Scientific Communication: TEX, RMarkdown
Winter Institute in Data Science

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2022-01-02

Scientific Communication

LaTeX

RMarkdown

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- 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)
- RMarkdown: (a `knitr` extension)

LaTeX

From the LaTeX Project (https://www.latex-project.org):

> *LaTeX is a high-quality typesetting system; it includes features designed for the production of technical and scientific documentation. LaTeX is the de facto standard for the communication and publication of scientific documents. LaTeX 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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- Now, macOS's Pages *requests* your LaTeX

Replicable, portable

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You could open/compile the first LaTeX document.

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`.doc` is actually 4 different file formats!

Automates frequently-used, tedious operations

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In LaTeX, the `{ }` enclose arguments:

```
\command{arg1}
```

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In LaTeX, the `{ }` enclose arguments:

```
\command{arg1}
```

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

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

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5. (Include `.bst` to adjust reference style)

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\bibliography{my_bib}
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Write "One should read `\cite{moore2015}`.", then add

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

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 TeX.

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`R` → `RStudio` analogous to `TeX build` → `TeX editor`

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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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library(rmarkdown)
tinytex::install_tinytex()
```

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```
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Or, just create `.html` files instead, and print to `.pdf`.

Resources

- "The Not So Short Introduction to LaTeX 2_ε" (Oetiker, et al.)
- "The Comprehensive LaTeX 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
  - RStudio $\rightsquigarrow$ File $\rightsquigarrow$ New file $\rightsquigarrow$ R Markdown
- Add name, title to preamble
- Compile
- Edit, compile

RMarkdown is

- light
- legible
- literate
- LaTeX

RMarkdown: light

1. no huge build over R

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```
1. Item 1
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```
1. Item 1
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```

vs.

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

RMarkdown: legible

```
I am **serious**
```

vs.

```
I am \bf{serious}
```

or

```
I am {\bf serious}
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```
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(Better for tables, figures, etc. Harder to see/adjust aspects of presentation)

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- 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: LaTeX

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: $3 + 4 = `r 3 + 4`$.
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In a paper, format the math *and* do the calculation:

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Above I typed:

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

Valid LaTeX will almost always knit well.

RMarkdown

For more formatting and chunk options, download the full

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

Rmd vs. the Console

Knit `.Rmd` file:

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

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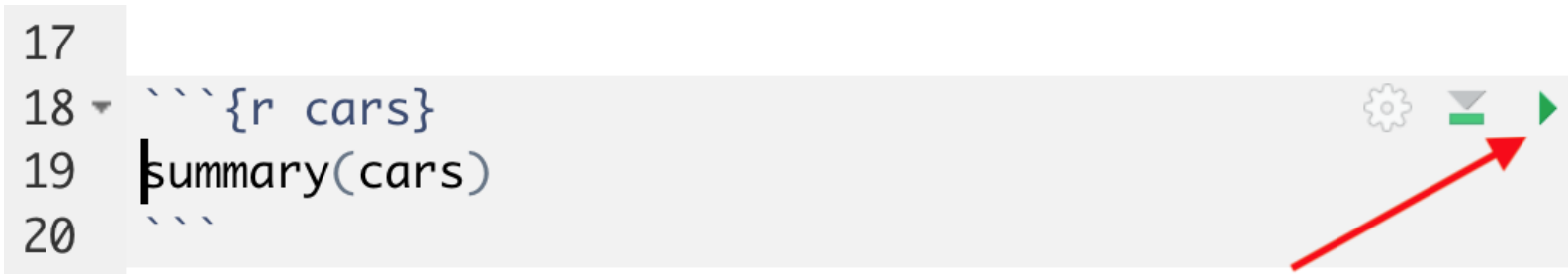
Knit `.Rmd` file:

- 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



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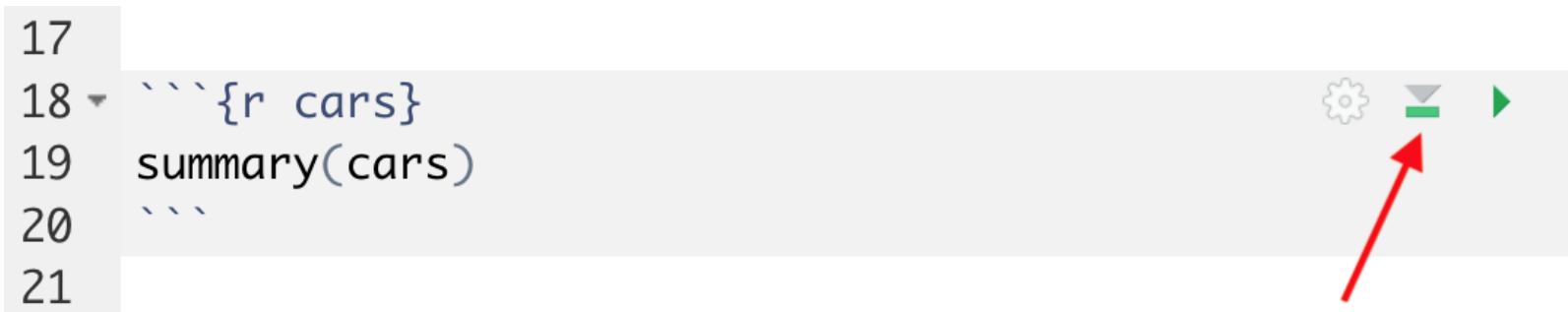
- When you compile/knit to create an output file, only code that is run is code in your `.Rmd` file, from top to bottom
- This notebook-like feature is an aspect of RStudio that is not *inherent* in `.Rmd` (which could be compiled from a command line outside of RStudio, e.g.). To avoid confusion about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

