`oxforddown`: Modified template for Murdoch University

Siobhon Egan

Bachelor of Science

Murdoch University

A thesis submitted for the degree of

Doctor of Philosophy

Month Year

For Johnny Cash

Acknowledgements

This is where you will normally thank your advisor, colleagues, family and friends, as well as funding and institutional support. In our case, we will give our praises to the people who developed the ideas and tools that allow us to push open science a little step forward by writing plain-text, transparent, and reproducible theses in R Markdown.

We must be grateful to John Gruber for inventing the original version of Markdown, to John MacFarlane for creating Pandoc (`http://pandoc.org`) which converts Markdown to a large number of output formats, and to Yihui Xie for creating `knitr` which introduced R Markdown as a way of embedding code in Markdown documents, and `bookdown` which added tools for technical and longer-form writing.

Special thanks to Chester Ismay, who created the `thesisdown` package that helped many a PhD student write their theses in R Markdown. And a very special thanks to John McManigle, whose adaption of Sam Evans' adaptation of Keith Gillow's original maths template for writing an Oxford University DPhil thesis in LaTeX provided the template that I in turn adapted for R Markdown.

Finally, profuse thanks to JJ Allaire, the founder and CEO of RStudio, and Hadley Wickham, the mastermind of the tidyverse without whom we'd all just given up and done data science in Python instead. Thanks for making data science easier, more accessible, and more fun for us all.

Ulrik Lyngs
Linacre College, Oxford
2 December 2018

Abstract

This *R Markdown* template is for writing an Oxford University thesis. The template is built using Yihui Xie's `bookdown` package, with heavy inspiration from Chester Ismay's `thesisdown` and the `OxThesis` LaTeX template (most recently adapted by John McManigle).

This template's sample content include illustrations of how to write a thesis in R Markdown, and largely follows the structure from this R Markdown workshop.

Congratulations for taking a step further into the lands of open, reproducible science by writing your thesis using a tool that allows you to transparently include tables and dynamically generated plots directly from the underlying data. Hip hooray!

I declare that (a) The thesis is my own account of my research, except where other sources are acknowledged, (b) All co-authors, where stated and certified by my principal Supervisor or Executive Author, have agreed that the works presented in this thesis represent substantial contributions from myself and (c) The thesis contains as its main content, work that has not been previously submitted for a degree at any other university.

Author's name

Contents

List of Figures

List of Tables

List of Abbreviations

1-D, 2-D . . . One- or two-dimensional, referring in this thesis to spatial dimensions in an image.

Otter . . . . . One of the finest of water mammals.

Hedgehog . . . Quite a nice prickly friend.

Preface

Welcome to the *R Markdown* Oxford University thesis template. This sample content is adapted from `thesisdown` and the formatting of PDF output is adapted from the OxThesis LaTeX template. Hopefully, writing your thesis in R Markdown will provide a nicer interface to the OxThesis template if you haven't used TeX or LaTeX before. More importantly, using *R Markdown* allows you to embed chunks of code directly into your thesis and generate plots and tables directly from the underlying data, avoiding copy-paste steps. This will get you into the habit of doing reproducible research, which benefits you long-term as a researcher, but also will greatly help anyone that is trying to reproduce or build upon your results down the road.

Using LaTeX together with *Markdown* is more consistent than the output of a word processor, much less prone to corruption or crashing, and the resulting file is smaller than a Word file. While you may never have had problems using Word in the past, your thesis is likely going to be about twice as large and complex as anything you've written before, taxing Word's capabilities.

Why use it?

R Markdown creates a simple and straightforward way to interface with the beauty of LaTeX. Packages have been written in **R** to work directly with LaTeX to produce nicely formatting tables and paragraphs. In addition to creating a user friendly interface to LaTeX, *R Markdown* allows you to read in your data, analyze it and to visualize it using **R**, **Python** or other languages, and provide documentation and commentary on the results of your project.

Further, it allows for results of code output to be passed inline to the commentary of your results. You'll see more on this later, focusing on **R**. If you are more into

Python or something else, you can still use *R Markdown* - see 'Other language engines' in Yihui Xie's *R Markdown: The Definitive Guide*.

Who should use it?

Anyone who needs to use data analysis, math, tables, a lot of figures, complex cross-references, or who just cares about reproducibility in research can benefit from using *R Markdown*. If you are working in 'softer' fields, the user-friendly nature of the *Markdown* syntax and its ability to keep track of and easily include figures, automatically generate a table of contents, index, references, table of figures, etc. should still make it of great benefit to your thesis project.

Below is list of relavent sections for preface material

Thesis layout

Provide background on thesis layout. Is it thesis by publication, general methods, separate studies, broken up into sections?

Project background

Is your research part of a broader study?

Ethics

List any ethics permits here.

Funding and Support

Did you receive any funding or in-kind help for the research?

State of contributions

For chapters with multiple authors clearly state contributions. See CRediT for a handy guide on author taxonomy.

List of publications

Examples may include:

- Peer review articles published during candidature relating to thesis
- Manuscripts in preparations
- Conference proceeding/abstracts - were they peer reviewed?
- Additional publications during candidature.

Further details

Always check the latest information regarding thesis guidelines and submission on the university website

Submitting your thesis

Graduate Research Degrees Regulations

Neque porro quisquam est qui dolorem ipsum quia dolor sit amet, consectetur, adipisci velit...

There is no one who loves pain itself, who seeks after it and wants to have it, simply because it is pain...

— Cicero's *de Finibus Bonorum et Malorum.*

1

R Markdown basics

Contents

Here is a brief introduction to using *R Markdown*. *Markdown* is a simple formatting

syntax for authoring HTML, PDF, and MS Word documents and much, much more. *R Markdown* provides the flexibility of *Markdown* with the implementation of **R** input and output. For more details on using *R Markdown* see `http://rmarkdown.rstudio.com`.

1.1 Basic markdown syntax

1.1.1 Whitespace

Be careful with your spacing. While whitespace largely is ignored, it does at times give markdown signals as to how to proceed. As a habit, try to keep everything left aligned whenever possible, especially as you type a new paragraph. In other words, there is no need to indent basic text in the Rmd document (in fact, it might cause your text to do funny things if you do).

1.1.2 Italics and bold

- *Italics* are done like *this* or _this_
- **Bold** is done like **this** or __this__
- ***Bold and italics*** is done like ***this***, ___this___, or (the most transparent solution, in my opinion) **_this_**

1.1.3 Inline code

- `Inline code` is created with backticks like `` `this` ``

1.1.4 Sub and superscript

Sub_2 and $super^2$ script is created like this~2~ and this^2^

1.1.5 Strikethrough

- ~~Strikethrough~~ is done ~~like this~~

1.1.6 'Escaping' (aka "What if I need an actual asterisk?")

- To include an actual *, _ or \, add another \ in front of them: *, _, \\

1.1.7 Endash (–), emdash (—)

- – and — with -- and ---

1.1.8 Blockquotes

Do like this:

> Put a > in front of the line.

1.1.9 Headings

Section headers are created with #'s of increasing number, i.e.

- # First-level heading
- ## Second-level heading
- ### Etc.

In PDF output, a level-five heading will turn into a paragraph heading, i.e. `\paragraph{My level-five heading}`, which appears as bold text on the same line as the subsequent paragraph.

1.1.10 Lists

Unordered list by starting a line with an * or a -:

- Item 1
- Item 2

Ordered lists by starting a line with a number. Notice that you can mislabel the numbers and *Markdown* will still make the order right in the output:

1. Item 1

2. Item 2

To create a sublist, indent the values a bit (at least four spaces or a tab):

1. Item 1
2. Item 2
3. Item 3
    - Item 3a
    - Item 3b

1.1.11 Line breaks

The official *Markdown* way to create line breaks is by ending a line with more than two spaces.

Roses are red. Violets are blue.

This appears on the same line in the output, because we didn't add spaces after red.

Roses are red.
Violets are blue.

This appears with a line break because I added spaces after red.

I find this is confusing, so I recommend the alternative way: Ending a line with a backslash will also create a linebreak:

Roses are red.\
Violets are blue.

To create a new paragraph, you put a blank line.

Therefore, this line starts its own paragraph.

1.1.12 Hyperlinks

- This is a hyperlink created by writing the text you want turned into a clickable link in `[square brackets followed by a](https://hyperlink-in-parentheses)`

1.1.13 Footnotes

- Are created[1] by writing either ^[my footnote text] for supplying the footnote content inline, or something like `[^a-random-footnote-label]` and supplying the text elsewhere in the format shown below [2]:

```
[^a-random-footnote-label]: This is a random test.
```

1.1.14 Comments

To write comments within your text that won't actually be included in the output, use the same syntax as for writing comments in HTML. That is, <!-- this will not be included in the output -->.

1.1.15 Math

The syntax for writing math is stolen from LaTeX. To write a math expression that will be shown **inline**, enclose it in dollar signs. - This: $A = \pi*r^{2}$ Becomes: $A = \pi * r^2$

To write a math expression that will be shown in a block, enclose it in two dollar signs.

This: $$A = \pi*r^{2}$$

Becomes:

$$A = \pi * r^2$$

To create numbered equations, put them in an 'equation' environment and give them a label with the syntax `(\#eq:label)`, like this:

```
\begin{equation}
  f\left(k\right) = \binom{n}{k} p^k\left(1-p\right)^{n-k}
  (\#eq:binom)
\end{equation}
```

[1] my footnote text
[2] This is a random test.

Becomes:

$$f\left(k\right) = \binom{n}{k} p^k \left(1-p\right)^{n-k} \tag{1.1}$$

For more (e.g. how to theorems), see e.g. the documentation on bookdown.org

1.2 Executable code chunks

The magic of R Markdown is that we can add executable code within our document to make it dynamic.

We do this either as *code chunks* (generally used for loading libraries and data, performing calculations, and adding images, plots, and tables), or *inline code* (generally used for dynamically reporting results within our text).

The syntax of a code chunk is shown in Figure 1.1.

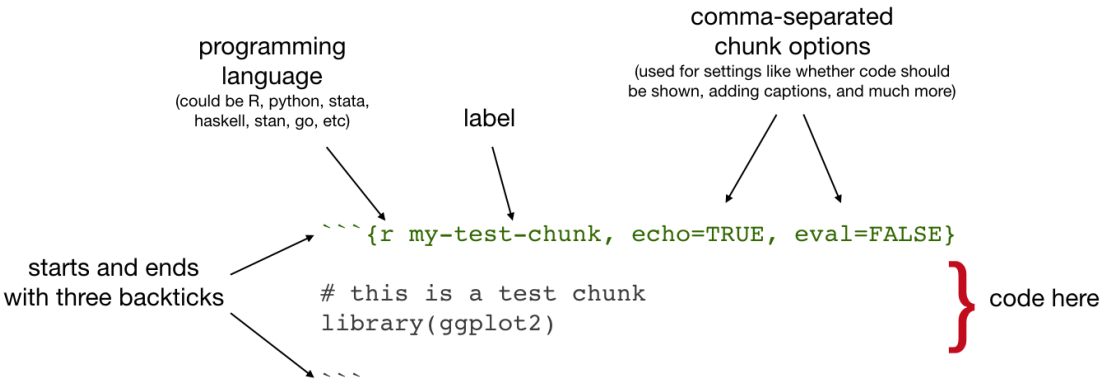


Figure 1.1: Code chunk syntax

Common chunk options include (see e.g. bookdown.org):

- `echo`: whether or not to display code in knitted output
- `eval`: whether or to to run the code in the chunk when knitting
- `include`: whether to include anything from the from a code chunk in the output document
- `fig.cap`: figure caption
- `fig.scap`: short figure caption, which will be used in the 'List of Figures' in the PDF front matter

IMPORTANT: Do *not* use underscoores in your chunk labels - if you do, you are likely to get an error in PDF output saying something like "! Package caption Error: \caption outside float".

1.2.1 Setup chunks - setup, images, plots

An R Markdown document usually begins with a chunk that is used to **load libraries**, and to **set default chunk options** with `knitr::opts_chunk$set`.

In your thesis, this will probably happen in **index.Rmd** and/or as opening chunks in each of your chapters.

````
```{r setup, include=FALSE}
# don't show code unless we explicitly set echo = TRUE
knitr::opts_chunk$set(echo = FALSE)


library(tidyverse)
```
````

1.2.2 Including images

Code chunks are also used for including images, with `include_graphics` from the `knitr` package, as in Figure 1.2

```
knitr::include_graphics("figures/sample-content/beltcrest.png")
```

Useful chunk options for figures include:

- `out.width` (use with a percentage) for setting the image size
- if you've got an image that gets waaay to big in your output, it will be constrained to the page width by setting `out.width = "100%"`

Figure rotation

You can use the chunk option `out.extra` to rotate images.

Figure 1.2: Oxford logo

The syntax is different for LaTeX and HTML, so for ease we might start by assigning the right string to a variable that depends on the format you're outputting to:

```
if (knitr::is_latex_output()){
  rotate180 <- "angle=180"
} else {
  rotate180 <- "style='transform:rotate(180deg);'"
}
```

Then you can reference that variable as the value of `out.extra` to rotate images, as in Figure 1.3.

