R Markdown

Garrick Aden-Buie
@grrrck

Toronto Data Workshop
2021-02-11

R Markdown

R's Secret Ingredient

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R Markdown

R's Special Sauce

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R Markdown

An Incomplete History

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R Markdown

Stuff I'm Working On and Want To Show Off

Garrick Aden-Buie
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Toronto Data Workshop
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About Me

👋 Hi, I'm **Garrick Aden-Buie**

About Me

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🦪 @grrrck

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® RStudio: `gradethis`, `learnr`

What is R Markdown?

(wrong answers only)

one

two

Break Free From Plastic engaged 14,734 volunteers in 55 countries to conduct 575 brand audits. These volunteers collected 346,494 pieces of plastic waste.

Break Free From Plastic engaged 14,734 volunteers in 55 countries to conduct 575 brand audits. These volunteers collected 346,494 pieces of plastic waste.

A brief history of `rmarkdown`


EAEML

A brief history of *literate programming*

Let us change our traditional attitude
to the construction of programs:

Instead of imagining that our main task
is to **instruct a computer what to do**,
let us concentrate rather on
explaining to human beings
what we want a computer to do.

Donald Knuth

Literate Programming

I was coerced like everybody else into adopting the ideas of structured programming, because I couldn't bear to be found guilty of writing **unstructured programs**.

Now I have a chance to get even ... surely nobody wants to admit writing an **illiterate program**.

Donald Knuth

Literate Programming

This language and its associated programs have come to be known as **the WEB system**.

I chose the name **WEB** partly because it was one of the few three-letter words of English that hadn't already been applied to computers.

Donald Knuth

Literate Programming

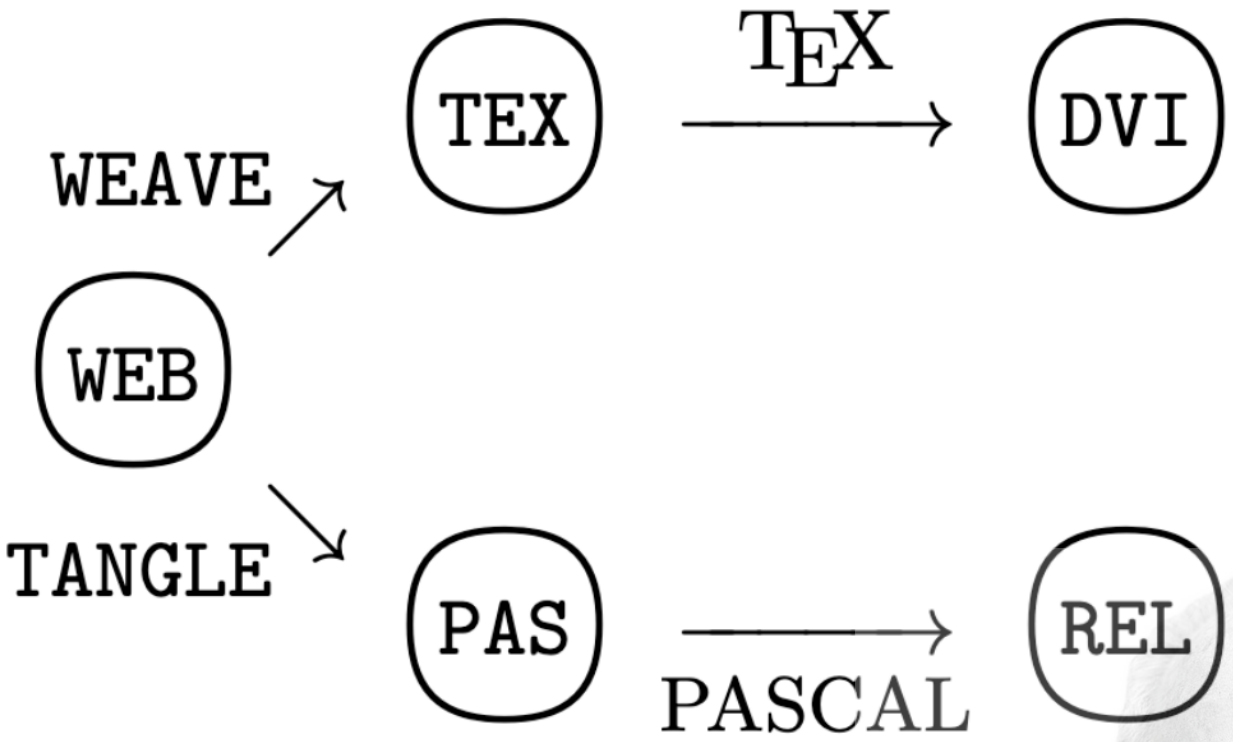


Figure 1. Dual usage of a WEB file.

Donald Knuth

Literate Programming

The result of the program will be to produce a list of the first thousand prime numbers...

```
⟨Program to print the first thousand prime numbers 2⟩ ≡
program print_primes (output);
  const m = 1000;
    ⟨Other constants of the program 5⟩
  var ⟨Variables of the program 4⟩
    begin ⟨Print the first m prime numbers 3⟩ ;
    end.
```

Donald Knuth

Literate Programming

We shall proceed to fill out the rest of the program by making whatever decisions seem easiest at each step.

So let's come up with a list of prime numbers.

