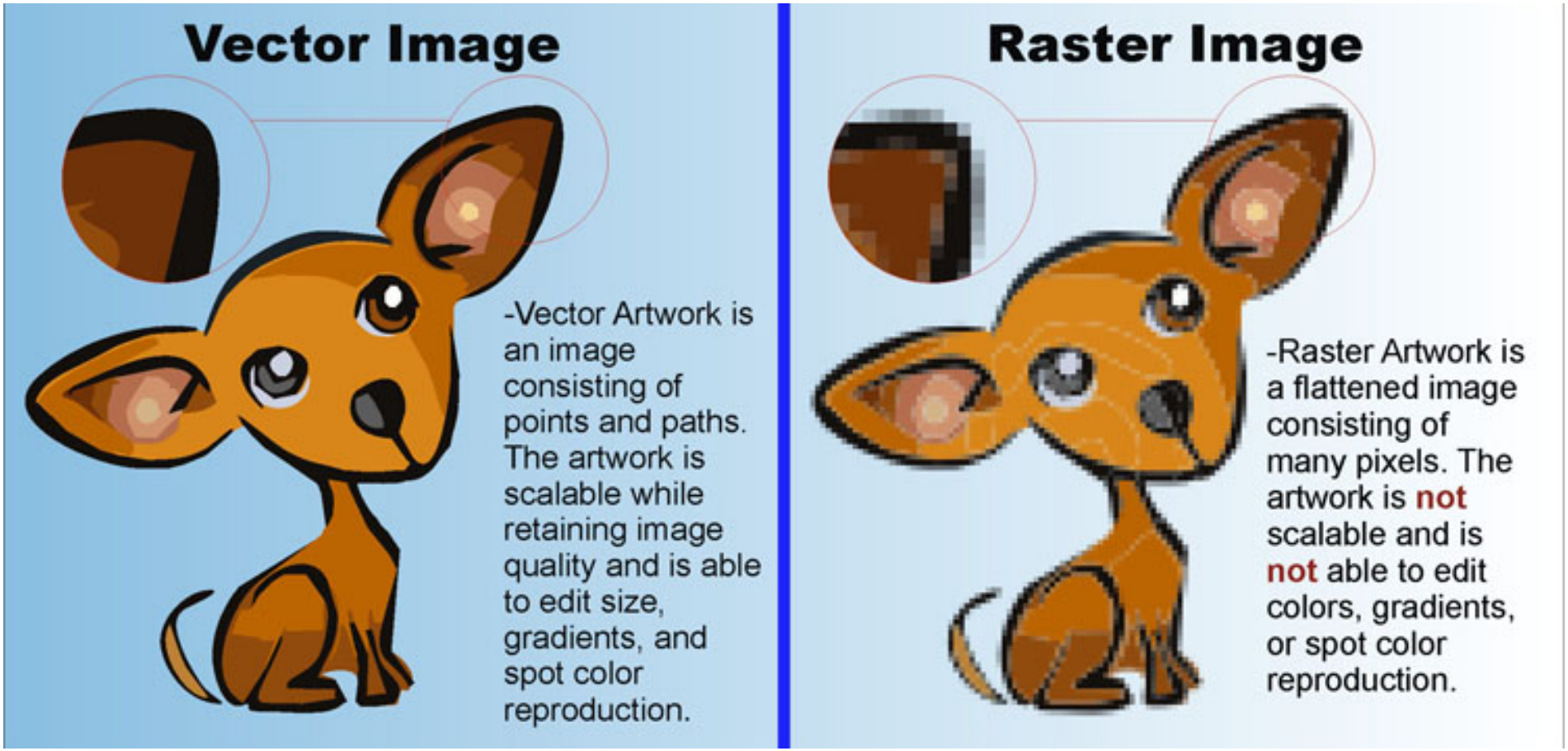
```
\begin{equation}
E = m_0 c^2 \,,
\end{equation}
\begin{equation}
E^2 = (m_0 c^2)^2 + (pc)^2 \,.
\end{equation}
```