1.2.3 Including plots

Similarly, code chunks are used for including dynamically generated plots. You use ordinary code in R or other languages - Figure 1.4 shows a plot of the `cars` dataset of stopping distances for cars at various speeds (this dataset is built in to **R**).

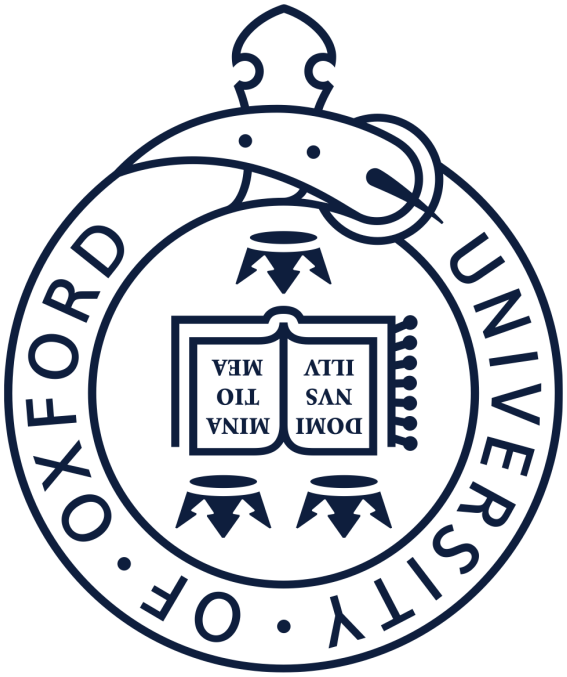


Figure 1.3: Oxford logo, rotated

```
cars %>%
  ggplot() +
    aes(x = speed, y = dist) +
    geom_point()
```

Under the hood, plots are included in your document in the same way as images - when you build the book or knit a chapter, the plot is automatically generated from your code, saved as an image, then included into the output document.

1.2.4 Including tables

Tables are usually included with the `kable` function from the `knitr` package.

Table 1.1 shows the first rows of that cars data - read in your own data, then use this approach to automatically generate tables.

```
cars %>%
  head() %>%
  knitr::kable(caption = "A knitr kable table")
```

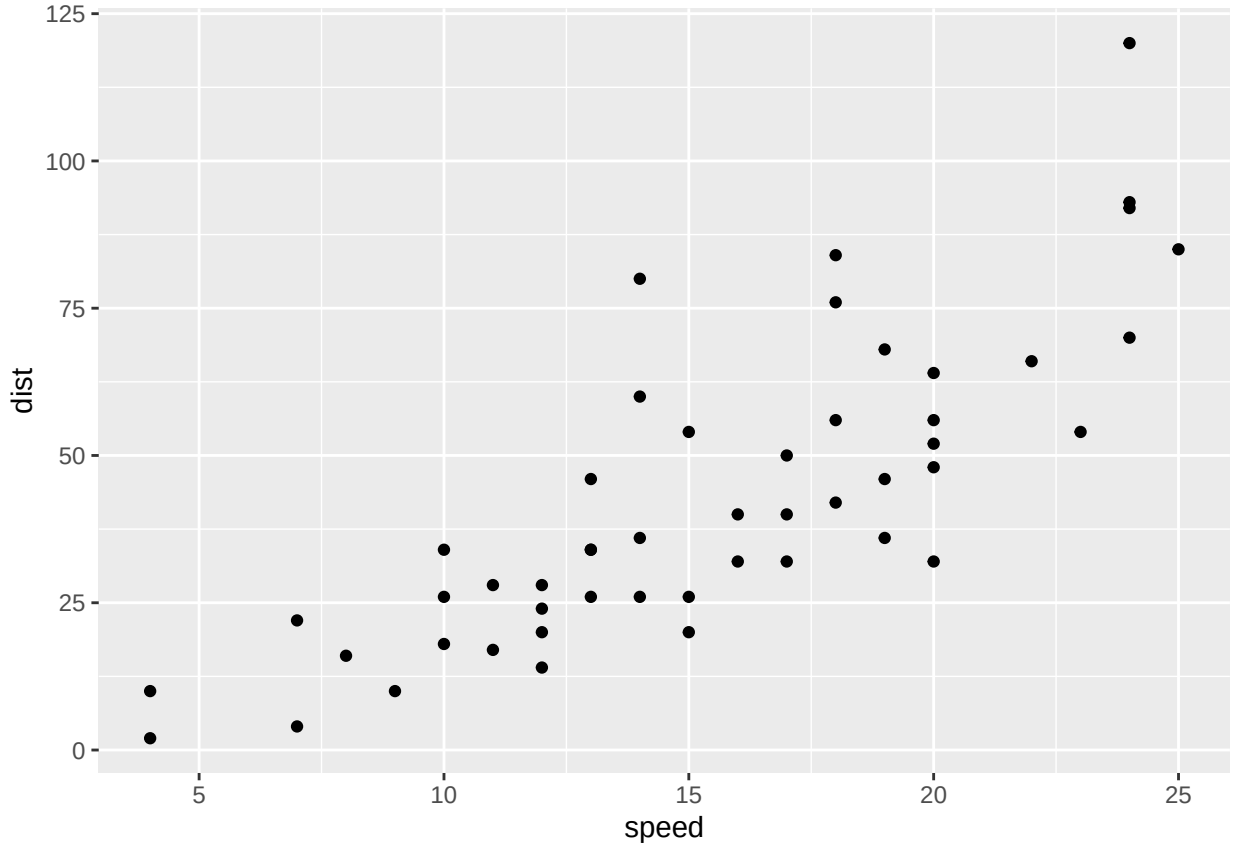


Figure 1.4: A ggplot of car stuff

Table 1.1: A knitr kable table

speed	dist
4	2
4	10
7	4
7	22
8	16
9	10

- Gotcha: when using `kable`, captions are set inside the `kable` function
- The `kable` package is often used with the `kableExtra` package

1.2.5 Control positioning

One thing that may be annoying is the way *R Markdown* handles "floats" like tables and figures. In your PDF output, LaTeX will try to find the best place to put your object based on the text around it and until you're really, truly done

writing you should just leave it where it lies.

In general, you should allow LaTeX to do this, but if you really *really* need a figure to be positioned where you put in the document, then you can make LaTeX attempt to do this with the chunk option `fig.pos="H"`, as in Figure 1.5:

```
knitr::include_graphics("figures/sample-content/beltcrest.png")
```

Figure 1.5: An Oxford logo that LaTeX will try to place at this position in the text

As anyone who has tried to manually play around with the placement of figures in a Word document knows, this can have lots of side effects with extra spacing on other pages, etc. Therefore, it is not generally a good idea to do this - only do it when you really need to ensure that an image follows directly under text where you refer to it (in this document, I needed to do this for Figure 3.1 in section 3.1.4). For more details, read the relevant section of the [R Markdown Cookbook]`https://bookdown.org/yihui/rmarkdown-cookbook/figure-placement.html`).

1.3 Executable inline code

'Inline code' simply means inclusion of code inside text. The syntax for doing this is `` `r R_CODE` `` For example, `` `r 4 + 4` `` will output 8 in your text.

You will usually use this in parts of your thesis where you report results - read in data or results in a code chunk, store things you want to report in a variable, then insert the value of that variable in your text. For example, we might assign the number of rows in the `cars` dataset to a variable:

```
num_car_observations <- nrow(cars)
```

We might then write:

"In the `cars` dataset, we have `` `r num_car_observations` `` observations."

Which would output:

"In the `cars` dataset, we have 50 observations."

1.4 Executable code in other languages than R

If you want to use other languages than R, such as Python, Julia C++, or SQL, see the relevant section of the *R Markdown Cookbook*

Thesis aims

2

Citations, cross-references, and collaboration

2.1 Citations

The usual way to include citations in an *R Markdown* document is to put references in a plain text file with the extension **.bib**, in **BibTex** format.[1] Then reference the path to this file in **index.Rmd**'s YAML header with `bibliography: example.bib`.

Most reference managers can create a .bib file with you references automatically. However, the **by far** best reference manager to use with *R Markdown* is Zotero with the Better BibTex plug-in, because the `citr` plugin for RStudio (see below) can read references directly from your Zotero library!

Here is an example of an entry in a **.bib** file:

```
@article{Shea2014,
  author =        {Shea, Nicholas and Boldt, Annika},
  journal =       {Trends in Cognitive Sciences},
  pages =         {186--193},
  title =         {{Supra-personal cognitive control}},
```

[1] The bibliography can be in other formats as well, including EndNote (**.enl**) and RIS (**.ris**), see rmarkdown.rstudio.com/authoring_bibliographies_and_citations.

```
  volume =        {18},
  year =          {2014},
  doi =           {10.1016/j.tics.2014.01.006},
}
```

In this entry highlighed section, 'Shea2014' is the **citation identifier**. To default way to cite an entry in your text is with this syntax: `[@citation-identifier]`.

So I might cite some things (Shea et al. 2014; Lottridge et al. 2012).

2.1.1 PDF output

In PDF output, the bibliography is handled by the OxThesis LaTeX template. If you set `bib-humanities: true` in **index.Rmd**, then in-text references will be formatted as author-year; otherwise references will be shown as numbers.

If you choose author-year formatting, a number of variations on the citation syntax are useful to know:

- Put author names outside the parenthesis
  - This: `@Shea2014 says blah.`
  - Becomes: Shea et al. (2014) says blah.
- Include only the citation-year (in parenthesis)
  - This: `Shea et al. says blah [-@Shea2014]`
  - Becomes: Shea et al. says blah (2014)
- Add text and page or chapter references to the citation
  - This: `[see @Shea2014, pp. 33-35; also @Wu2016, ch. 1]`
  - Becomes: Blah blah (see Shea et al. 2014, pp. 33-35; also Wu 2016, ch. 1).

2.1.2 Gitbook output

In gitbook output, citations are by default inserted in the Chicago author-date format.

To change the format, add `csl: some-other-style.csl` in **index.Rmd**'s YAML header. You can browse through and download styles at zotero.org/styles.

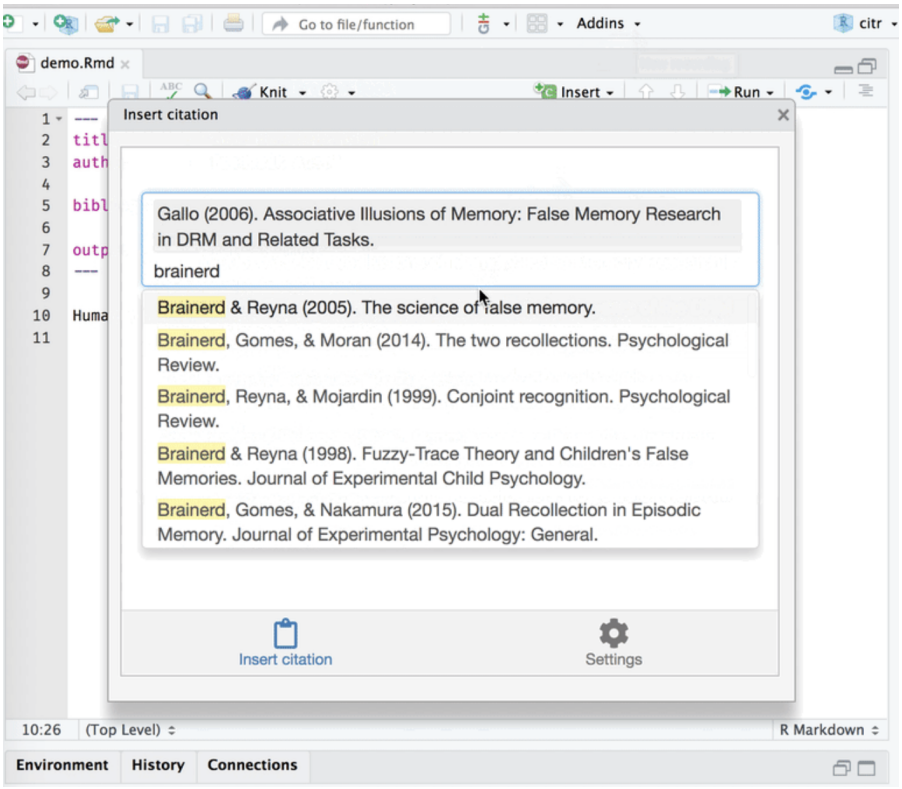


Figure 2.1: The 'citr' add-in

2.1.3 Insert references easily with the `citr` add-in

For an easy way to insert citations, try the `citr` RStudio add-in (Figure 2.1). You can install this add-in by typing `install.packages("citr")` in the R Console.

2.2 Cross-referencing

We can make cross-references to **sections** within our document, as well as to **figures** (images and plots) and **tables**.

The general cross-referencing syntax is `\@ref(label)`

2.2.1 Section references

Headers are automatically assigned a reference label, which is the text in lower caps separated by dashes. For example, `# My header` is automatically given the label `my-header`. So `# My header` can be referenced with `\@ref(my-section)`

Remember what we wrote in section 2.1?

We can also use **hyperlink syntax** and add # before the label, though this is only guaranteed to work properly in HTML output:

- So if we write `Remember what we wrote up in [the previous section](#citations)?`
- It becomes Remember what we wrote up in the previous section?