⟨Print the first *m* prime numbers 3⟩ ≡
⟨Fill table *p* with the first *m* prime numbers 11⟩
⟨Print table *p* 8⟩

Donald Knuth

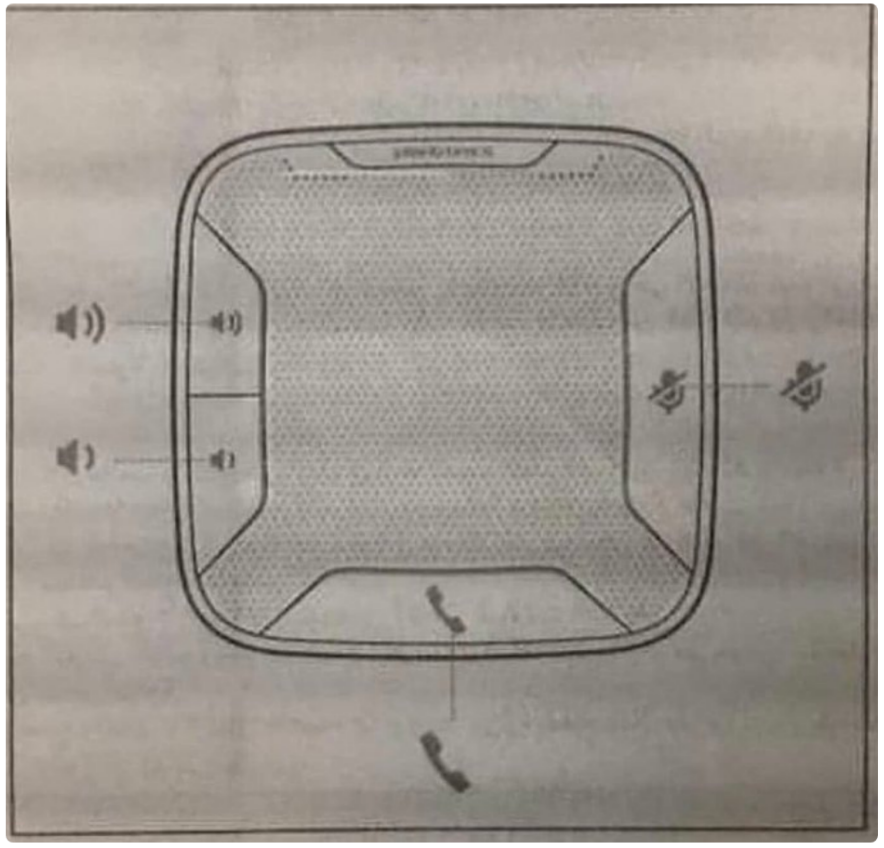
Now that the appropriate auxiliary variables have been introduced, the process of outputting table *p* almost writes itself.

```
⟨Print table p 8⟩ ≡
begin page_number <- 1; page_offset = 1;
while page_offset ≤ m do
  begin ⟨Output a page of answers 9⟩ ;
  page_number <- page_number + 1;
  page_offset <- page_offset + rr * cc;
  end;
end;
```

Donald Knuth

Ricardo Ferreira @riferrei · Feb 6, 2021

Developers commenting their code



Tolga Mırmırık
@mirmirik

Always...

A brief history of *literate programming* in R

sweave

sweave

```
\documentclass{article}

\usepackage{amsmath}
\usepackage{amscd}
\usepackage[utf8]{inputenc}

\begin{document}
\SweaveOpts{concordance=TRUE}

\title{An Sweave Demo}
\author{Charles J. Geyer}
\maketitle

% ....
```

sweave

```
This is a demo for using the \verb@Sweave@ command in R.  To
get started make a regular \LaTeX\ file (like this one) but
give it the suffix \verb@.Rnw@ instead of \verb@.tex@ and then
turn it into a \LaTeX\ file (\verb@foo.tex@) with the (unix) command
\begin{verbatim}
R CMD Sweave foo.Rnw
\end{verbatim}

Well, we can now include R in our document.  Here's a simple example
<<two>>=
2 + 2
@
```

sweave

```
Figure~\ref{fig:one} (p.~\pageref{fig:one})
is produced by the following code
<<label=fig1plot,include=FALSE>>=
plot(x, y)
abline(out1)
@
\begin{figure}
\begin{center}
<<label=fig1,fig=TRUE,echo=FALSE>>=
<<fig1plot>>
@
\end{center}
\caption{Scatter Plot with Regression Line}
\label{fig:one}
\end{figure}
Note that \verb@x@, \verb@y@, and \verb@out1@ are remembered from
the preceding code chunk.  We don't have to regenerate them.
All code chunks are part of one R ``session''.
```

sweave

```
Figure~\ref{fig:one} (p.~\pageref{fig:one})
is produced by the following code
<<label=fig1plot,include=FALSE>>=
plot(x, y)
abline(out1)
@
\begin{figure}
\begin{center}
<<label=fig1,fig=TRUE,echo=FALSE>>=
<<fig1plot>>
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\end{figure}
Note that \verb@x@, \verb@y@, and \verb@out1@ are remembered from
the preceding code chunk.  We don't have to regenerate them.
All code chunks are part of one R ``session''.
```

(for once we won't show the code chunk itself, look at **foo.Rnw** if you want to see what the actual code chunk was).

