An impressive sounding thesis title

Sam Greenwood

Submitted in accordance with the requirements for the degree of
Doctor of Philosophy

The University of Leeds
School of Earth and Environment

July 2020

The candidate confirms that the work submitted is their own and that appropriate credit has been given where reference has been made to the work of others.

Acknowledgements

I'd like to thank Stackoverflow for contributing the majority of my code, and to Wikipedia for always explaining topics that university lectures never could. I'd also like to thank Wolframalpha for solving my equations and fo never telling anyone that I couldn't integrate $\sqrt{x}$.

Abstract

There are currently some observations in this specific area of science, which are important because presumably somebody cares. Previous authors tried to explain them with some data/maths but I think they did so incompletely. Here I include more data/maths because it wasn't complicated enough already and I can't get a PhD if I don't. I perform some kind of experimental procedure and some kind of modelling technique that my supervisor told me to use to show that these observations can indeed be explained by something. My 4 years of work therefore demonstrates that previous authors were out by 1%, within the range of uncertainty.

Contents

List of Figures

Nomenclature

Acronyms

BRB	Be Right Back
CMB	Core Mantle Boundary

Mathematical Notation

$\mathcal{O}(x)$	Order of magnitude of x
∇	Gradient
$\nabla\cdot$	Divergence
$\oint$	Surface integral
$\sum$	Summation

Symbols

η	Magnetic diffusivity
γ	Grüneisen parameter

Units and Prefixes

eV	Electron volt
G	Giga, 1×10^9

Chapter 1

Introduction

1.1 Overview

This thesis is about someting.

1.2 Equations

An example of an equation (solve it for bonus points)

$$x = 35A + \frac{3B}{100}, \tag{1.1}$$

where typically A and B are taken as 12 and 23 respectively.

We can align equations

$$\frac{\partial y}{\partial x} = 3x^2 \tag{1.2}$$

$$y(0) = 0. \tag{1.3}$$

$$\tag{1.4}$$

Sometimes we have such a long equation that we need to split is across 2 lines. We can choose to withhold numbering both lines since it's all one equation

$$\overbrace{\int k\left(\frac{\nabla T}{T}\right)^2 \mathrm{d}V}^{E_\mathrm{k}} + \overbrace{\int \frac{\boldsymbol{i}^2}{\alpha_\mathrm{D} T}\mathrm{d}V}^{E_\alpha} + \overbrace{\int \frac{\Phi}{T}\mathrm{d}V}^{E_\mathrm{J}} = \overbrace{-\int \left(\frac{1}{T_\mathrm{c}} - \frac{1}{T}\right)\rho C_p \frac{\mathrm{D}T}{\mathrm{D}t}\mathrm{d}V}^{E_\mathrm{s}} + \overbrace{\left(\frac{1}{T_\mathrm{c}} - \frac{1}{T_\mathrm{i}}\right)Q_\mathrm{L}}^{E_\mathrm{L}} + \overbrace{\frac{Q_\mathrm{g}}{T_\mathrm{c}}}^{E_\mathrm{g}} . \tag{1.5}$$

This was my most complicated equation and I include it here to inflate my ego.

In equation 1.5 I have made use of using symbols that I frequently use defined in the symbols.tex file. dd, DD, Ek, Ej, Es, El, Eg, massf, Tc, and Ti are all defined in symbols.tex. If it's not worth it to you to have any predifined symbols then you can simply delete symbols.tex and remove the 'include symbols.tex' from the preamble.

Chapter 2

Including Figures

2.1 Introduction

Chapter 1 introduced including equations. In this chapter I will show how figures are included

2.2 Figures

Here is a figure. A useful way to define the width of the figure is by some fraction of the textwidth. Depending on how much white space is around the figure you'll have to play around with this to get it to the size you want it.

Figure 2.1: Can you guess whose eyes these belong to?

2.3 Common issues

Placement of figures is really the only difficulty you'll likely encounter. Often LaTeXwill end up placing the figure too far below where you want it, or even in the next section.

In Fig. 2.2, the [!hbt] options specified after 'begin figure' tell LaTeXwhere to try to place the figure in order. First try placing here as specified in the tex file (h), otherwise