Creating custom labels

It is a very good idea to create **custom labels** for our sections. This is because the automatically assigned labels will change when we change the titles of the sections - to avoid this, we can create the labels ourselves and leave them untouched if we change the section titles.

We create custom labels by adding {`#label`} after a header, e.g. `# My section {#my-label}`. See our chapter title for an example. That was section 2.

2.2.2 Figure (image and plot) references

- To refer to figures (i.e. images and plots) use the syntax `\@ref(fig:label)`
- **GOTCHA**: Figures and tables must have captions if you wish to cross-reference them.

Let's add an image:

```
knitr::include_graphics("figures/sample-content/captain.jpeg")
```

We refer to this image with `\@ref(fig:captain)`. So Figure 2.2 is this image.

And in Figure 1.4 we saw a cars plot.

2.2.3 Table references

- To refer to tables use the syntax `\@ref(tab:label)`

Let's include a table:

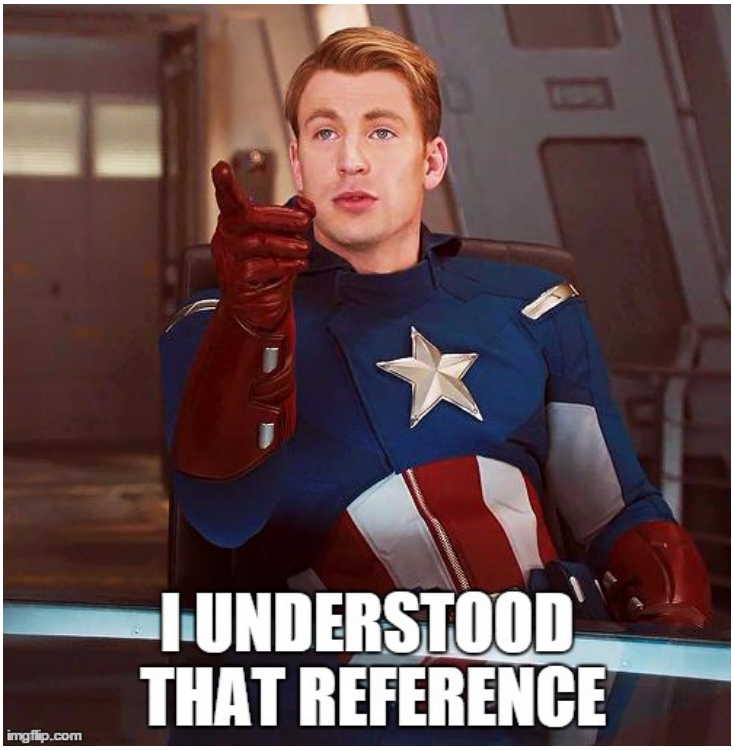


Figure 2.2: A marvel-lous meme

Table 2.1: Stopping cars

speed	dist
4	2
4	10
7	4
7	22
8	16

```
knitr::kable(cars[1:5,],
             caption="Stopping cars")
```

We refer to this table with `\@ref(tab:cars-table2)`. So Table 2.1 is this table. And in Table 1.1 we saw more or less the same cars table.

2.2.4 Including page numbers

Finally, in the PDF output we might also want to include the page number of a reference, so that it's easy to find in physical printed output. LaTeX has a command for this, which looks like this: `\pageref{fig/tab:label}` (note: curly

braces, not parentheses)

When we output to PDF, we can use raw LaTeX directly in our .Rmd files. So if we wanted to include the page of the cars plot we could write:

- This: `Figure \@ref(fig:cars-plot) on page \pageref(fig:cars-plot)`
- Becomes: Figure 1.4 on page 13

Include page numbers only in PDF output

A problem here is that LaTeX commands don't display in HTML output, so in the gitbook output we'd see simply "Figure 1.4 on page".

One way to get around this is to use inline R code to insert the text, and use an `ifelse` statement to check the output format and then insert the appropriate text.

- So this: `` `r ifelse(knitr::is_latex_output(), "Figure \\@ref(fig:cars-plot) on page \\pageref{fig:cars-plot}", "")` ``
- Inserts this (check this on both PDF and gitbook): Figure 1.4 on page 13

Note that we need to escape the backslash with another backslash here to get the correct output.

2.3 Collaborative writing

Best practices for collaboration and change tracking when using R Markdown are still an open question. In the blog post **One year to dissertate** by Lucy D'Agostino, which I highly recommend, the author notes that she knits .Rmd files to a word document, then uses the `googledrive` R package to send this to Google Drive for comments / revisions from co-authors, then incorporates Google Drive suggestions *by hand* into the .Rmd source files. This is a bit clunky, and there are ongoing discussions among the *R Markdown* developers about what the best way is to handle collaborative writing (see issue #1463 on GitHub, where CriticMarkup is among the suggestions).

2. Citations and cross-refs

For now, this is an open question in the community of R Markdown users. I often knit to a format that can easily be imported to Google Docs for comments, then go over suggested revisions and manually incorporate them back in to the .Rmd source files. For articles, I sometimes upload a near-final draft to Overleaf, then collaboratively make final edits to the LaTeX file there. I suspect some great solution will be developed in the not-to-distant future, probably by the RStudio team.

2.4 Additional resources

- *R Markdown: The Definitive Guide* - `https://bookdown.org/yihui/rmarkdown/`
- *R for Data Science* - `https://r4ds.had.co.nz`

3

Tables

Contents

3.1 Making LaTeX tables play nice

Dealing with tables in LaTeX can be painful. This section explains the main tricks you need to make the pain go away.

(Note: if you are looking at the ebook version, you will not see much difference in this section, as it is only relevant for PDF output!)

3.1.1 Making your table pretty

When you use `kable` to create tables, you will almost certainly want to set the option `booktabs = TRUE`. This makes your table look a million times better:

```
library(knitr)
library(tidyverse)


head(mtcars) %>%
  kable(booktabs = TRUE)
```

	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
Mazda RX4	21.0	6	160	110	3.90	2.620	16.46	0	1	4	4
Mazda RX4 Wag	21.0	6	160	110	3.90	2.875	17.02	0	1	4	4
Datsun 710	22.8	4	108	93	3.85	2.320	18.61	1	1	4	1
Hornet 4 Drive	21.4	6	258	110	3.08	3.215	19.44	1	0	3	1
Hornet Sportabout	18.7	8	360	175	3.15	3.440	17.02	0	0	3	2
Valiant	18.1	6	225	105	2.76	3.460	20.22	1	0	3	1

Compare this to the default style, which looks terrible:

```
head(mtcars) %>%
  kable()
```

	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
Mazda RX4	21.0	6	160	110	3.90	2.620	16.46	0	1	4	4
Mazda RX4 Wag	21.0	6	160	110	3.90	2.875	17.02	0	1	4	4
Datsun 710	22.8	4	108	93	3.85	2.320	18.61	1	1	4	1
Hornet 4 Drive	21.4	6	258	110	3.08	3.215	19.44	1	0	3	1
Hornet Sportabout	18.7	8	360	175	3.15	3.440	17.02	0	0	3	2
Valiant	18.1	6	225	105	2.76	3.460	20.22	1	0	3	1

3.1.2 If your table is too wide

You might find that your table expands into the margins of the page, like the tables above. Fix this with the `kable_styling` function from the `kableExtra` package:

```
library(kableExtra)


head(mtcars) %>%
```

	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
Mazda RX4	21.0	6	160	110	3.90	2.620	16.46	0	1	4	4
Mazda RX4 Wag	21.0	6	160	110	3.90	2.875	17.02	0	1	4	4
Datsun 710	22.8	4	108	93	3.85	2.320	18.61	1	1	4	1
Hornet 4 Drive	21.4	6	258	110	3.08	3.215	19.44	1	0	3	1
Hornet Sportabout	18.7	8	360	175	3.15	3.440	17.02	0	0	3	2
Valiant	18.1	6	225	105	2.76	3.460	20.22	1	0	3	1

```
kable(booktabs = TRUE) %>%
kable_styling(latex_options = "scale_down")
```

This scales down the table to fit the page width.

3.1.3 If your table is too long

If your table is too long to fit on a single page, set `longtable = TRUE` in the `kable` function to split the table across multiple pages.

```
a_long_table <- rbind(mtcars, mtcars)


a_long_table %>%
  select(1:8) %>%
  kable(booktabs = TRUE, longtable = TRUE)
```

	mpg	cyl	disp	hp	drat	wt	qsec	vs
Mazda RX4	21.0	6	160.0	110	3.90	2.620	16.46	0
Mazda RX4 Wag	21.0	6	160.0	110	3.90	2.875	17.02	0
Datsun 710	22.8	4	108.0	93	3.85	2.320	18.61	1
Hornet 4 Drive	21.4	6	258.0	110	3.08	3.215	19.44	1
Hornet Sportabout	18.7	8	360.0	175	3.15	3.440	17.02	0
Valiant	18.1	6	225.0	105	2.76	3.460	20.22	1
Duster 360	14.3	8	360.0	245	3.21	3.570	15.84	0
Merc 240D	24.4	4	146.7	62	3.69	3.190	20.00	1
Merc 230	22.8	4	140.8	95	3.92	3.150	22.90	1
Merc 280	19.2	6	167.6	123	3.92	3.440	18.30	1
Merc 280C	17.8	6	167.6	123	3.92	3.440	18.90	1
Merc 450SE	16.4	8	275.8	180	3.07	4.070	17.40	0
Merc 450SL	17.3	8	275.8	180	3.07	3.730	17.60	0
Merc 450SLC	15.2	8	275.8	180	3.07	3.780	18.00	0

Cadillac Fleetwood	10.4	8	472.0	205	2.93	5.250	17.98	0
Lincoln Continental	10.4	8	460.0	215	3.00	5.424	17.82	0
Chrysler Imperial	14.7	8	440.0	230	3.23	5.345	17.42	0
Fiat 128	32.4	4	78.7	66	4.08	2.200	19.47	1
Honda Civic	30.4	4	75.7	52	4.93	1.615	18.52	1
Toyota Corolla	33.9	4	71.1	65	4.22	1.835	19.90	1
Toyota Corona	21.5	4	120.1	97	3.70	2.465	20.01	1
Dodge Challenger	15.5	8	318.0	150	2.76	3.520	16.87	0
AMC Javelin	15.2	8	304.0	150	3.15	3.435	17.30	0
Camaro Z28	13.3	8	350.0	245	3.73	3.840	15.41	0
Pontiac Firebird	19.2	8	400.0	175	3.08	3.845	17.05	0
Fiat X1-9	27.3	4	79.0	66	4.08	1.935	18.90	1
Porsche 914-2	26.0	4	120.3	91	4.43	2.140	16.70	0
Lotus Europa	30.4	4	95.1	113	3.77	1.513	16.90	1
Ford Pantera L	15.8	8	351.0	264	4.22	3.170	14.50	0
Ferrari Dino	19.7	6	145.0	175	3.62	2.770	15.50	0
Maserati Bora	15.0	8	301.0	335	3.54	3.570	14.60	0
Volvo 142E	21.4	4	121.0	109	4.11	2.780	18.60	1
Mazda RX41	21.0	6	160.0	110	3.90	2.620	16.46	0
Mazda RX4 Wag1	21.0	6	160.0	110	3.90	2.875	17.02	0
Datsun 7101	22.8	4	108.0	93	3.85	2.320	18.61	1
Hornet 4 Drive1	21.4	6	258.0	110	3.08	3.215	19.44	1
Hornet Sportabout1	18.7	8	360.0	175	3.15	3.440	17.02	0
Valiant1	18.1	6	225.0	105	2.76	3.460	20.22	1
Duster 3601	14.3	8	360.0	245	3.21	3.570	15.84	0
Merc 240D1	24.4	4	146.7	62	3.69	3.190	20.00	1
Merc 2301	22.8	4	140.8	95	3.92	3.150	22.90	1
Merc 2801	19.2	6	167.6	123	3.92	3.440	18.30	1
Merc 280C1	17.8	6	167.6	123	3.92	3.440	18.90	1
Merc 450SE1	16.4	8	275.8	180	3.07	4.070	17.40	0
Merc 450SL1	17.3	8	275.8	180	3.07	3.730	17.60	0
Merc 450SLC1	15.2	8	275.8	180	3.07	3.780	18.00	0
Cadillac Fleetwood1	10.4	8	472.0	205	2.93	5.250	17.98	0
Lincoln Continental1	10.4	8	460.0	215	3.00	5.424	17.82	0
Chrysler Imperial1	14.7	8	440.0	230	3.23	5.345	17.42	0
Fiat 1281	32.4	4	78.7	66	4.08	2.200	19.47	1
Honda Civic1	30.4	4	75.7	52	4.93	1.615	18.52	1
Toyota Corolla1	33.9	4	71.1	65	4.22	1.835	19.90	1
Toyota Corona1	21.5	4	120.1	97	3.70	2.465	20.01	1
Dodge Challenger1	15.5	8	318.0	150	2.76	3.520	16.87	0
AMC Javelin1	15.2	8	304.0	150	3.15	3.435	17.30	0
Camaro Z281	13.3	8	350.0	245	3.73	3.840	15.41	0