Figure 1 (p. 2) is produced by the following code

```
> plot(x, y)
> abline(out1)
```

Note that **x**, **y**, and **out1** are remembered from the preceding code chunk. We don't have to regenerate them. All code chunks are part of one R "session".

sweave

```
Figure~\ref{fig:one} (p.~\pageref{fig:one})
is produced by the following code
<<label=fig1plot,include=FALSE>>=
plot(x, y)
abline(out1)
@
\begin{figure}
\begin{center}
<<label=fig1,fig=TRUE,echo=FALSE>>=
<<fig1plot>>
@
\end{center}
\caption{Scatter Plot with Regression Line}
\label{fig:one}
\end{figure}
Note that \verb@x@, \verb@y@, and \verb@out1@ are remembered from
the preceding code chunk.  We don't have to regenerate them.
All code chunks are part of one R ``session''.
```

sweave

```
Figure~\ref{fig:one} (p.~\pageref{fig:one})
is produced by the following code
<<label=fig1plot,include=FALSE>>=
plot(x, y)
abline(out1)
@
\begin{figure}
\begin{center}
<<label=fig1,fig=TRUE,echo=FALSE>>=
<<fig1plot>>
@
\end{center}
\caption{Scatter Plot with Regression Line}
\label{fig:one}
\end{figure}
Note that \verb@x@, \verb@y@, and \verb@out1@ are remembered from
the preceding code chunk.  We don't have to regenerate them.
All code chunks are part of one R ``session''.
```

sweave

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Figure~\ref{fig:one} (p.~\pageref{fig:one}
is produced by the following code
<<label=fig1plot,include=FALSE>>=
plot(x, y)
abline(out1)
@
\begin{figure}
\begin{center}
<<label=fig1,fig=TRUE,echo=FALSE>>=
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```

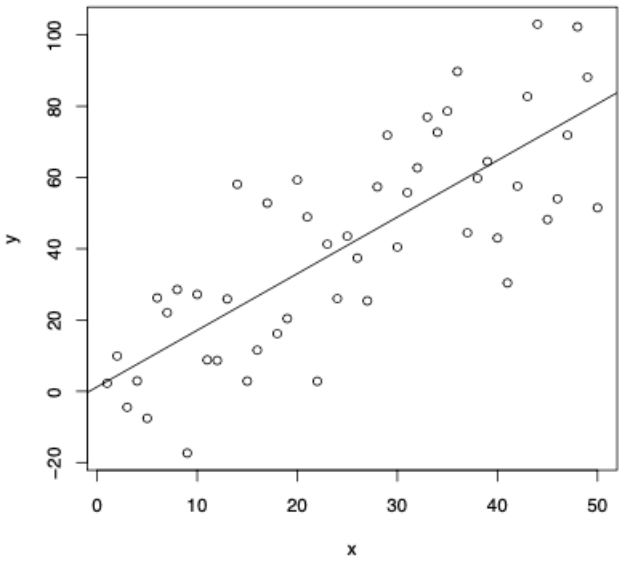


Figure 1: Scatter Plot with Regression Line

knitr

knitr

knitr

Yihui Xie - Interview by DataScience.LA at useR 2014

knitr

1. Write in markdown
2. Cleaner chunk and inline R code syntax
3. Easy figures
4. Still literate

knitr

```
Let's write another program that computes prime numbers, called `prime_numbers(

```
prime_numbers <- function(m = 1) {
  <<prime-numbers>>
}
```
```

knitr

```
Let's write another program that computes prime numbers, called `prime_numbers(

```
prime_numbers <- function(m = 1) {
  <<prime-numbers>>
}
```
```

Let's write another program that computes prime numbers, called `prime_numbers()`.

```
prime_numbers <- function(m = 1) {
  <<prime-numbers>>
}
```

knitr

```
Well, we can now include R in our document.  Here's a simple example.

```{r two}
2 + 2
```
```

knitr

```
Well, we can now include R in our document.  Here's a simple example.

```{r two}
2 + 2
```
```

Well, we can now include R in our document. Here's a simple example.

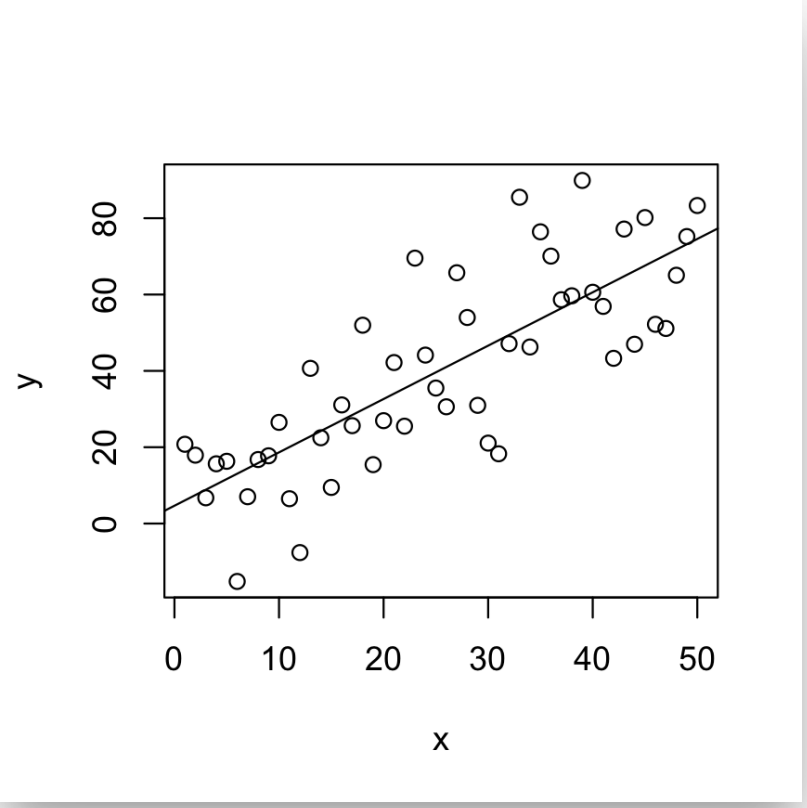
```r
2 + 2
```

```
## [1] 4
```

knitr

```
Figure 1 is produced by the following code

```{r fig1plot, fig.width = 4, fig.height = 4}
n <- 50
x <- seq(1, n)
y <- 3 + (1.5 * x) + (17.3 * rnorm(n))
fit <- lm(y ~ x)
plot(x, y)
par(mar = rep(0, 4))
abline(fit)
```
```



