

MPP-E1180 Lecture 5: Intro to Markup Lang. & Literate Programming (2)

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Objectives for the topic

- ▶ Advanced topics in markup languages and literate programming.
 - ▶ R Markdown Headers
 - ▶ Footnotes
 - ▶ BibTeX/Pandoc and citing R Packages
 - ▶ Time consuming analyses: caching and Make files

Assignment 2

Proposal for your Collaborative Research Project.

Deadline: 23 October

Submit: A (max) 2,000 word proposal created with **R Markdown**. The proposal will:

- ▶ State your research question. And justify why it is interesting.
- ▶ Provide a basic literature review (properly cited with BibTeX).
- ▶ Identify data sources and appropriate research methodologies for answering your question.

As always, submit the entire GitHub repo.

Assignment 2

Definitely see me with your ideas/draft.

Start thinking about **types of statistical models** that you want to use. I can include these in Lecture 8 (Statistical Modeling with R).

Example Paper

An example of a paper + analysis + data project using many of the tools we cover today is available at:

HertieDataScience/Examples/SimplePaperWithAnalysis

R Markdown Headers

An R Markdown file is **just a text file** with markup instructions that **RStudio** understands.

The key to formatting is the **header**.

It is at the start of a file and comes between ---.

The header is written in YAML.

YAML

YAML is a **human read-able data format**.

Elements are separated from values with a colon (:).

Each element is separated by new lines.

Hierarchy is maintained with tabs.

```
title: 'MPP-E1180 Lecture 5'
```

```
author: "Christopher Gandrud"
```

```
date: "25 September 2015"
```

```
output:
```

```
  ioslides_presentation:
```

```
    css: css/font-awesome.min.css
```

```
    logo: img/logo.png
```

```
  beamer_presentation: default
```

Super Nerd Point

YAML is a recursive acronym: “YAML Ain’t Markup Language”.

Different Presentation Styles

By default, R Markdown uses the ioslides HTML presentation slides style.

You can also use reveal.js.

First install the revealjs R package:

```
devtools::install_github("jjallaire/revealjs")
```

Then in the YAML header use:

```
output: revealjs::revealjs_presentation
```

For further styling see

<https://github.com/jjallaire/revealjs>

Table of Contents & Numbered Sections

You can add a table of contents and numbered sections to your PDF output:

```
output:
  pdf_document:
    toc: true
    number_sections: true
```

To do the same for **HTML** also include the information under `html_document`.

Figure Options

Create consistent figure formatting:

output:

```
pdf_document:  
  fig_width: 7  
  fig_height: 6  
  fig_caption: true
```

`fig_caption: true` attaches captions to figures.

To set the actual caption label, use the `fig.cap='SOME CAPTION'`
code chunk option.

Pandoc footnotes

R Markdown can use Pandoc footnotes.

In-text: In the text place a **unique** footnote key in the format:

- ▶ `[^KEY]`

At the end of your document put the full footnote starting with the key, e.g.

- ▶ `[^KEY]: This is a footnote.`

BibTeX citations

BibTeX allows you to create a **database** of **all** of the **literature/packages you cite**.

You can then insert them into your text and they will:

- ▶ Be **automatically formatted** consistently.
- ▶ Generate an appropriately ordered, consistently formatted **reference list** at the end of your document **with only the works you actually cited**.

The BibTeX Database

A BibTeX database is just a text file with the extension `.bib`.

Each entry follows a standard format depending on the type of media.

```
@DOCUMENT_TYPE{CITE_KEY,  
  title = {TITLE},  
  author = {AUTHOR},  
  . . . = {. . .},  
}
```

Note: Commas are very important!

The Cite Key

The cite key **links** a specific citation in your presentation document to a specific BibTeX database entry.

They must be **unique**.

It **does not matter** what order your BibTeX entries are in the .bib file.

BibTeX Articles

```
@article{Acemoglu2000,  
  author = {Acemoglu, Daron and Robinson, James A.},  
  title = {Why Did the West Extend the Franchise? Democracy  
          and Growth in Historical Perspective},  
  journal = {The Quarterly Journal of Economics},  
  year = {2000},  
  volume = {115},  
  number = {4},  
  pages = {1167--1199},  
}
```



```
@book{Cox1997,  
  title={Making Votes Count: Strategic Coordination in the  
        Electoral Systems},  
  author={Gary W. Cox},  
  year={1997},  
  volume = {7},  
  publisher={Cambridge University Press},  
  address = {Cambridge}  
}
```

More

For more media types and entry fields see
<http://en.wikipedia.org/wiki/BibTeX>.

Tip: Google Scholar

Google scholar generates BibTeX entries.

On an entry click Cite > BibTeX.

For a YouTube how-to see

https://www.youtube.com/watch?v=SsJSR2b4_qc.

Sometimes they need to be **cleaned** a little.

Linking your .bib file.