Pontiac Firebird1	19.2	8	400.0	175	3.08	3.845	17.05	0
Fiat X1-91	27.3	4	79.0	66	4.08	1.935	18.90	1
Porsche 914-21	26.0	4	120.3	91	4.43	2.140	16.70	0
Lotus Europa1	30.4	4	95.1	113	3.77	1.513	16.90	1
Ford Pantera L1	15.8	8	351.0	264	4.22	3.170	14.50	0
Ferrari Dino1	19.7	6	145.0	175	3.62	2.770	15.50	0
Maserati Bora1	15.0	8	301.0	335	3.54	3.570	14.60	0
Volvo 142E1	21.4	4	121.0	109	4.11	2.780	18.60	1

When you do this, you'll probably want to make the header repeat on new pages. Do this with the `kable_styling` function from `kableExtra`:

```
a_long_table %>%
  kable(booktabs = TRUE, longtable = TRUE) %>%
  kable_styling(latex_options = "repeat_header")
```

	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
Mazda RX4	21.0	6	160.0	110	3.90	2.620	16.46	0	1	4	4
Mazda RX4 Wag	21.0	6	160.0	110	3.90	2.875	17.02	0	1	4	4
Datsun 710	22.8	4	108.0	93	3.85	2.320	18.61	1	1	4	1
Hornet 4 Drive	21.4	6	258.0	110	3.08	3.215	19.44	1	0	3	1
Hornet Sportabout	18.7	8	360.0	175	3.15	3.440	17.02	0	0	3	2
Valiant	18.1	6	225.0	105	2.76	3.460	20.22	1	0	3	1
Duster 360	14.3	8	360.0	245	3.21	3.570	15.84	0	0	3	4
Merc 240D	24.4	4	146.7	62	3.69	3.190	20.00	1	0	4	2
Merc 230	22.8	4	140.8	95	3.92	3.150	22.90	1	0	4	2
Merc 280	19.2	6	167.6	123	3.92	3.440	18.30	1	0	4	4
Merc 280C	17.8	6	167.6	123	3.92	3.440	18.90	1	0	4	4
Merc 450SE	16.4	8	275.8	180	3.07	4.070	17.40	0	0	3	3
Merc 450SL	17.3	8	275.8	180	3.07	3.730	17.60	0	0	3	3
Merc 450SLC	15.2	8	275.8	180	3.07	3.780	18.00	0	0	3	3
Cadillac Fleetwood	10.4	8	472.0	205	2.93	5.250	17.98	0	0	3	4
Lincoln Continental	10.4	8	460.0	215	3.00	5.424	17.82	0	0	3	4
Chrysler Imperial	14.7	8	440.0	230	3.23	5.345	17.42	0	0	3	4
Fiat 128	32.4	4	78.7	66	4.08	2.200	19.47	1	1	4	1
Honda Civic	30.4	4	75.7	52	4.93	1.615	18.52	1	1	4	2
Toyota Corolla	33.9	4	71.1	65	4.22	1.835	19.90	1	1	4	1
Toyota Corona	21.5	4	120.1	97	3.70	2.465	20.01	1	0	3	1
Dodge Challenger	15.5	8	318.0	150	2.76	3.520	16.87	0	0	3	2
AMC Javelin	15.2	8	304.0	150	3.15	3.435	17.30	0	0	3	2
Camaro Z28	13.3	8	350.0	245	3.73	3.840	15.41	0	0	3	4

(continued)

	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
Pontiac Firebird	19.2	8	400.0	175	3.08	3.845	17.05	0	0	3	2
Fiat X1-9	27.3	4	79.0	66	4.08	1.935	18.90	1	1	4	1
Porsche 914-2	26.0	4	120.3	91	4.43	2.140	16.70	0	1	5	2
Lotus Europa	30.4	4	95.1	113	3.77	1.513	16.90	1	1	5	2
Ford Pantera L	15.8	8	351.0	264	4.22	3.170	14.50	0	1	5	4
Ferrari Dino	19.7	6	145.0	175	3.62	2.770	15.50	0	1	5	6
Maserati Bora	15.0	8	301.0	335	3.54	3.570	14.60	0	1	5	8
Volvo 142E	21.4	4	121.0	109	4.11	2.780	18.60	1	1	4	2
Mazda RX41	21.0	6	160.0	110	3.90	2.620	16.46	0	1	4	4
Mazda RX4 Wag1	21.0	6	160.0	110	3.90	2.875	17.02	0	1	4	4
Datsun 7101	22.8	4	108.0	93	3.85	2.320	18.61	1	1	4	1
Hornet 4 Drive1	21.4	6	258.0	110	3.08	3.215	19.44	1	0	3	1
Hornet Sportabout1	18.7	8	360.0	175	3.15	3.440	17.02	0	0	3	2
Valiant1	18.1	6	225.0	105	2.76	3.460	20.22	1	0	3	1
Duster 3601	14.3	8	360.0	245	3.21	3.570	15.84	0	0	3	4
Merc 240D1	24.4	4	146.7	62	3.69	3.190	20.00	1	0	4	2
Merc 2301	22.8	4	140.8	95	3.92	3.150	22.90	1	0	4	2
Merc 2801	19.2	6	167.6	123	3.92	3.440	18.30	1	0	4	4
Merc 280C1	17.8	6	167.6	123	3.92	3.440	18.90	1	0	4	4
Merc 450SE1	16.4	8	275.8	180	3.07	4.070	17.40	0	0	3	3
Merc 450SL1	17.3	8	275.8	180	3.07	3.730	17.60	0	0	3	3
Merc 450SLC1	15.2	8	275.8	180	3.07	3.780	18.00	0	0	3	3
Cadillac Fleetwood1	10.4	8	472.0	205	2.93	5.250	17.98	0	0	3	4
Lincoln Continental1	10.4	8	460.0	215	3.00	5.424	17.82	0	0	3	4
Chrysler Imperial1	14.7	8	440.0	230	3.23	5.345	17.42	0	0	3	4
Fiat 1281	32.4	4	78.7	66	4.08	2.200	19.47	1	1	4	1
Honda Civic1	30.4	4	75.7	52	4.93	1.615	18.52	1	1	4	2
Toyota Corolla1	33.9	4	71.1	65	4.22	1.835	19.90	1	1	4	1
Toyota Corona1	21.5	4	120.1	97	3.70	2.465	20.01	1	0	3	1
Dodge Challenger1	15.5	8	318.0	150	2.76	3.520	16.87	0	0	3	2
AMC Javelin1	15.2	8	304.0	150	3.15	3.435	17.30	0	0	3	2
Camaro Z281	13.3	8	350.0	245	3.73	3.840	15.41	0	0	3	4
Pontiac Firebird1	19.2	8	400.0	175	3.08	3.845	17.05	0	0	3	2
Fiat X1-91	27.3	4	79.0	66	4.08	1.935	18.90	1	1	4	1
Porsche 914-21	26.0	4	120.3	91	4.43	2.140	16.70	0	1	5	2
Lotus Europa1	30.4	4	95.1	113	3.77	1.513	16.90	1	1	5	2
Ford Pantera L1	15.8	8	351.0	264	4.22	3.170	14.50	0	1	5	4
Ferrari Dino1	19.7	6	145.0	175	3.62	2.770	15.50	0	1	5	6
Maserati Bora1	15.0	8	301.0	335	3.54	3.570	14.60	0	1	5	8
Volvo 142E1	21.4	4	121.0	109	4.11	2.780	18.60	1	1	4	2

(continued)

	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb

Unfortunately, we cannot use the `scale_down` option with a `longtable`. So if a `longtable` is too wide, you can either manually adjust the font size, or show the table in landscape layout. To adjust the font size, use kableExtra's `font_size` option:

```
a_long_table %>%
  kable(booktabs = TRUE, longtable = TRUE) %>%
  kable_styling(font_size = 9, latex_options = "repeat_header")
```

	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
Mazda RX4	21.0	6	160.0	110	3.90	2.620	16.46	0	1	4	4
Mazda RX4 Wag	21.0	6	160.0	110	3.90	2.875	17.02	0	1	4	4
Datsun 710	22.8	4	108.0	93	3.85	2.320	18.61	1	1	4	1
Hornet 4 Drive	21.4	6	258.0	110	3.08	3.215	19.44	1	0	3	1
Hornet Sportabout	18.7	8	360.0	175	3.15	3.440	17.02	0	0	3	2
Valiant	18.1	6	225.0	105	2.76	3.460	20.22	1	0	3	1
Duster 360	14.3	8	360.0	245	3.21	3.570	15.84	0	0	3	4
Merc 240D	24.4	4	146.7	62	3.69	3.190	20.00	1	0	4	2
Merc 230	22.8	4	140.8	95	3.92	3.150	22.90	1	0	4	2
Merc 280	19.2	6	167.6	123	3.92	3.440	18.30	1	0	4	4
Merc 280C	17.8	6	167.6	123	3.92	3.440	18.90	1	0	4	4
Merc 450SE	16.4	8	275.8	180	3.07	4.070	17.40	0	0	3	3
Merc 450SL	17.3	8	275.8	180	3.07	3.730	17.60	0	0	3	3
Merc 450SLC	15.2	8	275.8	180	3.07	3.780	18.00	0	0	3	3
Cadillac Fleetwood	10.4	8	472.0	205	2.93	5.250	17.98	0	0	3	4
Lincoln Continental	10.4	8	460.0	215	3.00	5.424	17.82	0	0	3	4
Chrysler Imperial	14.7	8	440.0	230	3.23	5.345	17.42	0	0	3	4
Fiat 128	32.4	4	78.7	66	4.08	2.200	19.47	1	1	4	1
Honda Civic	30.4	4	75.7	52	4.93	1.615	18.52	1	1	4	2
Toyota Corolla	33.9	4	71.1	65	4.22	1.835	19.90	1	1	4	1
Toyota Corona	21.5	4	120.1	97	3.70	2.465	20.01	1	0	3	1
Dodge Challenger	15.5	8	318.0	150	2.76	3.520	16.87	0	0	3	2
AMC Javelin	15.2	8	304.0	150	3.15	3.435	17.30	0	0	3	2
Camaro Z28	13.3	8	350.0	245	3.73	3.840	15.41	0	0	3	4
Pontiac Firebird	19.2	8	400.0	175	3.08	3.845	17.05	0	0	3	2
Fiat X1-9	27.3	4	79.0	66	4.08	1.935	18.90	1	1	4	1
Porsche 914-2	26.0	4	120.3	91	4.43	2.140	16.70	0	1	5	2
Lotus Europa	30.4	4	95.1	113	3.77	1.513	16.90	1	1	5	2
Ford Pantera L	15.8	8	351.0	264	4.22	3.170	14.50	0	1	5	4
Ferrari Dino	19.7	6	145.0	175	3.62	2.770	15.50	0	1	5	6
Maserati Bora	15.0	8	301.0	335	3.54	3.570	14.60	0	1	5	8
Volvo 142E	21.4	4	121.0	109	4.11	2.780	18.60	1	1	4	2
Mazda RX41	21.0	6	160.0	110	3.90	2.620	16.46	0	1	4	4
Mazda RX4 Wag1	21.0	6	160.0	110	3.90	2.875	17.02	0	1	4	4
Datsun 7101	22.8	4	108.0	93	3.85	2.320	18.61	1	1	4	1
Hornet 4 Drive1	21.4	6	258.0	110	3.08	3.215	19.44	1	0	3	1

(continued)

	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
Hornet Sportabout1	18.7	8	360.0	175	3.15	3.440	17.02	0	0	3	2
Valiant1	18.1	6	225.0	105	2.76	3.460	20.22	1	0	3	1
Duster 3601	14.3	8	360.0	245	3.21	3.570	15.84	0	0	3	4
Merc 240D1	24.4	4	146.7	62	3.69	3.190	20.00	1	0	4	2
Merc 2301	22.8	4	140.8	95	3.92	3.150	22.90	1	0	4	2
Merc 2801	19.2	6	167.6	123	3.92	3.440	18.30	1	0	4	4
Merc 280C1	17.8	6	167.6	123	3.92	3.440	18.90	1	0	4	4
Merc 450SE1	16.4	8	275.8	180	3.07	4.070	17.40	0	0	3	3
Merc 450SL1	17.3	8	275.8	180	3.07	3.730	17.60	0	0	3	3
Merc 450SLC1	15.2	8	275.8	180	3.07	3.780	18.00	0	0	3	3
Cadillac Fleetwood1	10.4	8	472.0	205	2.93	5.250	17.98	0	0	3	4
Lincoln Continental1	10.4	8	460.0	215	3.00	5.424	17.82	0	0	3	4
Chrysler Imperial1	14.7	8	440.0	230	3.23	5.345	17.42	0	0	3	4
Fiat 1281	32.4	4	78.7	66	4.08	2.200	19.47	1	1	4	1
Honda Civic1	30.4	4	75.7	52	4.93	1.615	18.52	1	1	4	2
Toyota Corolla1	33.9	4	71.1	65	4.22	1.835	19.90	1	1	4	1
Toyota Corona1	21.5	4	120.1	97	3.70	2.465	20.01	1	0	3	1
Dodge Challenger1	15.5	8	318.0	150	2.76	3.520	16.87	0	0	3	2
AMC Javelin1	15.2	8	304.0	150	3.15	3.435	17.30	0	0	3	2
Camaro Z281	13.3	8	350.0	245	3.73	3.840	15.41	0	0	3	4
Pontiac Firebird1	19.2	8	400.0	175	3.08	3.845	17.05	0	0	3	2
Fiat X1-91	27.3	4	79.0	66	4.08	1.935	18.90	1	1	4	1
Porsche 914-21	26.0	4	120.3	91	4.43	2.140	16.70	0	1	5	2
Lotus Europa1	30.4	4	95.1	113	3.77	1.513	16.90	1	1	5	2
Ford Pantera L1	15.8	8	351.0	264	4.22	3.170	14.50	0	1	5	4
Ferrari Dino1	19.7	6	145.0	175	3.62	2.770	15.50	0	1	5	6
Maserati Bora1	15.0	8	301.0	335	3.54	3.570	14.60	0	1	5	8
Volvo 142E1	21.4	4	121.0	109	4.11	2.780	18.60	1	1	4	2