knitr

```
For one point, `x` is `r x[10]`, `y` is `r y[10]` and we predict
`y` will be `r predict(fit, list(x = 10))`.
```

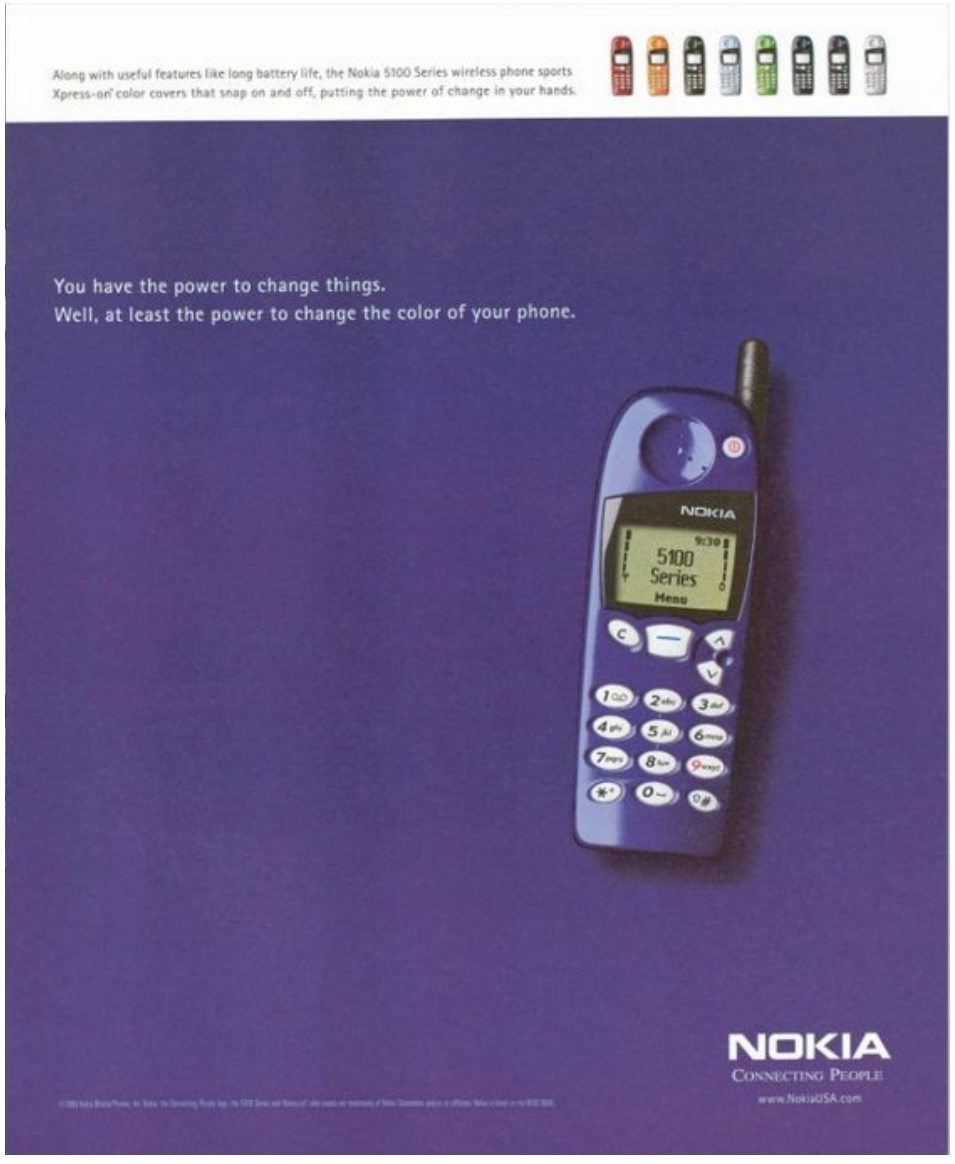
knitr

```
For one point, `x` is `r x[10]`, `y` is `r y[10]` and we predict
`y` will be `r predict(fit, list(x = 10))`.
```