To link your .bib file to your RMarkdown document add to the header:

```
bibliography:
```

- BIB_FILE_NAME.bib
- ANOTHER_BIB_FILE_NAME.bib

Note: The files should be in the **same directory** as your R Markdown file.

Including BibTeX citations in RMarkdown

R Markdown uses Pandoc syntax to include a citation in-text.

General format: @CITE_KEY.

So if the cite key is Box1973 then @Box1973 will return Box and Tiao (1973) in the text of the presentation document.

Formatting In-Text Citations

Markup	Result
<code>[@Box1973]</code>	(Box and Tiao 1973)
<code>[see @Box1973]</code>	(see Box and Tiao 1973)
<code>[see @Box1973, 33–40]</code>	(see Box and Tiao 1973, 33–40)
<code>[@Box1973; @Acemoglu2000]</code>	(Box and Tiao 1973; Acemoglu and Ro
<code>@Box1973 [33–40]</code>	Box and Tiao (1973, 33–40)

Reference List

A reference list with the full bibliographic details of all cited documents will be **automatically created** at the end of your document.

Tip: Put a `# References` at the very end of your R Markdown document to have a section heading before the reference list.

Citing R and R Packages

Why cite?

- ▶ Give **credit** to the software authors (just like when citing literature).
- ▶ Enable **reproducible research**: identify which software you used and **which version**.

Citing R and R Packages

Base R way: print citation, copy BibTeX entry into your *.bib* file.

Cite R:

```
toBibtex(citation())
```

```
## @Manual{,  
##   title = {R: A Language and Environment for Statistical  
##   author = {{R Core Team}},  
##   organization = {R Foundation for Statistical Computing  
##   address = {Vienna, Austria},  
##   year = {2015},  
##   url = {https://www.R-project.org/},  
## }
```

Citing R and R Packages

Cite R Packages:

```
toBibtex(citation('dplyr'))
```

```
## @Manual{,  
##   title = {dplyr: A Grammar of Data Manipulation},  
##   author = {Hadley Wickham and Romain Francois},  
##   year = {2015},  
##   note = {R package version 0.4.3},  
##   url = {http://CRAN.R-project.org/package=dplyr},  
## }
```

Citing R and R Packages: LoadandCite

The dynamic literate programming way: Use LoadandCite from the repmis package.

Load all of the packages at the beginning of you R Markdown file in a chunk with `include=FALSE`.

LoadandCite loads the packages and creates a BibTeX file with all of the citations.

```
pkgs <- c('dplyr', 'ggplot2')  
  
repmis::LoadandCite(pkgs, file = 'RpackageCitations.bib')
```

Note: Use a file name that is different from your literature BibTeX file!

Citing R and R Packages: Load and Cite

Include the .bib file in your RMarkdown header.

Each **cite key** follows: R-PKG_NAME.

R itself has the key CiteR.

So @R-dplyr and @CiteR create the citations:

- ▶ Wickham and Francois (2015)
- ▶ R Core Team (2015)

Time Consuming/Intensive Analyses

Knitting your analysis and presentation documents together by placing all of your R code into code chunks can sometimes be **problematic**:

- ▶ When they are **time consuming**: requires a lot of computational time.
- ▶ When they **access files over the internet**: bad practice to make many repeated calls to the same URL, can crash the site. This is equivalent to a denial-of-service attack.
- ▶ When they are **many lines long**.

Solutions

- ▶ Long lines: use `source()` to run R code in other files.
- ▶ Caching for time/computationally intensive work: `cache=TRUE`
code chunk option: only runs the chunk when the **chunk code changes**.

Advanced: Make files

Make files are the ultimate solution to these problems.

Make is a command line program.

Big Idea: run a *make* file that runs a list of specific files in order.

Files are **only run** if they have been **changed** since the last time the make file was last run.

See Ch. 6 of RRRR if you might want to do this.

Seminar: Practice

Clone the HertieDataScience/Examples repo and play around with **SimplePaperWithAnalysis**.

Seminar: Begin working on your Proposal

Begin working with your partner on your research proposal.

- ▶ Identify the research area and key literature.
- ▶ Create a new repo and R Markdown document for your proposal.
- ▶ Begin building a BibTeX database for your key literature and try including them in your proposal.
- ▶ Begin identifying data sources.

References

Acemoglu, Daron, and James A. Robinson. 2000. "Why Did the West Extend the Franchise? Democracy, Inequality, and Growth in Historical Perspective." *The Quarterly Journal of Economics* 115 (4): 1167–99.

Box, G. E. P., and G. C. Tiao. 1973. *Bayesian Inference in Statistical Analysis*. New York: Wiley Classics.

R Core Team. 2015. *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing. <https://www.R-project.org/>.

Wickham, Hadley, and Romain Francois. 2015. *Dplyr: A Grammar of Data Manipulation*.
<http://CRAN.R-project.org/package=dplyr>.