Rmd + the Console: Love the Green Bar



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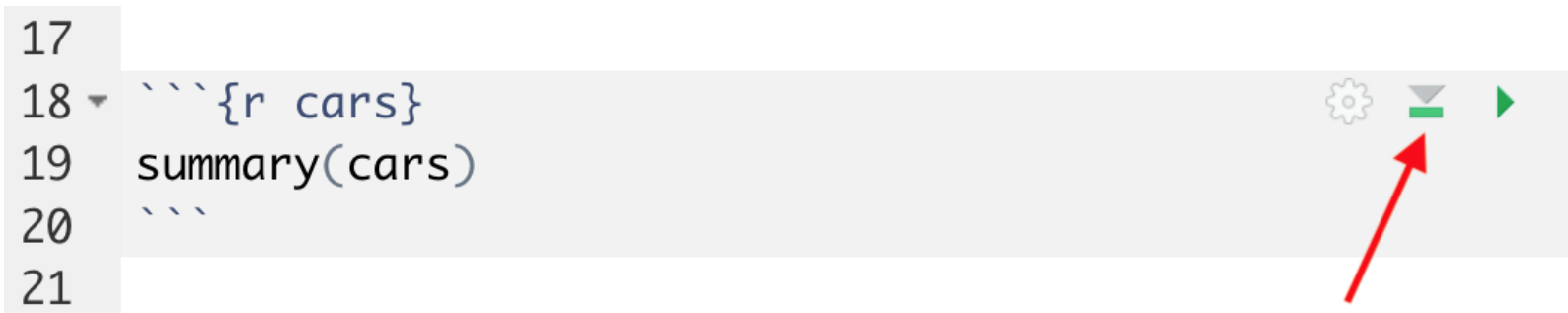
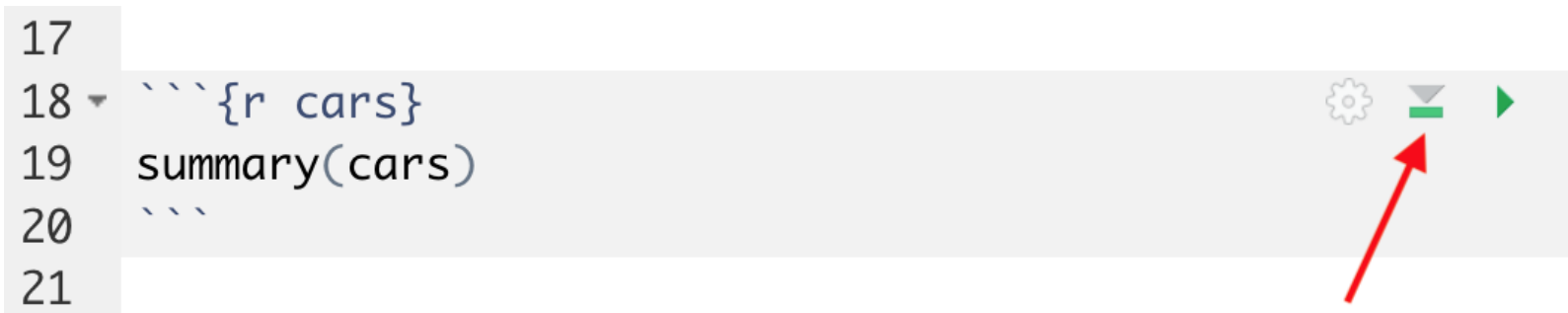


"Run all chunks above" at Console.

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 LaTeX in LaTeX?

`\LaTeX`

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

How do I format LaTeX in LaTeX?

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How to format "LaTeX is great."?

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

How do I format LaTeX in LaTeX?

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How to format "LaTeX is great."?

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

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

The Core Transformation Functions Quiz

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

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

Create a `.Rmd` file, write code[1] 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.

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