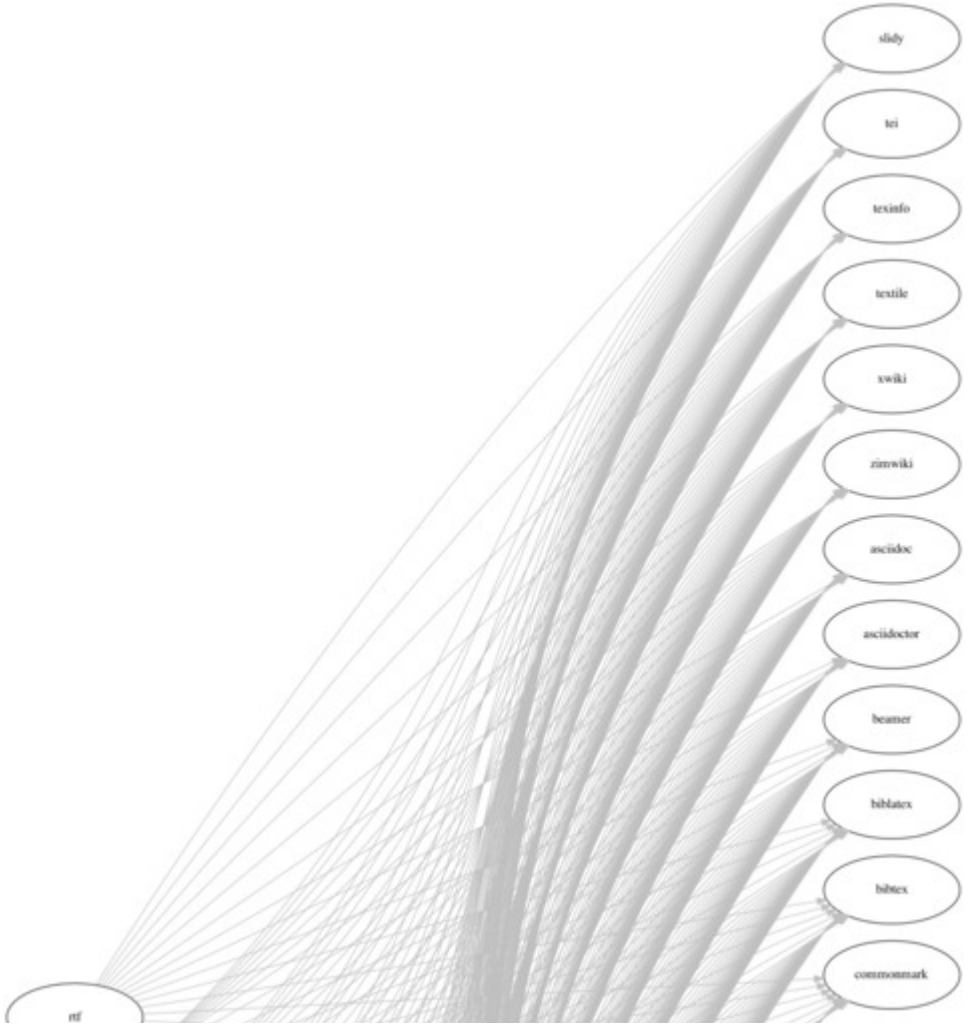
For one point, x is 10, y is 26.5050704 and we predict y will be 18.6470099.