$$E = m_0 c^2 , \quad (4)$$
$$E^2 = (m_0 c^2)^2 + (pc)^2 . \quad (5)$$

```
\begin{align}
E  =  m_0 c^2 \,,\\
E^2  =  (m_0 c^2)^2 + (pc)^2 \,.
\end{align}
```

$$E = m_0 c^2 , \quad (6)$$
$$E^2 = (m_0 c^2)^2 + (pc)^2 . \quad (7)$$

Vector graphics vs. Raster images



- Use `inkscape` to generate vector graphics

Formatting figures in LaTeX

- Always use relative scaling to specify the width of the figure, i.e., `[width = 0.75\textwidth]`
- I prefer to centre the figure. To do that use `\centering`, do **NOT** use `\begin{center}` and `\end{center}`
- Tweak the caption location, label, separator: `[labelsep=space, tableposition=top]{caption}`
- You can use `~\cref{fig:minion}` to cross reference the figure. Requires package `cleveref`

```
\begin{figure}
\centering
\includegraphics[width=0.65\textwidth]
                                {figs/minion}
\caption[Minion]{
Dave the Minion from Despicable Me!}
\label{fig:minion} % Unique identifier
                   % for cross-reference
\end{figure}
```

Figure: Dave the Minion from Despicable Me!

\begin[option]{figure}

Parameter	Position
h	Place the float here, i.e., approximately at the same point it occurs in the source text (however, not exactly at the spot)
t	Position at the top of the page.
b	Position at the bottom of the page.
p	Put on a special page for floats only.
!	Override internal parameters LaTeX uses for determining "good" float positions.
H	Places the float at precisely the location in the LaTeX code. Requires the float package. This is somewhat equivalent to h!

A badly formatted table

```
\begin{tabular}{|l|c|c|c|c|}
\hline
& \multicolumn{2}{c}{Species I} &
 \multicolumn{2}{c|}{Species II} \\
\hline
DM  & mean & SD  & mean & SD  \\
\hline
\hline
I1MD & 6.23 & 0.91 & 5.2  & 0.7  \\
\hline
I1LL & 7.48 & 0.56 & 8.7  & 0.71 \\
\hline
I2MD & 3.99 & 0.63 & 4.22 & 0.54 \\
\hline
I2LL & 6.81 & 0.02 & 6.66 & 0.01 \\
\hline
CMD & 13.47 & 0.09 & 10.55 & 0.05 \\
\hline
CBL & 11.88 & 0.05 & 13.11 & 0.04\\
\hline
\end{tabular}
```

	Species I		Species II	
DM	mean	SD	mean	SD
I1MD	6.23	0.91	5.2	0.7
I1LL	7.48	0.56	8.7	0.71
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CMD	13.47	0.09	10.55	0.05
CBL	11.88	0.05	13.11	0.04

A nice looking table

```
\begin{tabular}{l c c c c}
\hline
\multirow{2}{*}{DM}
 & \multicolumn{2}{c}{Species I}
 & \multicolumn{2}{c}{Species II} \\
\cline{2-5}
  & mean & SD  & mean & SD  \\
\hline
I1MD & 6.23 & 0.91 & 5.2  & 0.7  \\

I1LL & 7.48 & 0.56 & 8.7  & 0.71 \\

I2MD & 3.99 & 0.63 & 4.22 & 0.54 \\

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CMD & 13.47 & 0.09 & 10.55 & 0.05 \\

CBL & 11.88 & 0.05 & 13.11 & 0.04\\
\hline
\end{tabular}
```

DM	Species I		Species II	
	mean	SD	mean	SD
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I1LL	7.48	0.56	8.7	0.71
I2MD	3.99	0.63	4.22	0.54
I2LL	6.81	0.02	6.66	0.01
CMD	13.47	0.09	10.55	0.05
CBL	11.88	0.05	13.11	0.04