To put the table in landscape mode, use kableExtra's `landscape` function:

```
a_long_table %>%
  kable(booktabs = TRUE, longtable = TRUE) %>%
  kable_styling(latex_options = "repeat_header") %>%
  landscape()
```

	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
Mazda RX4	21.0	6	160.0	110	3.90	2.620	16.46	0	1	4	4
Mazda RX4 Wag	21.0	6	160.0	110	3.90	2.875	17.02	0	1	4	4
Datsun 710	22.8	4	108.0	93	3.85	2.320	18.61	1	1	4	1
Hornet 4 Drive	21.4	6	258.0	110	3.08	3.215	19.44	1	0	3	1
Hornet Sportabout	18.7	8	360.0	175	3.15	3.440	17.02	0	0	3	2
Valiant	18.1	6	225.0	105	2.76	3.460	20.22	1	0	3	1
Duster 360	14.3	8	360.0	245	3.21	3.570	15.84	0	0	3	4
Merc 240D	24.4	4	146.7	62	3.69	3.190	20.00	1	0	4	2
Merc 230	22.8	4	140.8	95	3.92	3.150	22.90	1	0	4	2
Merc 280	19.2	6	167.6	123	3.92	3.440	18.30	1	0	4	4
Merc 280C	17.8	6	167.6	123	3.92	3.440	18.90	1	0	4	4
Merc 450SE	16.4	8	275.8	180	3.07	4.070	17.40	0	0	3	3
Merc 450SL	17.3	8	275.8	180	3.07	3.730	17.60	0	0	3	3
Merc 450SLC	15.2	8	275.8	180	3.07	3.780	18.00	0	0	3	3
Cadillac Fleetwood	10.4	8	472.0	205	2.93	5.250	17.98	0	0	3	4
Lincoln Continental	10.4	8	460.0	215	3.00	5.424	17.82	0	0	3	4
Chrysler Imperial	14.7	8	440.0	230	3.23	5.345	17.42	0	0	3	4
Fiat 128	32.4	4	78.7	66	4.08	2.200	19.47	1	1	4	1
Honda Civic	30.4	4	75.7	52	4.93	1.615	18.52	1	1	4	2
Toyota Corolla	33.9	4	71.1	65	4.22	1.835	19.90	1	1	4	1
Toyota Corona	21.5	4	120.1	97	3.70	2.465	20.01	1	0	3	1
Dodge Challenger	15.5	8	318.0	150	2.76	3.520	16.87	0	0	3	2
AMC Javelin	15.2	8	304.0	150	3.15	3.435	17.30	0	0	3	2
Camaro Z28	13.3	8	350.0	245	3.73	3.840	15.41	0	0	3	4
Pontiac Firebird	19.2	8	400.0	175	3.08	3.845	17.05	0	0	3	2

(continued)

	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
Fiat X1-9	27.3	4	79.0	66	4.08	1.935	18.90	1	1	4	1
Porsche 914-2	26.0	4	120.3	91	4.43	2.140	16.70	0	1	5	2
Lotus Europa	30.4	4	95.1	113	3.77	1.513	16.90	1	1	5	2
Ford Pantera L	15.8	8	351.0	264	4.22	3.170	14.50	0	1	5	4
Ferrari Dino	19.7	6	145.0	175	3.62	2.770	15.50	0	1	5	6
Maserati Bora	15.0	8	301.0	335	3.54	3.570	14.60	0	1	5	8
Volvo 142E	21.4	4	121.0	109	4.11	2.780	18.60	1	1	4	2
Mazda RX41	21.0	6	160.0	110	3.90	2.620	16.46	0	1	4	4
Mazda RX4 Wag1	21.0	6	160.0	110	3.90	2.875	17.02	0	1	4	4
Datsun 7101	22.8	4	108.0	93	3.85	2.320	18.61	1	1	4	1
Hornet 4 Drive1	21.4	6	258.0	110	3.08	3.215	19.44	1	0	3	1
Hornet Sportabout1	18.7	8	360.0	175	3.15	3.440	17.02	0	0	3	2
Valiant1	18.1	6	225.0	105	2.76	3.460	20.22	1	0	3	1
Duster 3601	14.3	8	360.0	245	3.21	3.570	15.84	0	0	3	4
Merc 240D1	24.4	4	146.7	62	3.69	3.190	20.00	1	0	4	2
Merc 2301	22.8	4	140.8	95	3.92	3.150	22.90	1	0	4	2
Merc 2801	19.2	6	167.6	123	3.92	3.440	18.30	1	0	4	4
Merc 280C1	17.8	6	167.6	123	3.92	3.440	18.90	1	0	4	4
Merc 450SE1	16.4	8	275.8	180	3.07	4.070	17.40	0	0	3	3
Merc 450SL1	17.3	8	275.8	180	3.07	3.730	17.60	0	0	3	3
Merc 450SLC1	15.2	8	275.8	180	3.07	3.780	18.00	0	0	3	3
Cadillac Fleetwood1	10.4	8	472.0	205	2.93	5.250	17.98	0	0	3	4
Lincoln Continental1	10.4	8	460.0	215	3.00	5.424	17.82	0	0	3	4
Chrysler Imperial1	14.7	8	440.0	230	3.23	5.345	17.42	0	0	3	4

(continued)

	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
Fiat 1281	32.4	4	78.7	66	4.08	2.200	19.47	1	1	4	1
Honda Civic1	30.4	4	75.7	52	4.93	1.615	18.52	1	1	4	2
Toyota Corolla1	33.9	4	71.1	65	4.22	1.835	19.90	1	1	4	1
Toyota Corona1	21.5	4	120.1	97	3.70	2.465	20.01	1	0	3	1
Dodge Challenger1	15.5	8	318.0	150	2.76	3.520	16.87	0	0	3	2
AMC Javelin1	15.2	8	304.0	150	3.15	3.435	17.30	0	0	3	2
Camaro Z281	13.3	8	350.0	245	3.73	3.840	15.41	0	0	3	4
Pontiac Firebird1	19.2	8	400.0	175	3.08	3.845	17.05	0	0	3	2
Fiat X1-91	27.3	4	79.0	66	4.08	1.935	18.90	1	1	4	1
Porsche 914-21	26.0	4	120.3	91	4.43	2.140	16.70	0	1	5	2
Lotus Europa1	30.4	4	95.1	113	3.77	1.513	16.90	1	1	5	2
Ford Pantera L1	15.8	8	351.0	264	4.22	3.170	14.50	0	1	5	4
Ferrari Dino1	19.7	6	145.0	175	3.62	2.770	15.50	0	1	5	6
Maserati Bora1	15.0	8	301.0	335	3.54	3.570	14.60	0	1	5	8
Volvo 142E1	21.4	4	121.0	109	4.11	2.780	18.60	1	1	4	2

3.1.4 Max power: manually adjust the raw LaTeX output

For total flexibility, you can adjust the raw LaTeX output from `kable`/`kableExtra` that generates the table. Let us consider how we would do this for the example of adjusting the font size if our table is too wide: Latex has a bunch of standard commands that set an approximate font size, as shown below in Figure 3.1.

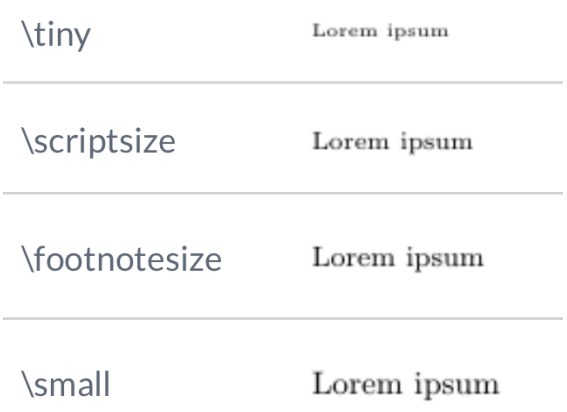


Figure 3.1: Font sizes in LaTeX

You could use these to manually adjust the font size in your longtable in two steps:

1. Wrap the longtable environment in, e.g., a `scriptsize` environment, by doing a string replacement in the output from `kable`/`kableExtra`
2. Add the attributes that make R Markdown understand that the table is a table (it seems R drops these when we do the string replacement)

```
our_adjusted_table <- a_long_table %>%
  kable(booktabs = TRUE, longtable = TRUE) %>%
  kable_styling(latex_options = "repeat_header") %>%
  # wrap the longtable in a tiny environment
  str_replace('\\\\begin\\{longtable\\}',
              '\\\\begin\\{scriptsize\\}\n\\\\begin\\{longtable\\}') %>%
  str_replace('\\\\end\\{longtable\\}',
              '\\\\end\\{longtable\\}\n\\\\end\\{scriptsize\\}')
```

```
#add attributes to make R Markdown treat this as a kable LaTeX table again
our_adjusted_table %>%
  structure(format = "latex", class = "knitr_kable")
```

	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
Mazda RX4	21.0	6	160.0	110	3.90	2.620	16.46	0	1	4	4
Mazda RX4 Wag	21.0	6	160.0	110	3.90	2.875	17.02	0	1	4	4
Datsun 710	22.8	4	108.0	93	3.85	2.320	18.61	1	1	4	1
Hornet 4 Drive	21.4	6	258.0	110	3.08	3.215	19.44	1	0	3	1
Hornet Sportabout	18.7	8	360.0	175	3.15	3.440	17.02	0	0	3	2
Valiant	18.1	6	225.0	105	2.76	3.460	20.22	1	0	3	1
Duster 360	14.3	8	360.0	245	3.21	3.570	15.84	0	0	3	4
Merc 240D	24.4	4	146.7	62	3.69	3.190	20.00	1	0	4	2
Merc 230	22.8	4	140.8	95	3.92	3.150	22.90	1	0	4	2
Merc 280	19.2	6	167.6	123	3.92	3.440	18.30	1	0	4	4
Merc 280C	17.8	6	167.6	123	3.92	3.440	18.90	1	0	4	4
Merc 450SE	16.4	8	275.8	180	3.07	4.070	17.40	0	0	3	3
Merc 450SL	17.3	8	275.8	180	3.07	3.730	17.60	0	0	3	3
Merc 450SLC	15.2	8	275.8	180	3.07	3.780	18.00	0	0	3	3
Cadillac Fleetwood	10.4	8	472.0	205	2.93	5.250	17.98	0	0	3	4
Lincoln Continental	10.4	8	460.0	215	3.00	5.424	17.82	0	0	3	4
Chrysler Imperial	14.7	8	440.0	230	3.23	5.345	17.42	0	0	3	4
Fiat 128	32.4	4	78.7	66	4.08	2.200	19.47	1	1	4	1
Honda Civic	30.4	4	75.7	52	4.93	1.615	18.52	1	1	4	2
Toyota Corolla	33.9	4	71.1	65	4.22	1.835	19.90	1	1	4	1
Toyota Corona	21.5	4	120.1	97	3.70	2.465	20.01	1	0	3	1
Dodge Challenger	15.5	8	318.0	150	2.76	3.520	16.87	0	0	3	2
AMC Javelin	15.2	8	304.0	150	3.15	3.435	17.30	0	0	3	2
Camaro Z28	13.3	8	350.0	245	3.73	3.840	15.41	0	0	3	4
Pontiac Firebird	19.2	8	400.0	175	3.08	3.845	17.05	0	0	3	2
Fiat X1-9	27.3	4	79.0	66	4.08	1.935	18.90	1	1	4	1
Porsche 914-2	26.0	4	120.3	91	4.43	2.140	16.70	0	1	5	2
Lotus Europa	30.4	4	95.1	113	3.77	1.513	16.90	1	1	5	2
Ford Pantera L	15.8	8	351.0	264	4.22	3.170	14.50	0	1	5	4
Ferrari Dino	19.7	6	145.0	175	3.62	2.770	15.50	0	1	5	6
Maserati Bora	15.0	8	301.0	335	3.54	3.570	14.60	0	1	5	8
Volvo 142E	21.4	4	121.0	109	4.11	2.780	18.60	1	1	4	2
Mazda RX41	21.0	6	160.0	110	3.90	2.620	16.46	0	1	4	4
Mazda RX4 Wag1	21.0	6	160.0	110	3.90	2.875	17.02	0	1	4	4
Datsun 7101	22.8	4	108.0	93	3.85	2.320	18.61	1	1	4	1
Hornet 4 Drive1	21.4	6	258.0	110	3.08	3.215	19.44	1	0	3	1
Hornet Sportabout1	18.7	8	360.0	175	3.15	3.440	17.02	0	0	3	2
Valiant1	18.1	6	225.0	105	2.76	3.460	20.22	1	0	3	1
Duster 3601	14.3	8	360.0	245	3.21	3.570	15.84	0	0	3	4
Merc 240D1	24.4	4	146.7	62	3.69	3.190	20.00	1	0	4	2
Merc 2301	22.8	4	140.8	95	3.92	3.150	22.90	1	0	4	2
Merc 2801	19.2	6	167.6	123	3.92	3.440	18.30	1	0	4	4
Merc 280C1	17.8	6	167.6	123	3.92	3.440	18.90	1	0	4	4
Merc 450SE1	16.4	8	275.8	180	3.07	4.070	17.40	0	0	3	3
Merc 450SL1	17.3	8	275.8	180	3.07	3.730	17.60	0	0	3	3
Merc 450SLC1	15.2	8	275.8	180	3.07	3.780	18.00	0	0	3	3
Cadillac Fleetwood1	10.4	8	472.0	205	2.93	5.250	17.98	0	0	3	4
Lincoln Continental1	10.4	8	460.0	215	3.00	5.424	17.82	0	0	3	4
Chrysler Imperial1	14.7	8	440.0	230	3.23	5.345	17.42	0	0	3	4
Fiat 1281	32.4	4	78.7	66	4.08	2.200	19.47	1	1	4	1
Honda Civic1	30.4	4	75.7	52	4.93	1.615	18.52	1	1	4	2
Toyota Corolla1	33.9	4	71.1	65	4.22	1.835	19.90	1	1	4	1

