

Communicating Science using Rmarkown

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Effective science communicators educate non-specialist audiences about scientific topics, issues, and debates in ways that are informative, accessible, and empowering.

Science communicators should be able to answer the following questions:

- Who is my audience?
- What is my message for my audience?
- What medium am I going to use to communicate my message to my audience?

The **lay public** is made up of all the people who are not experts in a specific field. When addressing the lay public:

- Keep the story simple and front-load exciting aspects
- Make the story relevant to your audience
- Use analogies and visuals
- Front-load the story
- Avoid jargon - simple language but don't oversimplify
- Include the people and the process (challenges, successes, collaborations, etc.)

The **media** is a “mediator” between scientists and the public. Note the media is not a homogenous group.

Describing your process, challenges, successes, and collaborations are important for writing an informative and engaging press release. Read a few popular science articles to get a sense of how your research might eventually appear in the news and magazines.

Articles about your work should include visuals—videos or photos—that will draw readers’ attention to the article and help them grasp the gist of the piece.

Scientists can share their knowledge with **policy makers** through meetings, testimonies, and open presentations. Suggestions for communicating with policy makers:

- Know what issues policy makers are currently discussing and debating
- Keep your explanations simple and relevant
- Think of some actionable solutions to the problem
- Think about the problem and solution in the context of the policy maker's constituency
- Be confident in yourself and what you know
- Approach a meeting as a conversation, not a presentation
- Create a one-pager with your message and key points

Visuals make the data supporting your message clear and accessible to your audience. Science visualizations include:

- 1 Graphs, tables, and infographics
- 2 Conceptual diagrams
- 3 Maps, Satellite photos
- 4 Photographs

Keep the following points in mind:

- 1 Use a consistent style and format
- 2 Use colors with purpose
- 3 Use high-resolution graphics
- 4 Format your graphics and include labels, legends, and captions

Reproducible Reports (RMarkdown)

The final product of a data analysis project is often a report: scientific publications, news articles, an analysis report for your company, or lecture notes for a class.

Now imagine after you are done you realize you:

- had the wrong dataset
- have a new dataset for the same analysis
- made a mistake and fix the error, or
- your boss or someone you are training wants to see the code and be able to reproduce the results

Situations like these are common for a data scientist.

R markdown is a format for **literate programming** documents.

It is based on **markdown**, a markup language that is widely used to generate html pages.

You can learn more about markdown here: [click here](#)

Literate programming weaves instructions, documentation, and detailed comments in between machine executable code.

With R markdown, you need to **compile** the document into the final report.

You can start an R markdown document in RStudio by clicking on **File, New File**, then **R Markdown**. You will then be asked for a title and author.

Final reports can be to be in: HTML, PDF, Microsoft Word, or presentation formats.

As a convention, we use the `.Rmd` suffix for these files.

Once you gain experience with R Markdown, you will be able to do this without the template and can simply start from a blank template.

In the template, you will see several things to note (in the following slides).

The Header

At the top you see:

```
---  
title: "Nanosttring Analysis"  
author: "Evan Johnson"  
date: "12/5/2019"  
output: html_document:  
---
```

One parameter that we will highlight is output. By changing this to, say, pdf_document, we can control the type of output that is produced.

The Header

```
---  
title: "Nanostring Analysis"  
author: "Evan Johnson"  
date: "12/5/2019"  
output:  
  html_document:  
    code_folding: hide  
    toc: true  
    toc_float: true  
    theme: "flatly"  
editor_options:  
  chunk_output_type: console  
---
```

In various places in the document, we see something like this:

```
```{r}  
summary(pressure)
```
```

These are the code chunks. When you compile the document, the R code inside the chunk, in this case `summary(pressure)`, will be evaluated and the result included in that position in the final document.

To add your own R chunks, you can type the characters above quickly with the key binding `command-option-I` on the Mac and `Ctrl-Alt-I` on Windows.

This applies to plots as well; the plot will be placed in that position. We can write something like this:

```
```{r}  
plot(pressure)
```
```

By default, the code will show up as well. To avoid having the code show up, you can use an argument. To avoid this, you can use the argument `echo=FALSE`. For example:

```
```{r, echo=FALSE}  
summary(pressure)
```
```

Its a good habit to adding a label to the R code chunks. This will be very useful when debugging, among other situations. You do this by adding a descriptive word like this:

```
```{r pressure-summary}  
summary(pressure)
```
```


One of the R chunks may contain a complex looking call:

```
```{r setup, include=FALSE}  
knitr::opts_chunk$set(echo = TRUE)
```
```

We use the **knitr** package to compile R markdown documents. The specific function used to compile is the `knit` function, which takes a filename as input. RStudio provides a button that makes it easier to compile the document.

We will explore other R Markdown options: headers, tabsets, and latex equations in class and in your Exercises.

Note: From now on, all R-based Exercises should preferably be done using an R Markdown document. Your document should include headers, descriptive text, R code, and plots/figures!

There is a lot more you can do with R markdown. We highly recommend you continue learning as you gain more experience writing reports in R. There are many free resources on the internet including:

- 1 RStudio's tutorial: <https://rmarkdown.rstudio.com>
- 2 The cheat sheet: <https://www.rstudio.com/wp-content/uploads/2015/02/rmarkdown-cheatsheet.pdf>
- 3 The knitR book: <https://yihui.name/knitr/>

R Markdown is a powerful tool for literate programming. To gain more practice, recreate the .Rmd file for the example file: “Rmarkdown_example.html.”

Session info

```
sessionInfo()
```

```
## R version 4.3.2 (2023-10-31)
## Platform: aarch64-apple-darwin20 (64-bit)
## Running under: macOS Ventura 13.5.1
##
## Matrix products: default
## BLAS: /Library/Frameworks/R.framework/Versions/4.3-arm64/Resources/lib/libRblas.0.dylib
## LAPACK: /Library/Frameworks/R.framework/Versions/4.3-arm64/Resources/lib/libRlapack.dylib; LAPACK version 3.11.0
##
## locale:
##  [1] en_US.UTF-8/en_US.UTF-8/en_US.UTF-8/C/en_US.UTF-8/en_US.UTF-8
##
## time zone: America/Denver
## tzcode source: internal
##
## attached base packages:
## [1] stats      graphics  grDevices  utils      datasets  methods   base
##
## loaded via a namespace (and not attached):
##  [1] compiler_4.3.2    fastmap_1.1.1     cli_3.6.1        tools_4.3.2
##  [5] htmltools_0.5.6.1 rstudioapi_0.15.0 yaml_2.3.7        rmarkdown_2.25
##  [9] knitr_1.44        xfun_0.40         digest_0.6.33    rlang_1.1.1
## [13] evaluate_0.22
```