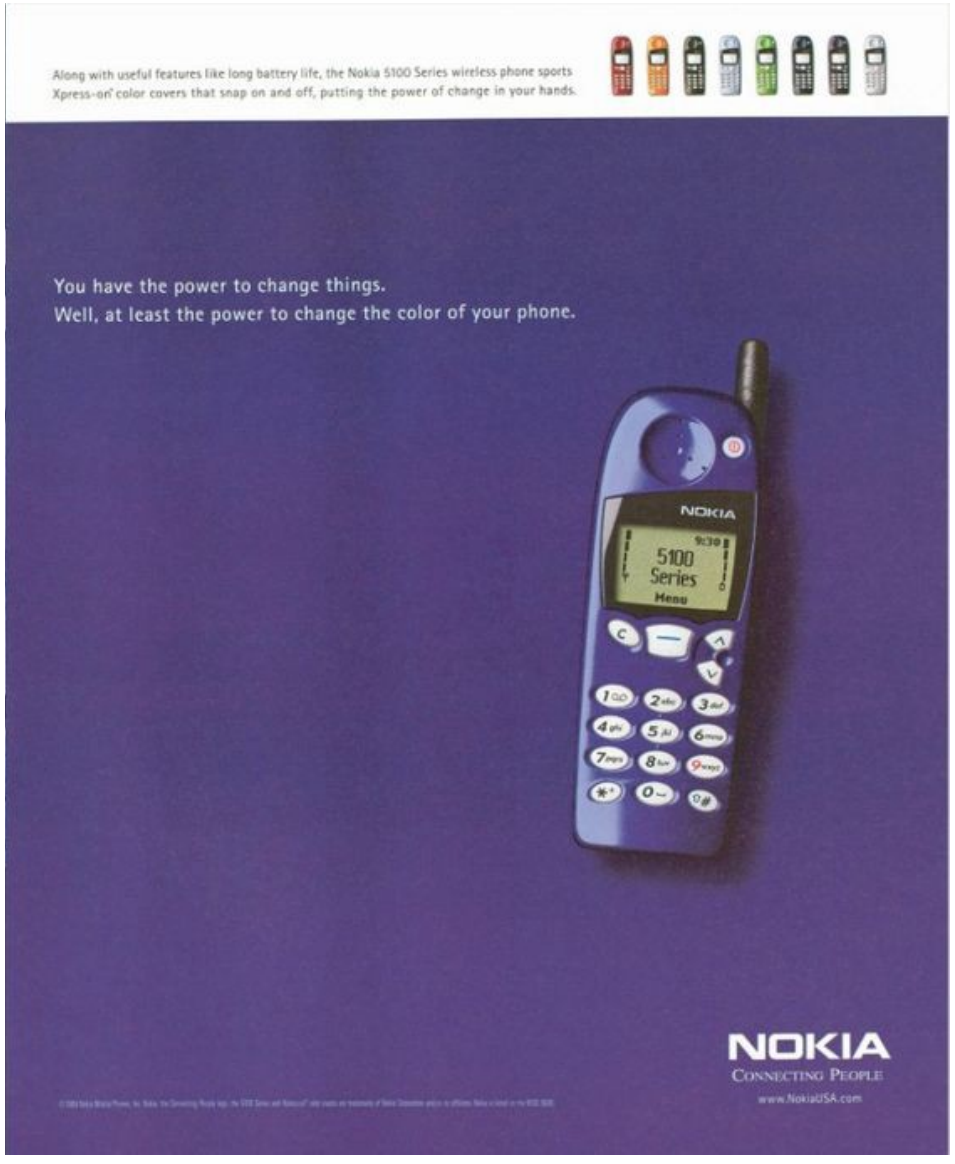
knitr with pandoc

knitr with pandoc



knitr with pandoc





knitr with pandoc

Terminal

```
pandoc report.md -o report.pdf
```

knitr with pandoc

Terminal

```
pandoc report.md -o report.docx
```

knitr with pandoc

Terminal

```
pandoc report.md -o report.pptx
```

knitr with pandoc

Terminal

```
pandoc report.md -o report.epub
```

knitr with pandoc

Terminal

```
pandoc report.md -o report.html
```

knitr with pandoc

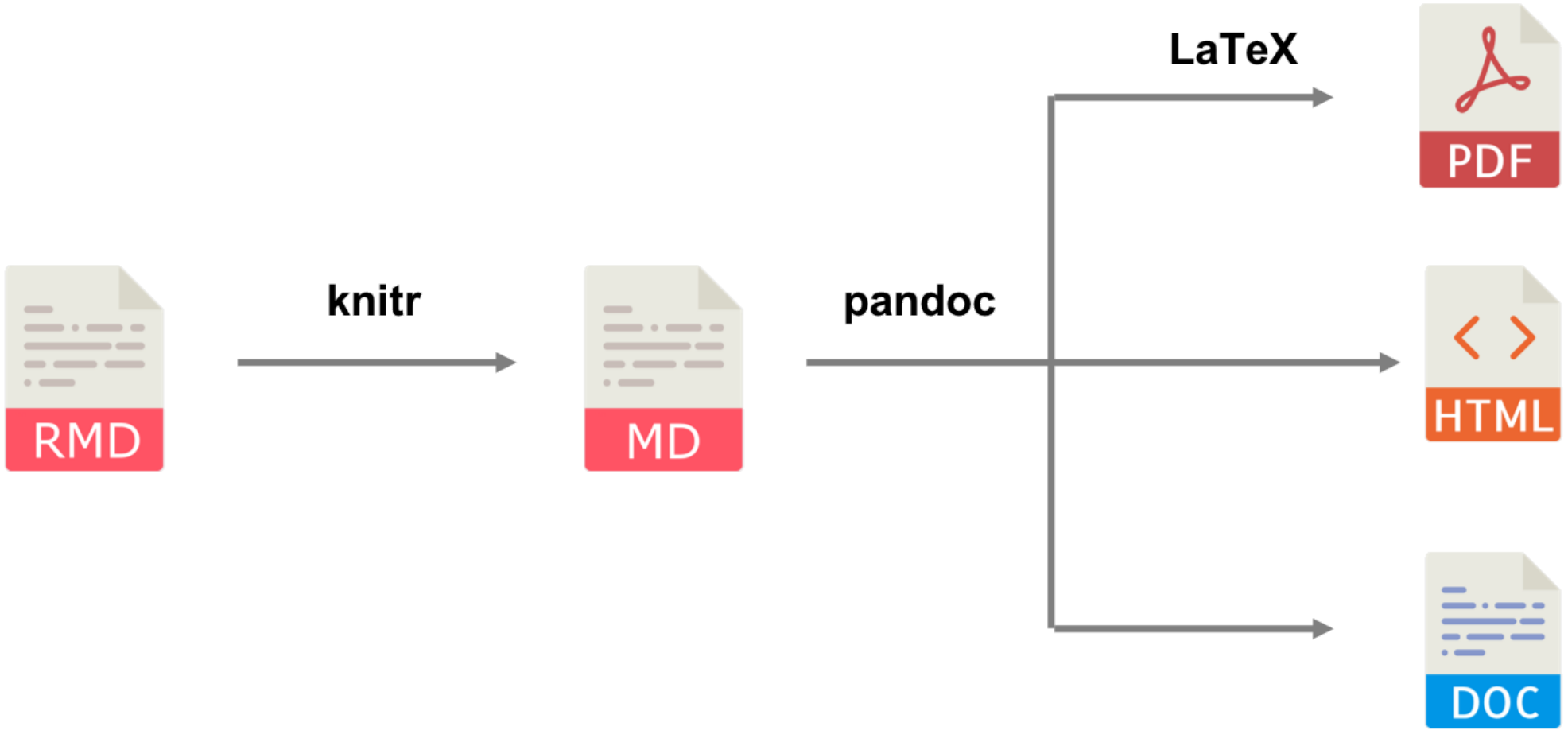
Terminal

```
pandoc report.md -o report.html --no-highlight \
  --css assets/css/title-slide.css \
  --css assets/css/toronto-data-workshop.css \
  --section-divs --standalone --variable math=true
```