(continued)

	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
Toyota Corona1	21.5	4	120.1	97	3.70	2.465	20.01	1	0	3	1
Dodge Challenger1	15.5	8	318.0	150	2.76	3.520	16.87	0	0	3	2
AMC Javelin1	15.2	8	304.0	150	3.15	3.435	17.30	0	0	3	2
Camaro Z281	13.3	8	350.0	245	3.73	3.840	15.41	0	0	3	4
Pontiac Firebird1	19.2	8	400.0	175	3.08	3.845	17.05	0	0	3	2
Fiat X1-91	27.3	4	79.0	66	4.08	1.935	18.90	1	1	4	1
Porsche 914-21	26.0	4	120.3	91	4.43	2.140	16.70	0	1	5	2
Lotus Europa1	30.4	4	95.1	113	3.77	1.513	16.90	1	1	5	2
Ford Pantera L1	15.8	8	351.0	264	4.22	3.170	14.50	0	1	5	4
Ferrari Dino1	19.7	6	145.0	175	3.62	2.770	15.50	0	1	5	6
Maserati Bora1	15.0	8	301.0	335	3.54	3.570	14.60	0	1	5	8
Volvo 142E1	21.4	4	121.0	109	4.11	2.780	18.60	1	1	4	2

There is grandeur in this view of life, with its several powers, having been originally breathed into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved.

— Charles Darwin (Darwin 1859)

4

Customisations and extensions

Contents

This chapter describes a number of additional tips and tricks as well as possible customizations to the `oxforddown` thesis.

4.1 Front matter

4.1.1 Shorten captions shown in the list of figures (PDF)

You might want your list of figures (which follows the table of contents) to have shorter (or just different) figure descriptions than the actual figure captions.

Do this using the chunk option `fig.scap` ('short caption'), for example {`r captain-image, fig.cap="A very long and descriptive (and potentially boring) caption that doesn't fit in the list of figures, but helps the reader understand what the figure communicates.", fig.scap="A concise description`

```
for the list of figures"
```

4.1.2 Shorten captions shown in the list of tables (PDF)

You might want your list of tables (which follows the list of figures in your thesis front matter) to have shorter (or just different) table descriptions than the actual table captions.

If you are using `knitr::kable` to generate a table, you can do this with the argument `caption.short`, e.g.:

```
knitr::kable(mtcars,
             caption = "A very long and descriptive (and potentially
             boring) caption that doesn't fit in the list of figures,
             but helps the reader understand what the figure
             communicates.",
             caption.short = "A concise description for the list of tables")
```

4.2 Shorten running header (PDF)

You might want a chapter's running header (i.e. the header showing the title of the current chapter at the top of page) to be shorter (or just different) to the actual chapter title.

Do this by adding the latex command `\chaptermark{My shorter version}` after your chapter title.

For example, chapter 2's running header is simply 'Cites and cross-refs', because it begins like this:

```
# Citations, cross-references, and collaboration {#cites-and-refs}
\chaptermark{Cites and cross-refs}
```

4.3 Unnumbered chapters

To make chapters unnumbered (normally only relevant to the Introduction and/or the Conclusion), follow the chapter header with {-}, e.g. `# Introduction {-}`.

When you do this, you must also follow the heading with these two latex commands:

```
\adjustmtc
\markboth{The Name of Your Unnumbered Chapter}{}
```

Otherwise the chapter's mini table of contents and the running header will show the previous chapter.

4.4 Beginning chapters with quotes (PDF)

The OxThesis LaTeX template lets you inject some wittiness into your thesis by including a block of type `savequote` at the beginning of chapters. To do this, use the syntax ```` ```{block type='savequote'} ````.[1]

Add the reference for the quote with the chunk option `quote_author="my author name"`. You will also want to add the chunk option `include=knitr::is_latex_output()` so that quotes are only included in PDF output.

It's not possible to use markdown syntax inside chunk options, so if you want to e.g. italicise a book name in the reference use a 'text reference': Create a named piece of text with '(ref:label-name) My text', then point to this in the chunk option with `quote_author='(ref:label-name)'`.

4.5 Highlighting corrections (HTML & PDF)

For when it comes time to do corrections, you may want to highlight changes made when you submit a post-viva, corrected copy to your examiners so they can quickly verify you've completed the task. You can do so like this:

[1] For more on custom block types, see the relevant section in *Authoring Books with R Markdown*.

4.5.1 Short, inline corrections

Highlight **short, inline corrections** by doing `[like this]{.correction}` — the text between the square brackets will then be highlighted in blue in the output.

Note that pandoc might get confused by citations and cross-references inside inline corrections. In particular, it might get confused by `"[what @Shea2014 said]{.correction}"` which becomes (what Shea et al. 2014, said){.correction} In such cases, you can use LaTeX syntax directly. The correction highlighting uses the soul package, so you can do like this:

- If using biblatex for references, use `"\hl{what \textcite{Shea2014} said}`
- If using natbib for references, use `"\hl{what \cite{Shea2014} said}`

Using raw LaTeX has the drawback of corrections then not showing up in HTML output at all, but you might only care about correction highlighting in the PDF for your examiners anyway!

4.5.2 Blocks of added or changed material

Highlight entire **blocks of added or changed material** by putting them in a block of type `correction`, using the syntax ```` ```{block type='correction'} ````.[2] Like so:

> For larger chunks, like this paragraph or indeed entire figures, you can use the `correction` block type. This environment **highlights paragraph-sized and larger blocks** with the same blue colour.

Note that correction blocks cannot be included in word output.

4.5.3 Stopping corrections from being highlighted

To turn off correction highlighting, go to the YAML header of **index.Rmd**, then:

- PDF output: set `corrections: false`

[2] In the **.tex** file for PDF output, this will put the content between `\begin{correction}` and `\end{correction}`; in gitbook output it will be put between `<div class="correction">` and `</div>`.

- HTML output: remove or comment out - `templates/corrections.css`

4.6 Apply custom font color and highlighting to text (HTML & PDF)

The lua filter that adds the functionality to highlight corrections adds two more tricks: you can apply your own choice of colour to highlight text, or change the font color. The syntax is as follows:

> Here's `[some text in pink highlighting]{highlight="pink"}`
> Becomes: Here's some text in pink highlighting.
>
> `[Here's some text with blue font]{color="blue"}`
> Becomes: Here's some text with blue font
>
> Finally — never, ever actually do this – `[here's some text with black highlighting and yellow font]{highlight="black" color="yellow"}`
> Becomes: here's some text with black highlighting and yellow font

The file **scripts_and_filters/colour_and_highlight.lua** implements this, if you want to fiddle around with it. It works with both PDF and HTML output.

4.7 Including another paper in your thesis - embed a PDF document

You may want to embed existing PDF documents into the thesis, for example if your department allows a 'portfolio' style thesis and you need to include an existing typeset publication as a chapter.

In gitbook output, you can simply use `knitr::include_graphics` and it should include a scrollable (and downloadable) PDF. You will probably want to set the chunk options `out.width='100%'` and `out.height='1000px'`:

```
knitr::include_graphics("figures/sample-content/pdf_embed_example/Lyngs2020_FB.pdf")
```

In LaTeX output, however, this approach can cause odd behaviour. Therefore, when you build your thesis to PDF, split the PDF into an alphanumerically sorted

sequence of **single-page** PDF files (you can do this automatically with the package `pdftools`). You can then use the appropriate LaTeX command to insert them, as shown below (for brevity, in the `oxforddown` PDF sample content we're only including two pages). *Note that the chunk option* ***`results='asis'`*** *must be set.* You may also want to remove margins from the PDF files, which you can do with Adobe Acrobat (paid version) and likely other software.

```
# install.packages(pdftools)
# split PDF into pages stored in
    figures/sample-content/pdf_embed_example/split/
#
    pdftools::pdf_split("figures/sample-content/pdf_embed_example/Lyngs2020_FB.pdf",
# output = "figures/sample-content/pdf_embed_example/split/")

# grab the pages
pages <- list.files("figures/sample-content/pdf_embed_example/split",
    full.names = TRUE)

# set how wide you want the inserted PDFs to be:
# 1.0 is 100 per cent of the oxforddown PDF page width;
# you may want to make it a bit bigger
pdf_width <- 1.2

# for each PDF page, insert it nicely and
# end with a page break
cat(stringr::str_c("\\newpage \\begin{center}
    \\makebox[\\linewidth][c]{\\includegraphics[width=", pdf_width,
    "\\linewidth]{", pages, "}} \\end{center}"))
```

'I Just Want to Hack Myself to Not Get Distracted': Evaluating Design Interventions for Self-Control on Facebook

Ulrik Lyngs[1], **Kai Lukoff**[2], **Petr Slovak**[3], **William Seymour**[1], **Helena Webb**[1], **Marina Jirotka**[1], **Jun Zhao**[1], **Max Van Kleek**[1], **Nigel Shadbolt**[1]
[1]Department of Computer Science, University of Oxford, UK, {first.last}@cs.ox.ac.uk
[2]Human Centered Design & Engineering, University of Washington, Seattle, US, kai1@uw.edu
[3]Department of Informatics, King's College London, UK, petr.slovak@kcl.ac.uk

ABSTRACT
Beyond being the world's largest social network, Facebook is for many also one of its greatest sources of digital distraction. For students, problematic use has been associated with negative effects on academic achievement and general wellbeing. To understand what strategies could help users regain control, we investigated how simple interventions to the Facebook UI affect behaviour and perceived control. We assigned 58 university students to one of three interventions: goal reminders, removed newsfeed, or white background (control). We logged use for 6 weeks, applied interventions in the middle weeks, and administered fortnightly surveys. Both goal reminders and removed newsfeed helped participants stay on task and avoid distraction. However, goal reminders were often annoying, and removing the newsfeed made some fear missing out on information. Our findings point to future interventions such as controls for adjusting types and amount of available information, and flexible blocking which matches individual definitions of 'distraction'.

Author Keywords
Facebook; problematic use; self-control; distraction; ICT non-use; addiction; focus; interruptions

CCS Concepts
•**Human-centered computing** → **Empirical studies in HCI;**

INTRODUCTION

Research on 'Problematic Facebook Use' (PFU) has investigated correlations between Facebook use and negative effects on outcomes such as level of academic achievement [35] and subjective wellbeing [58, 57]. A cross-cutting finding is that negative outcomes are associated with difficulty at exerting self-control over use, as well as specific use patterns including viewing friends' wide-audience broadcasts rather than receiving targeted communication from strong ties [13, 58].

CHI '20, April 25–30, 2020, Honolulu, HI, USA.

ACM ISBN 978-1-4503-6708-0/20/04.
http://dx.doi.org/10.1145/3313831.3376672

Much of this work has focused on self-control over Facebook use in student populations [2, 44, 46], with media multitasking research finding that students often give in to use which provides short-term 'guilty pleasures' over important, but aversive academic tasks [76, 88, 60]. In the present paper, we present a mixed-methods study exploring how two interventions to Facebook — goal reminders and removing the newsfeed — affect university students' patterns of use and perceived control over Facebook use. To triangulate self-report with objective measurement, our study combined usage logging with fortnightly surveys and post-study interviews.

