

Scientific Communication: T_EX, RMarkdown Winter Institute in Data Science

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Scientific Communication

L^AT_EX

RMarkdown

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- ▶ is replicable, portable
- ▶ automates frequently-used or tedious operations
- ▶ (usually) separates content and formatting
- ▶ allows the author control ...
- ▶ but supplies legible defaults and structure that allow the reader (and author) to focus on content

Scientific Communication

A brief history of languages

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- ▶ knitr (Xie): 2012 (integrate R into anything)

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- ▶ knitr (Xie): 2012 (integrate R into anything)
- ▶ RMarkdown: (a knitr extension)

L^AT_EX

From the L^AT_EX Project (<https://www.latex-project.org>):

L^AT_EX is a high-quality typesetting system; it includes features designed for the production of technical and scientific documentation. L^AT_EX is the de facto standard for the communication and publication of scientific documents. L^AT_EX is available as free software.

Convey ideas, procedures, results clearly

Consider

$$(E_i^{100} x_i) / (x^2 + \theta \sqrt{z})$$

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$$(E_i^{100} x_i) / (x^2 + \text{theta sqrt}(z))$$

This is difficult to read.

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On the other hand,

$$\frac{\sum_{i=1}^{100} x_i}{x^2 + \theta \sqrt{z}}$$

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- ▶ Historically: difficult, bad spacing, etc. on WYSIWYGs
- ▶ Now, macOS's Pages *requests* your L^AT_EX

Replicable, portable

L^AT_EX is plain text. You can open it in any text editor.

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You could open/compile the first L^AT_EX document.

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You could open/compile the first L^AT_EX document.

.doc is actually 4 different file formats!

Automates frequently-used, tedious operations

Don't make a Table of Contents.

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Just `\tableofcontents`.

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In L^AT_EX documents, the `\` prefaces a command.

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In \LaTeX documents, the `\` prefaces a command.

In \LaTeX , the `{ }` enclose arguments:

`\command{arg1}`

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In \LaTeX documents, the `\` prefaces a command.

In \LaTeX , the `{ }` enclose arguments:

`\command{arg1}`

In \LaTeX , the `[]` enclose (opt) further params:

`\command[param1,param2]{arg1}`

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4. Include `.bib` file name, so `LATEX/knitr` finds refs
5. (Include `.bst` to adjust reference style)

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```
\bibliographystyle{apsa-leeper}
```

```
\bibliography{my_bib}
```

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Don't compile a bibliography, or reformat it.

Write “One should read `\cite{moore2015}`.”, then add

```
\bibliographystyle{apsa-leeper}  
\bibliography{my_bib}
```

Which will render as “One should read Moore (2015)”.

and

Moore, Ryan T. “Overcoming Barriers to Heterogeneous-Group Learning in the Political Science Classroom”. *PS: Political Science & Politics*, 48(1):149–156, 2015.

To build documents into **.pdf**, need an installation of T_EX.

You need a T_EX engine for processing.

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Or `tinytex`.

Or Overleaf.

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R \rightarrow RStudio analogous to TeX `build` \rightarrow TeX editor

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If you don't have a T_EX build, try `tinytex`.

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```
install.packages("rmarkdown")
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library(rmarkdown)
tinytex::install_tinytex()
```

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If you don't have a \TeX build, try `tinytex`.

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```
install.packages("rmarkdown")
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Or, just create `.html` files instead, and print to `.pdf`.

Resources

- ▶ “The Not So Short Introduction to L^AT_EX 2_ε”
(Oetiker, et al.)
- ▶ “The Comprehensive L^AT_EX Symbol List”
(Pakin \approx 15,000!)
- ▶ Detexify
<http://detexify.kirelabs.org/classify.html>
- ▶ Overleaf (<https://www.overleaf.com>)

RMarkdown

First, a quick example!

- ▶ Create `.Rmd` file
- ▶ Add name, title to preamble
- ▶ Compile
- ▶ Edit, compile

RMarkdown is

- ▶ light
- ▶ legible
- ▶ literate
- ▶ L^AT_EX

RMarkdown: light

1. no huge build over R

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2. less “ink”

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1. Item 1
2. Item 2

RMarkdown: light

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2. Item 2

vs.

```
\begin{enumerate}  
\item Item 1  
\item Item 2  
\end{enumerate}
```

RMarkdown: legible

I am **serious**

vs.

I am **serious**

or

I am **serious**

RMarkdown: legible

I am **serious**

vs.

I am **serious**

or

I am **serious**

(Better for tables, figures, etc. Harder to see/adjust aspects of presentation)

RMarkdown: literate

- ▶ Code in these notes is run, output is recreated

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Look, three plus four is 7.

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Look, three plus four is 7.

What I typed above:

```
Look, three plus four is `r 3 + 4`.
```

RMarkdown: literate

This literacy is great for papers: analysis is *in* your paper.

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Often want to *see* the code and the (somewhat more) raw results.

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Often want to *see* the code and the (somewhat more) raw results.

That makes this literacy perfect for reports (“notebooks”).

RMarkdown: L^AT_EX

In a paper, format the math *and* do the calculation:

Look: $3 + 4 = 7$.