R Markdown

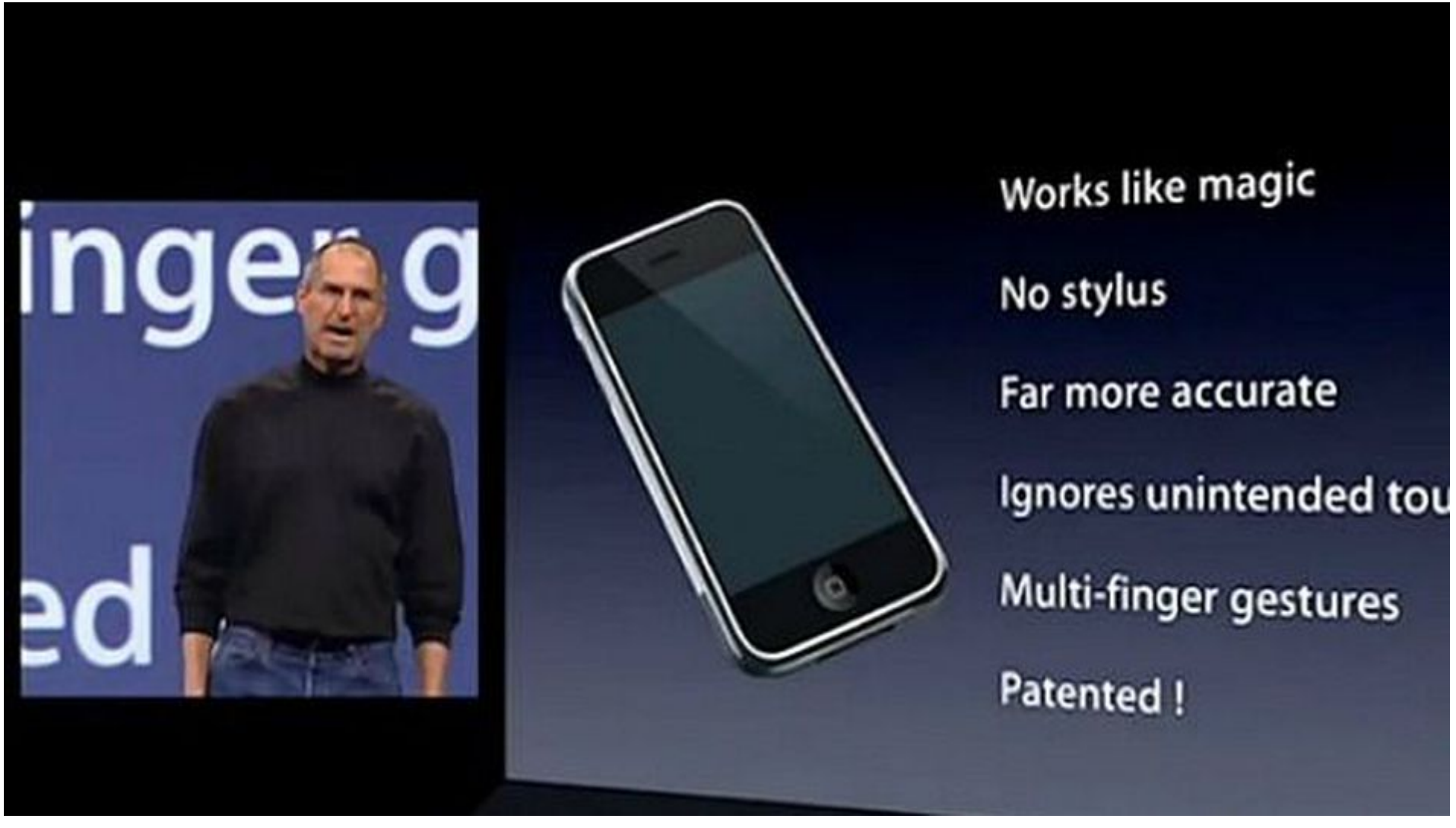
R Markdown

R Markdown



R Markdown

R Markdown


Works like magic
No stylus
Far more accurate
Ignores unintended tou
Multi-finger gestures
Patented !