We found that both interventions helped participants stay on task and use Facebook more in line with their intentions. In terms of use patterns, goal reminders led to less scrolling, fewer and shorter visits, and less time on site, whereas removing the newsfeed led to less scrolling, shorter visits, and less content 'liked'. However, goal reminders were often experienced as annoying, and removing the newsfeed made some participants fear missing out on information. After the study, participants suggested a range of design solutions to mitigate self-control struggles on Facebook, including controls for filtering or removing the newsfeed, reminders of time spent and of use goals, and removing features that drive engagement. As an exploratory study, this work should be followed by confirmatory studies to assess whether our findings replicate, and how they may generalise beyond a student population.

RELATED WORK

Struggles with Facebook use

Whereas many uses of Facebook offer important benefits, such as social support, rapid spread of information, or facilitation of real-world interactions [78], a substantial amount of research has focused on negative aspects [58]. For example, studies have reported correlations between patterns of Facebook use and lower academic achievement [77, 86], low self-esteem, depression and anxiety [51], feelings of isolation and loneliness [2], and general psychological distress [15]. Such 'Problematic Facebook Use' (PFU) has been studied under various names (including 'Facebook dependence' [87] and 'Facebook addiction'[5]), but a recent review summarised a common definition as 'problematic behaviour characterised by addictive-like symptoms and/or self-regulation difficulties related to Facebook use leading to negative consequences in personal and social life' [58].

REFERENCES

[1] Alexander T. Adams, Jean Costa, Malte F. Jung, and Tanzeem Choudhury. 2015. Mindless Computing: Designing Technologies to Subtly Influence Behavior. In *Proceedings of the 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing*. ACM, 719–730. DOI: http://dx.doi.org/10.1145/2750858.2805843

[2] Sami Abdo Radman Al-Dubai, Kurubaran Ganasegeran, Mustafa Ahmed Mahdi Al-Shagga, Hematram Yadav, and John T. Arokiasamy. 2013. Adverse Health Effects and Unhealthy Behaviors among Medical Students Using Facebook. https://www.hindawi.com/journals/tswj/2013/465161/. (2013). DOI:http://dx.doi.org/10.1155/2013/465161

[3] All Party Parliamentary Group on Social Media and Young People's Mental Health and Wellbeing. 2019. *#NewFilters to Manage the Impact of Social Media on Young People's Mental Health and Wellbeing*. Technical Report. UK Parliament.

[4] Hunt Allcott, Luca Braghieri, Sarah Eichmeyer, and Matthew Gentzkow. 2019. *The Welfare Effects of Social Media*. Working Paper 25514. National Bureau of Economic Research. DOI: http://dx.doi.org/10.3386/w25514

[5] Cecilie Schou Andreassen, Torbjørn Torsheim, Geir Scott Brunborg, and Staale Pallesen. 2012. Development of a Facebook Addiction Scale. *Psychological Reports* 110, 2 (apr 2012), 501–517. DOI: http://dx.doi.org/10.2466/02.09.18.PR0.110.2.501-517

[6] Yummy Apps. 2019. Todobook. (May 2019).

[7] Albert Bandura. 1982. Self-efficacy mechanism in human agency. *American Psychologist* 37, 2 (1982), 122–147. DOI: http://dx.doi.org/10.1037/0003-066x.37.2.122

[8] Fanni Bányai, Ágnes Zsila, Orsolya Király, Aniko Maraz, Zsuzsanna Elekes, Mark D. Griffiths, Cecilie Schou Andreassen, and Zsolt Demetrovics. 09-Jan-2017. Problematic Social Media Use: Results from a Large-Scale Nationally Representative Adolescent Sample. *PLOS ONE* 12, 1 (09-Jan-2017), e0169839. DOI: http://dx.doi.org/10.1371/journal.pone.0169839

[9] Elliot T Berkman, Cendri A Hutcherson, Jordan L Livingston, Lauren E Kahn, and Michael Inzlicht. 2017. Self-Control as Value-Based Choice. *Current Directions in Psychological Science* 26, 5 (2017), 422–428. DOI: http://dx.doi.org/10.1177/0963721417704394

[10] Walter R. Boot, Daniel J. Simons, Cary Stothart, and Cassie Stutts. 2013. The Pervasive Problem with Placebos in Psychology. *Perspectives on Psychological Science* 8, 4 (jul 2013), 445–454. DOI: http://dx.doi.org/10.1177/1745691613491271

[11] Amara Brook. 2011. Ecological Footprint Feedback: Motivating or Discouraging? *Social Influence* 6, 2 (April 2011), 113–128. DOI: http://dx.doi.org/10.1080/15534510.2011.566801

[12] Gharad Bryan, Dean Karlan, and Scott Nelson. 2010. Commitment Devices. *Annual Review of Economics* 2, 1 (Sept. 2010), 671–698. DOI:http://dx.doi.org/10.1146/annurev.economics.102308.124324

[13] Moira Burke and Robert E. Kraut. 2016. The Relationship Between Facebook Use and Well-Being Depends on Communication Type and Tie Strength. *Journal of Computer-Mediated Communication* 21, 4 (2016), 265–281. DOI: http://dx.doi.org/10.1111/jcc4.12162

[14] Moira Burke, Cameron Marlow, and Thomas Lento. 2010. Social Network Activity and Social Well-Being. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '10)*. ACM, New York, NY, USA, 1909–1912. DOI: http://dx.doi.org/10.1145/1753326.1753613

[15] Wenhong Chen and Kye-Hyoung Lee. 2013. Sharing, Liking, Commenting, and Distressed? The Pathway between Facebook Interaction and Psychological Distress. *Cyberpsychology, Behavior and Social Networking* 16, 10 (oct 2013), 728–734. DOI: http://dx.doi.org/10.1089/cyber.2012.0272

[16] Justin Cheng, Moira Burke, and Elena Goetz Davis. 2019. Understanding Perceptions of Problematic Facebook Use: When People Experience Negative Life Impact and a Lack of Control. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (CHI '19)*. ACM, New York, NY, USA, 199:1–199:13. DOI: http://dx.doi.org/10.1145/3290605.3300429

[17] Jacob Cohen. 1992. A Power Primer. *Psychological Bulletin* 112, 1 (1992), 155–159. DOI: http://dx.doi.org/10.1037/0033-2909.112.1.155

[18] Anna L Cox, Sandy J J Gould, Marta E Cecchinato, Ioanna Iacovides, and Ian Renfree. 2016. Design Frictions for Mindful Interactions: The Case for Microboundaries. In *Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems (CHI EA '16)*. ACM, New York, NY, USA, 1389–1397. DOI: http://dx.doi.org/10.1145/2851581.2892410

[19] Helen Creswick, Liz Dowthwaite, Ansgar Koene, Elvira Perez Vallejos, Virginia Portillo, Monica Cano, and Christopher Woodard. 2019. "... They don't really listen to people". *Journal of Information, Communication and Ethics in Society* 17, 2 (May 2019), 167–182. DOI: http://dx.doi.org/10.1108/jices-11-2018-0090

[20] Angela L. Duckworth, Katherine L. Milkman, and David Laibson. 2018. Beyond Willpower: Strategies for Reducing Failures of Self-Control. *Psychological Science in the Public Interest* 19, 3 (Dec. 2018), 102–129. DOI: http://dx.doi.org/10.1177/1529100618821893

655

4.8 Including another paper in your thesis - R Markdown child document

Sometimes you want to include another paper you are currently writing as a chapter in your thesis. Above 4.7, we described the simplest way to do this: include the other paper as a pdf. However, in some cases you instead want to include the R Markdown source from this paper, and have it compiled within your thesis. This is a little bit more tricky, because you need to keep careful track of your file paths, but it is possible by including the paper as a child document. There are four main steps:

1. Include the paper as a child document
2. Make file paths compatible with knitting the article on its own, as well as when it's include in your thesis
3. Make header levels correct
4. Make figure widths correct

4.8.1 An example paper in another folder

Take this simple example (files for this are in this GitHub repository):

```
|--paper_to_include
|  |--my_paper.Rmd
|  |--data
|  |  |--cat_salt.csv
|  |--figures
|  |  |--cat.jpg
|
|--thesis
```

As the chart suggests, you have another folder, **paper_to_include/** living in the same containing folder as your thesis folder. In the **paper_to_include** folder, the file **my_paper.Rmd** is where you write the paper. In **my_paper.Rmd**, you

read in a CSV file found in the subfolder **data/cats.csv**, and also an image from the subfolder **figures/cat.jpg**.

4.8.2 Step 1: Include paper as a child document

In your thesis folder, create an Rmd file for the chapter where you want to include another paper. Add one or more code chunks that include R Markdown files from that paper as child documents:

````
# Including an external chapter


```{r child = "../paper_to_include/my_paper.Rmd"}
```
````

4.8.3 Step 2: Make file paths compatible

Use parameters to adjust the file path of images based on values you set in the YAML header of an R Markdown file. In **my_paper.Rmd**, create a parameter called `other_path` and set it to an empty string:

```
---
title: "A fabulous article in a different folder"
params:
  other_path: ""
---
```

In **my_paper.Rmd**, put this at the start of the filepath when you read in data or include images:

```
library(tidyverse)
library(knitr)


cat_data <- read_csv(str_c(params$other_path, "data/cats.csv"))
include_graphics(str_c(params$other_path, "figures/cat.jpg"))
```

Finally, in your thesis folder's **index.Rmd** file, also create the parameter `other_path`. But here, set it to where the **paper_to_include/** folder is relative to your thesis folder:

```
params:
  other_path: "../paper_to_include/"
```

Note on HTML output

Note that if you want to host an HTML version on your thesis online, you will need to include graphics in the content that you host online - the internet obviously won't be able to see filepaths that are just referring to stuff in another folder on your computer!

4.8.4 Step 3: Make sure header levels are correct

Unless the paper you want to include is also written as a book, your header levels are probably going to be off. That is, the level 1 headers (# Some header) you use for main sections in the other paper turns into chaper titles when included in your thesis.

To avoid this, first *increment all heading levels by one in* ***paper_to_include/my_paper.Rmd*** (# Some header -> ## Some header). Then in **paper_to_include/** create a lua filter that decrements header levels by one: Create a text file, save it as **reduce_header_level.lua**, and give it the content below.

```
function Header(el)
  if (el.level <= 1) then
    error("I don't know how to decrease the level of h1")
  end
  el.level = el.level - 1
  return el
end
```

In the YAML header of **paper_to_include/my_paper.Rmd**, use this filter:

```
---
title: "A fabulous article in a different folder"
params:
  other_path: ""
output:
  pdf_document:
    pandoc_args: ["--lua-filter=reduce_header_level.lua"]
---
```

Now, your header levels will be correct both when you knit the paper on its own and when its included in your thesis.

4.8.5 Step 4. Make sure figure widths are correct

It might be that your figure widths when knitting your paper on its own, and when including it in your thesis, need to be different. You can again use parameters to set figure widths.

Imagine you want figure width to be 80% of the page width when knitting your paper on its own, but 100% in your thesis. In **paper_to_include/my_paper.Rmd**, first add a parameter we could call `out_width` and set it to the string "80%":

```
---
title: "A fabulous article in a different folder"
params:
  other_path: ""
  out_width: "80%"
output:
  pdf_document:
    pandoc_args: ["--lua-filter=reduce_header_level.lua"]
---
```

Then, make sure use that parameter to set the output width when you include figures in **paper_to_include/my_paper.Rmd**:

````
```{r, out.width=params$out_width, fig.cap="A very funny cat"}
include_graphics(str_c(params$other_path, "figures/cat.jpg"))
```
````

Finally, create the parameter `out_width` in your thesis' **index.Rmd** file:

```
params:
  other_path: "../paper_to_include/"
  out_width: "80%"
```

Now, the output width of your figure will be 80% when knitting your paper on its own, and 100% when knitting it as child document of your thesis.

4.9 Customizing referencing

4.9.1 Using a .csl file with pandoc instead of biblatex

The `oxforddown` package uses biblatex in LaTeX for referencing. It is also possible to use pandoc for referencing by providing a .csl file in the YAML header of **index.Rmd** (likely requiring commenting out the biblatex code in **templates/template.tex**). This may be helpful for those who have a .csl file describing the referencing format for a particular journal. However, note that this approach does not support chapter bibliographies (see Section 4.9.2).

```
csl: ecology.csl
```

4.9.2 Customizing biblatex and adding chapter bibliographies

This section provides one example of customizing biblatex. Much of this code was combined from searches on Stack Exchange and other sources (e.g. here).