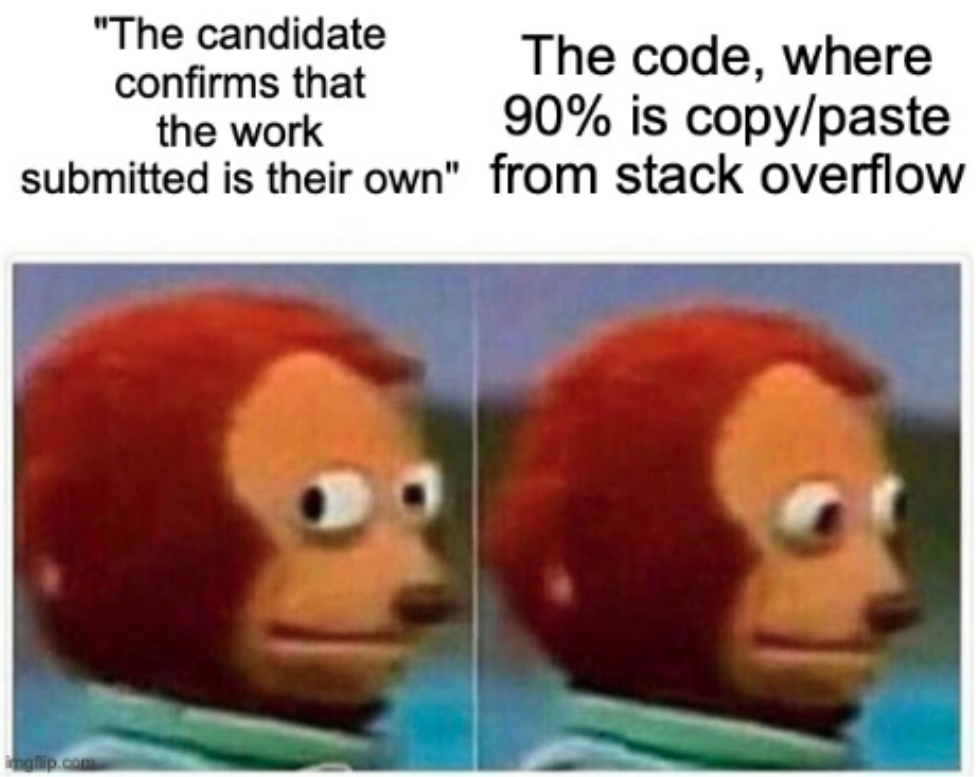

Figure 2.2: Not sure that programming would be feasible without copy/paste

try at the bottom of the page (b), otherwise try placing at the top of the page (t). The exclamation point specified to overrule any behaviour for figure placement that LaTeXmay have (e.g. from the document class I think?).

Sometimes the figure will end up in the next section, not what we want! As a last resort I will add the clearpage just before the next section forcing placement of figures/tables before the new section starts. You might end up with some extra white space but it's a compromise sometimes we have to make.

2.4 Next section

Here's some *Lorem ipsum* to bulk out the text and show that the figure is being placed in this section, despite being part of the previous section. Uncommenting the clearpage command just above the section command will force the figure to be placed, then clear the page before coming to this section.

Fun fact, *Lorem ipsum* is typically a corrupted version of *De finibus bonorum et malorum*, a first-century BC text by the Roman statesman and philosopher Cicero, with words altered, added, and removed to make it nonsensical, improper Latin (according to Wikipedia anyway). It is used as placeholder text since the word length distribution

Figure 2.3: By the time we come to write up, we've all been asked this at least once. This is the honest answer.

is about the same as English and so serves as a useful representation of what text will end up looking like (in terms of number of words on a line etc).

Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetuer id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante.

Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

Chapter 3

Another chapter

3.1 Introduction

Not really much more to say tbh. Afraid you need to just get on with it now.

3.2 Methods

3.3 Results

3.4 Discussion and Conclusions

Chapter 4

A further chapter

4.1 Introduction

Again, just get on with it.

4.2 Methods

4.3 Results

4.4 Discussion and Conclusions

Chapter 5

The final chapter

Oh, one last thing I guess are references. You can cite papers with the (author, year) e.g. This effect is significant (Davies et al., 2015). or just the year e.g. The study of Mound et al. (2019) found ...

I personally wrote this thesis in Overleaf and linked it to my mendeley account to directly import the bib file. I liked to just copy the paper title and paste into Mendeley's desktop app 'Literature search', then drop that paper into my 'Thesis' group. Sync on the app, then refresh the file on Overleaf and it's done. Do whatever works for you best.

A note on using Overleaf. They will only compile your document if it takes less than 1 minute (4 minutes for the pro account). Once you start including lots of figures, for a thesis, you will easily exceed 1 minute limit. You could start downloading the source files and compiling them locally but that's probably a faff. There's lots of information out there on using desktop apps with LaTeX. I was lucky to have had a v1 Overleaf account, that when transferred to the new v2 account, kept the git integration that is now a paid feature. I could just git pull to my local drive then compile with the included Makefile (even make local changes and push those back to Overleaf if I didn't have an internet connection). I did this just because I was used to the Overleaf editor and quite liked it but, as always, do whatever works best for you.

All the best with finishing your PhD. It will be long, hard, and uncomfortable at times (that's what she said?) and nobody finds it easy, you are not alone. It will feel like you've learnt more about your project in the 6 months of writing than you did in the preceding 3 years. Never worry about creating a perfect (or even decent for that matter) draft of your thesis, best to get chapters off to your supervisors for comments earlier rather than later. Even the version you submit will still need to have whatever changes the examiners suggest applied. I submitted yesterday and as I put together this template, I've already found a mistake. A thesis is never finished, just submitted.

Bibliography

Davies, Christopher, Monica Pozzo, David Gubbins, and Dario Alfè (2015). "Constraints from material properties on the dynamics and evolution of Earth's core". In: *Nature Geoscience* 8.9, pp. 678–685.

Mound, Jon, Chris Davies, Sebastian Rost, and Jon Aurnou (2019). "Regional stratification at the top of Earth's core due to core–mantle boundary heat flux variations". In: *Nature Geoscience*.

Appendix

Put all the work that really should have featured in the main document but you didn't have the time/space here.