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In a paper, format the math *and* do the calculation:

Look: $3 + 4 = 7$.

Above I typed:

Look: `$3 + 4 = `r 3 + 4`$`.

RMarkdown: L^AT_EX

In a paper, format the math *and* do the calculation:

Look: $3 + 4 = 7$.

Above I typed:

Look: $3 + 4 = 7$.

(Warning: formatting the line above was a challenge.)

Valid L^AT_EX will almost always knit well.

RMarkdown

Let's build an RMarkdown file from scratch.

RMarkdown

Let's build an RMarkdown file from scratch.

▶ RStudio \rightsquigarrow File \rightsquigarrow New file \rightsquigarrow R Markdown

(get ready ...)

RMarkdown

For more formatting and chunk options, download the full

[http://www.ryantmoore.org/files/class/introPolResearch/
PS_Rmd_template_full.Rmd](http://www.ryantmoore.org/files/class/introPolResearch/PS_Rmd_template_full.Rmd)

or the simpler

[http://www.ryantmoore.org/files/class/introPolResearch/
PS_Rmd_template_simple.Rmd](http://www.ryantmoore.org/files/class/introPolResearch/PS_Rmd_template_simple.Rmd)

Rmd vs. the Console

Knit `.Rmd` file:

- ▶ R runs the code from top to bottom of `.Rmd` file

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Knit `.Rmd` file:

- ▶ R runs the code from top to bottom of `.Rmd` file
- ▶ Does not run other code; does **not** look in Console's workspace
- ▶ `.Rmd` file needs to be entirely self-contained
- ▶ Set working directory, read data, create intermediate objects, etc. *within* the `.Rmd` file

Rmd vs. the Console: Beware Green Arrow

```
17  
18 ```{r cars}  
19 |summary(cars)|  
20 ```
```



Rmd vs. the Console: Beware Green Arrow

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- ▶ When you compile/knit to create an output file, only code that is run is code in your `.Rmd` file, from top to bottom

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- ▶ When you compile/knit to create an output file, only code that is run is code in your `.Rmd` file, from top to bottom
- ▶ This notebook-like feature is an aspect of RStudio that is not *inherent* in `.Rmd` (which could be compiled from a command line outside of RStudio, e.g.). To avoid confusion about the state, knit `.Rmd` file and look at output, rather than using green arrow.

Rmd + the Console: Love the Green Bar

17

18 ```{r cars}

19 summary(cars)

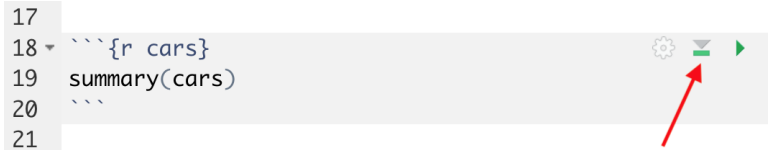
20 ```

21



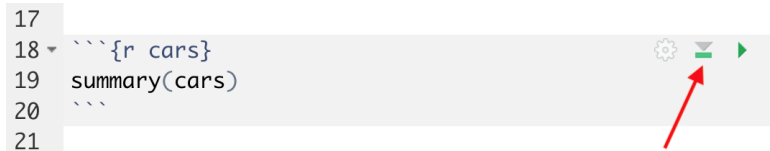
Rmd + the Console: Love the Green Bar

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```



“Run all chunks above” at Console.

Rmd + the Console: Love the Green Bar



“Run all chunks above” at Console.

- ▶ Ctrl-Shift-f10
- ▶ Alt-Cmd-P

(I know, you're wondering ...)

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How do I format \LaTeX in \LaTeX ?

(I know, you're wondering ...)

How do I format L^AT_EX in L^AT_EX?

\LaTeX

(I know, you're wondering ...)

How do I format L^AT_EX in L^AT_EX?

\LaTeX

How to format “L^AT_EX is great.”?

(I know, you're wondering ...)

How do I format L^AT_EX in L^AT_EX?

`\LaTeX`

How to format “L^AT_EX is great.”?

With a space in L^AT_EX: `\LaTeX~ is great.`

With a space in RMarkdown: `\LaTeX\ is great.`

The Core Transformation Functions¹ Quiz

Load the `gss_cat` data in the `forcats` package:

```
library(forcats)
data("gss_cat")
```

Create a `.Rmd` file, write code in chunks to

1. Sort `gss_cat` by the values of `tvhours` (largest first). Store this as `gss_cat`, and show the first 10 rows.
2. Create a new var `birthyear` – each resp's `year` minus `age` – and attach it as column of `gss_cat`. Show `summary(gss_cat$birthyear)` and dimensions of `gss_cat`.
3. Create df `gss_cat_tv`, which has only the rows of `gss_cat` where `tvhours > 3`?
4. Calculate the mean value of `tvhours` in `gss_cat` within categories of `relig`. Sort this summary.

(Breakout groups of 3)_____

¹`filter()`, `arrange()`, `group_by()`, `ungroup()`, `select()`, `rename()`, `mutate()`, `transmute()`, `summarise()`