In **templates/template.tex**, one can replace the existing biblatex calls with the following to achieve referencing that looks like this:

(Charmantier and Gienapp 2014)

Charmantier, A. and P. Gienapp (2014). Climate change and timing of avian breeding and migration: evolutionary versus plastic changes. Evolutionary Applications 7(1):15–28. doi: 10.1111/eva.12126.

```
\usepackage[backend=biber,
    bibencoding=utf8,
    refsection=chapter, % referencing by chapter
    style=authoryear,
    firstinits=true,
    isbn=false,
    doi=true,
    url=false,
    eprint=false,
    related=false,
    dashed=false,
    clearlang=true,
    maxcitenames=2,
    mincitenames=1,
    maxbibnames=10,
    abbreviate=false,
    minbibnames=3,
    uniquelist=minyear,
    sortcites=true,
    date=year
]{biblatex}
\AtEveryBibitem{%
  \clearlist{language}%
  \clearfield{note}
}

\DeclareFieldFormat{titlecase}{\MakeTitleCase{#1}}
```

```
\newrobustcmd{\MakeTitleCase}[1]{%
  \ifthenelse{\ifcurrentfield{booktitle}\OR\ifcurrentfield{booksubtitle}%
    \OR\ifcurrentfield{maintitle}\OR\ifcurrentfield{mainsubtitle}%
    \OR\ifcurrentfield{journaltitle}\OR\ifcurrentfield{journalsubtitle}%
    \OR\ifcurrentfield{issuetitle}\OR\ifcurrentfield{issuesubtitle}%
    \OR\ifentrytype{book}\OR\ifentrytype{mvbook}\OR\ifentrytype{bookinbook}%
    \OR\ifentrytype{booklet}\OR\ifentrytype{suppbook}%
    \OR\ifentrytype{collection}\OR\ifentrytype{mvcollection}%
    \OR\ifentrytype{suppcollection}\OR\ifentrytype{manual}%
    \OR\ifentrytype{periodical}\OR\ifentrytype{suppperiodical}%
    \OR\ifentrytype{proceedings}\OR\ifentrytype{mvproceedings}%
    \OR\ifentrytype{reference}\OR\ifentrytype{mvreference}%
    \OR\ifentrytype{report}\OR\ifentrytype{thesis}}
    {#1}
    {\MakeSentenceCase{#1}}}

% \renewbibmacro{in:}{}
% suppress "in" for articles
%
\renewbibmacro{in:}{%
  \ifentrytype{article}{}{\printtext{\bibstring{in}\intitlepunct}}}
%-- no "quotes" around titles of chapters/article titles
\DeclareFieldFormat[article, inbook, incollection, inproceedings, misc, thesis, unp
{title}{#1}
%-- no punctuation after volume
\DeclareFieldFormat[article]
{volume}{{#1}}
%-- puts number/issue between brackets
\DeclareFieldFormat[article, inbook, incollection, inproceedings, misc, thesis, unp
```

```
{number}{\mkbibparens{#1}}
%-- and then for articles directly the pages w/o any "pages" or "pp."
\DeclareFieldFormat[article]
{pages}{#1}
%-- for some types replace "pages" by "p."
\DeclareFieldFormat[inproceedings, incollection, inbook]
{pages}{p. #1}
%-- format 16(4):224--225 for articles
\renewbibmacro*{volume+number+eid}{
  \printfield{volume}%
  \printfield{number}%
  \printunit{\addcolon}
}
```

If you would like chapter bibliographies, in addition insert the following code at the end of each chapter, and comment out the entire REFERENCES section at the end of template.tex.

```
\printbibliography[segment=\therefsection,heading=subbibliography]
```

4.10 Customizing the page headers and footers (PDF)

This can now be done directly in **index.Rmd**'s YAML header. If you are a LaTeX expert and need further customisation that what's currently provided, you can tweak the relevant sections of **templates/template.tex** - the relevant code is beneath the line that begins `\usepackage{fancyhdr}`.

4.11 Diving in to the OxThesis LaTeX template (PDF)

For LaTeX minded people, you can read through **templates/template.tex** to see which additional customisation options are available as well as **templates/ociamthesis.cls** which supplies the base class. For example, **template.tex** provides an option for master's degree submissions, which changes identifying information to candidate number and includes a word count. At the time of writing, you must set this directly in **template.tex** rather than from the YAML header in **index.Rmd**.

4.12 Customising to a different university

4.12.1 The minimal route

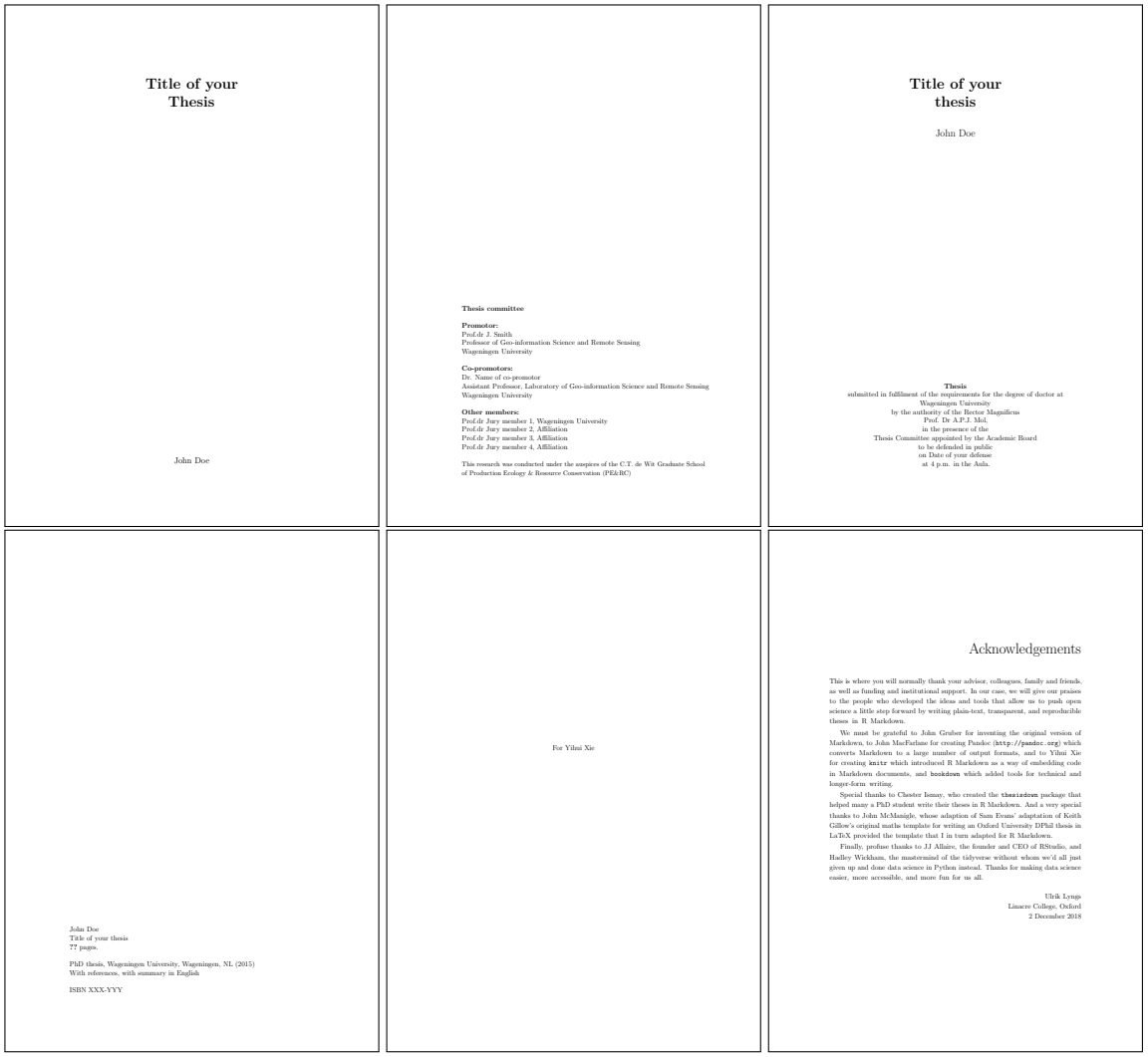
If the front matter in the OxThesis LaTeX template is suitable to your university, customising `oxforddown` to your needs could be as simple as putting the name of your institution and the path to your university's logo in **index.Rmd**:

```
university: University of You
university-logo: figures/your-logo-here.pdf
```

4.12.2 Replacing the entire title page with your required content

If you have a **.tex** file with some required front matter from your university that you want to replace the OxThesis template's title page altogether, you can provide a filepath to this file in **index.Rmd**. `oxforddown`'s sample content includes and example of this — if you use the YAML below, your front matter will look like this:

```
alternative-title-page: front-and-back-matter/alt-title-page-example.tex
```



Title of your Thesis

John Doe

Thesis committee

Promotor:
Prof.dr J. Smith
Professor of Geo-information Science and Remote Sensing
Wageningen University

Co-promotors:
Dr. Name of co-promotor
Assistant Professor, Laboratory of Geo-information Science and Remote Sensing
Wageningen University

Other members:
Prof.dr Jury member 1, Wageningen University
Prof.dr Jury member 2, Affiliation
Prof.dr Jury member 3, Affiliation
Prof.dr Jury member 4, Affiliation

This research was conducted under the auspices of the C.T. de Wit Graduate School of Production Ecology & Resource Conservation (PE&RC)

Title of your thesis

John Doe

Thesis
submitted in fulfilment of the requirements for the degree of doctor at
Wageningen University
by the authority of the Rector Magnificus
Prof. Dr A.P.J. Mol,
in the presence of the
Thesis Committee appointed by the Academic Board
to be defended in public
on Date of your defense
at 4 p.m. in the Aula.

John Doe
Title of your thesis
77 pages.

PhD thesis, Wageningen University, Wageningen, NL (2015)
With references, with summary in English

ISBN XXX-YYY

For Yihui Xie

Acknowledgements

This is where you will normally thank your advisor, colleagues, family and friends, as well as funding and institutional support. In our case, we will give our praises to the people who developed the ideas and tools that allow us to push open science a little step forward by writing plain-text, transparent, and reproducible theses in R Markdown.

We must be grateful to John Gruber for inventing the original version of Markdown, to John MacFarlane for creating Pandoc (`http://pandoc.org`) which converts Markdown to a large number of output formats, and to Yihui Xie for creating `knitr` which introduced R Markdown as a way of embedding code in Markdown documents, and `bookdown` which added tools for technical and longer-form writing.

Special thanks to Chester Ismay, who created the `thesisdown` package that helped many a PhD student write their theses in R Markdown. And a very special thanks to John McManigle, whose adaption of Sam Evans' adaptation of Keith Gillow's original maths template for writing an Oxford University DPhil thesis in LaTeX provided the template that I in turn adapted for R Markdown.

Finally, profuse thanks to JJ Allaire, the founder and CEO of RStudio, and Hadley Wickham, the mastermind of the tidyverse without whom we'd all just given up and done data science in Python instead. Thanks for making data science easier, more accessible, and more fun for us all.

Ulrik Lyngs
Linacre College, Oxford
2 December 2018

5

Troubleshooting

This chapter describes common errors you may run into, and how to fix them.

5.1 Error: Failed to build the bibliography via biber

This can happen if you've had a failed build, perhaps in relation to RStudio shutting down abruptly.

Try doing this:

1. type `make clean-knits` in the terminal tab (or run `file.remove(list.files(pattern = "*.(log|mtc|maf|aux|bbl|blg|xml)"))` in the R console) to clean up files generated by LaTeX during a build
2. restart your computer

If this does not solve the problem, try using the natbib LaTeX package instead of biblatex for handling references. To do this, go to **index.Rmd** and

1. set `use-biblatex: false` and `use-natbib: true`
2. set `citation_package: natbib` under

```
output:
  bookdown::pdf_book:
    citation_package: natbib
```

Alles Gescheite ist schon gedacht worden.
Man muss nur versuchen, es noch einmal zu denken.

All intelligent thoughts have already been thought;
what is necessary is only to try to think them again.

— Johann Wolfgang von Goethe (von Goethe 1829)

Conclusion

If we don't want Conclusion to have a chapter number next to it, we can add the `{-}` attribute.

More info

And here's some other random info: the first paragraph after a chapter title or section head *shouldn't be* indented, because indents are to tell the reader that you're starting a new paragraph. Since that's obvious after a chapter or section title, proper typesetting doesn't add an indent there.

This paragraph, by contrast, *will* be indented as it should because it is not the first one after the 'More info' heading. All hail LaTeX. (If you're reading the HTML version, you won't see any indentation - have a look at the PDF version to understand what in the earth this section is babbling on about).

Appendices

A

The First Appendix

This first appendix includes an R chunk that was hidden in the document (using `echo = FALSE`) to help with readibility:

In 02-rmd-basics-code.Rmd

```
library(tidyverse)

knitr::include_graphics("figures/sample-content/chunk-parts.png")
```

And here's another one from the same chapter, i.e. Chapter 1.2:

```
knitr::include_graphics("figures/sample-content/beltcrest.png")
```

B

The Second Appendix, for Fun

Bibliography

Darwin, C. (1859). *On the Origin of Species by Means of Natural Selection or the Preservation of Favoured Races in the Struggle for Life*. London: John Murray.

Lottridge, D., E. Marschner, E. Wang, M. Romanovsky, and C. Nass (2012). "Browser design impacts multitasking". *Proceedings of the Human Factors and Ergonomics Society 56th Annual Meeting*. DOI: 10.1177/1071181312561289.

Shea, N., A. Boldt, D. Bang, N. Yeung, C. Heyes, and C. D. Frith (2014). *Supra-personal cognitive control and metacognition*. **Trends in Cognitive Sciences**, 18:4, pp. 186–193. DOI: 10.1016/j.tics.2014.01.006.

Von Goethe, J. W. (1829). *Wilhelm Meisters Wanderjahre oder die Entsagenden*. de. Cotta.

Wu, T. (2016). *The Attention Merchants: The Epic Scramble to Get Inside Our Heads*. Knopf Publishing Group.