An even nicer looking table

```
\begin{tabular}{l c c c c}
\toprule
\multirow{2}{*}{DM}
& \multicolumn{2}{c}{Species I}
& \multicolumn{2}{c}{Species II} \\
\cmidrule{2-5}
  & mean & SD  & mean & SD  \\
\midrule
I1MD & 6.23 & 0.91 & 5.2  & 0.7  \\

I1LL & 7.48 & 0.56 & 8.7  & 0.71 \\

I2MD & 3.99 & 0.63 & 4.22 & 0.54 \\

I2LL & 6.81 & 0.02 & 6.66 & 0.01 \\

CMD & 13.47 & 0.09 & 10.55 & 0.05 \\

CBL & 11.88 & 0.05 & 13.11 & 0.04\\
\bottomrule
\end{tabular}
```

DM	Species I		Species II	
	mean	SD	mean	SD
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CMD	13.47	0.09	10.55	0.05
CBL	11.88	0.05	13.11	0.04

Formatting tables

- Use `tabulary` package for tables with paragraph text.
- Never use vertical lines in your table. It looks ugly!
- Use `booktabs` package for rules instead of lines.
- Never use `\hline` or `\cline`, use `\toprule`, `\midrule`, `\bottomrule` and `\cmidrule{i-j}`.
- Use `\centering` to center your tables, do **NOT** use `\begin{center}` and `\end{center}` as it adds additional white space
- Visual table editor: http://truben.no/table/

bibTeX 1

- Put your references in a `.bib` file in 'bibtex' database format:

```
@Article{Jacobson1999Towards,
  author = {Van Jacobson},
  title = {Towards the Analysis of Massive Multiplayer Online
           Role-Playing Games},
  journal = {Journal of Ubiquitous Information},
  Month = jun,
  Year = 1999,
  Volume = 6,
  Pages = {75--83}}

@InProceedings{Brooks1997Methodology,
  author = {Fredrick P. Brooks and John Kubiatowicz and
            Christos Papadimitriou},
  title = {A Methodology for the Study of the
           Location-Identity Split},
  booktitle = {Proceedings of OOPSLA},
  Month = jun,
  Year = 1997}
```

- Most reference managers can export to bibtex format.

bibTeX 2

- Each entry in the `.bib` file has a *key* that you can use to reference it in the document. For example, `Jacobson1999Towards` is the key for this article:

```
@Article{Jacobson1999Towards,
  author = {Van Jacobson},
  ...
}
```

- It's a good idea to use a key based on the name, year and title.
- LaTeX can automatically format your in-text citations and generate a list of references; it knows most standard styles, and you can design your own.
- `Mendeley` auto-generates bibTeXkeys.
- Alternatively, use `Google Scholar` to get the references.

bibTeX 3

- Use the `natbib` package[2] with `\citet`and `\citep` for textual and parenthetical citations, respectively.
- Reference `\bibliography` at the end, and specify a `\bibliographystyle`.

```
\documentclass{article}
\usepackage[authoryear]{natbib}
\begin{document}

\citet{Brooks1997Methodology}
show that \ldots. Clearly,
all odd numbers are prime
\citep{Jacobson1999Towards}.

\bibliography{bib-example}
% if 'bib-example' is the name of
% your bib file

\bibliographystyle{plainnat}
% try changing to abbrvnat

\end{document}
```

Brooks et al. [1997] show that .... Clearly, all odd numbers are pri
[Jacobson, 1999].

References

Fredrick P. Brooks, John Kubiatowicz, and Christos Papadimitriou. A metho
ology for the study of the location-identity split. In *Proceedings of OOPSL*
June 1997.

Van Jacobson. Towards the analysis of massive multiplayer online role-playi
games. *Journal of Ubiquitous Information*, 6:75–83, June 1999.

[2] There is a new package with more features named `biblatex` but most of the articles templates still use `natbib`.

Acknowlegements

This LaTeXfor Beginners course is loosely based on and examples from:

- John Miller's An interactive introduction to LaTeX: https://www.writelatex.com/blog/7
- WikiBook on LaTeX: https://en.wikibooks.org/wiki/LaTeX
- ShareLaTeXLearn: https://www.sharelatex.com/learn
- CUED Textprocessing: http://www.eng.cam.ac.uk/help/tpl/textprocessing/
- UCS Course on LaTeX 2_{ε}: http://www.ucs.cam.ac.uk/docs/course-notes/unix-courses/earlier/latex