PDF Reports

Word Documents

PowerPoint Presentations

Interactive Dashboards

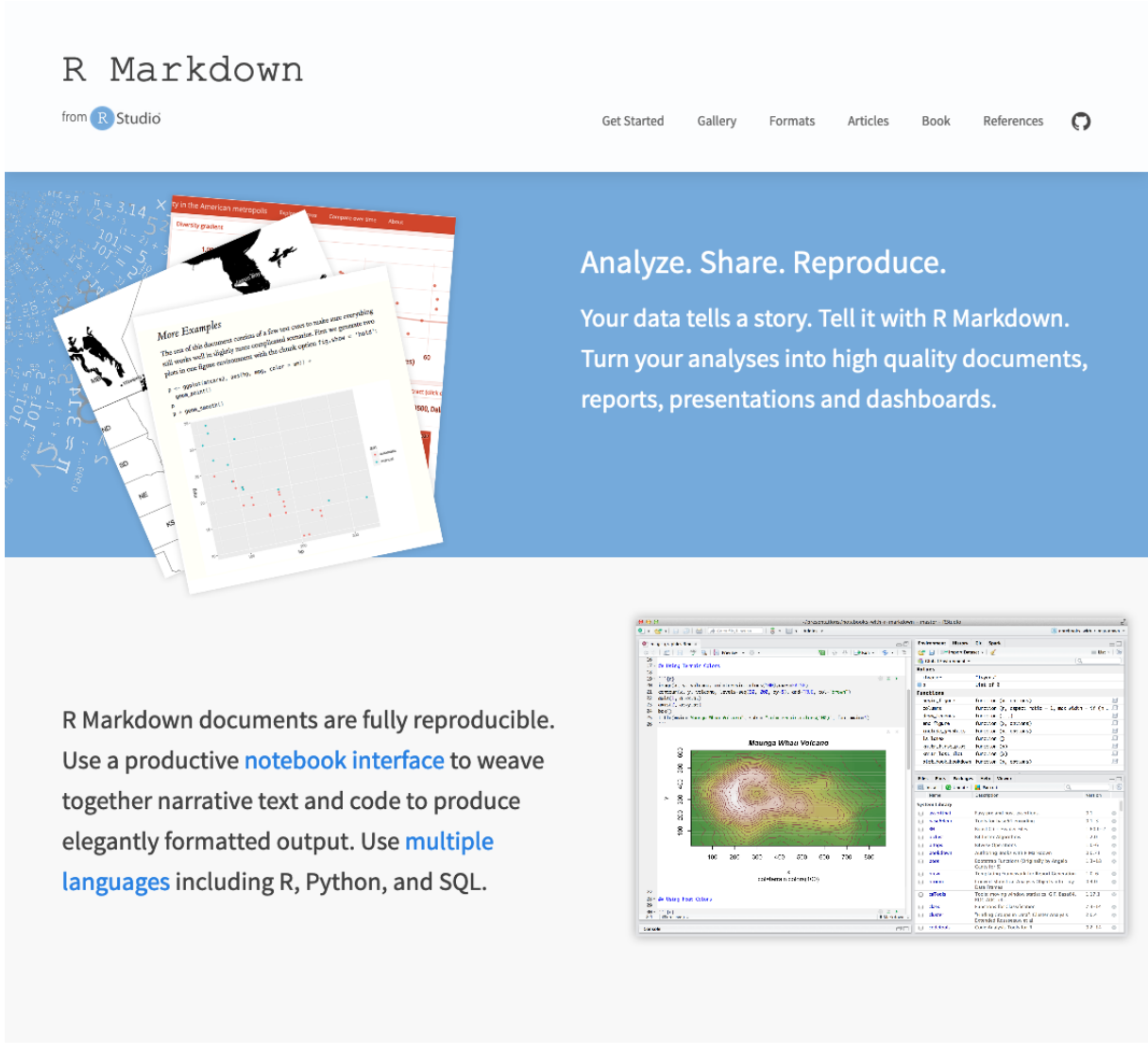
Books

Websites

Slides Like These!

rmarkdown

rmarkdown.rstudio.com



epoxy

knitr documents can write themselves

```
```{r}
years <- c(2019, 2020)
grand_total <- c(858462, 346494)
```

```{r plastics}
items <- paste(
  "\n- In", years, "we collected", grand_total, "pieces of plastic."
)
items
```
```

knitr documents can write themselves

```
```{r}
years <- c(2019, 2020)
grand_total <- c(858462, 346494)
```

```{r plastics}
items <- paste(
  "\n- In", years, "we collected", grand_total, "pieces of plastic."
)
items
```
```

```
## [1] "\n- In 2019 we collected 858462 pieces of plastic."
## [2] "\n- In 2020 we collected 346494 pieces of plastic."
```

knitr documents can write themselves

```
```{r}
years <- c(2019, 2020)
grand_total <- c(858462, 346494)
```

```{r plastics, results = "asis"}
items <- paste(
  "\n- In", years, "we collected", grand_total, "pieces of plastic."
)
cat(items)
```
```

knitr documents can write themselves

```
```{r}
years <- c(2019, 2020)
grand_total <- c(858462, 346494)
```

```{r plastics, results = "asis"}
items <- paste(
  "\n- In", years, "we collected", grand_total, "pieces of plastic."
)
cat(items)
```
```

```
- In 2019 we collected 858462 pieces of plastic.
- In 2020 we collected 346494 pieces of plastic.
```

knitr documents can write themselves

```
```{r}
years <- c(2019, 2020)
grand_total <- c(858462, 346494)
```

```{r plastics, results = "asis"}
items <- paste(
  "\n- In", years, "we collected", grand_total, "pieces of plastic."
)
cat(items)
```
```

- In 2019 we collected 858462 pieces of plastic.
- In 2020 we collected 346494 pieces of plastic.

Meet glue

```
paste(
  "\n- In", years, "we collected", grand_total, "pieces of plastic."
)
```

```
## [1] "\n- In 2019 we collected 858462 pieces of plastic."
## [2] "\n- In 2020 we collected 346494 pieces of plastic."
```

Meet glue

```
paste(
  "\n- In", years, "we collected", grand_total, "pieces of plastic."
)
```

```
## [1] "\n- In 2019 we collected 858462 pieces of plastic."
## [2] "\n- In 2020 we collected 346494 pieces of plastic."
```

```
library(glue)

glue("\n- In {years} we collected {grand_total} pieces of plastic.")
```

```
## - In 2019 we collected 858462 pieces of plastic.
## - In 2020 we collected 346494 pieces of plastic.
```

epoxy, like superglue

- gadenbuie/epoxy

epoxy, like superglue

- gadenbuie/epoxy

epoxy, like superglue

👉 gadenbuie/epoxy

```
library(epoxy)
```

epoxy, like superglue

```
glue("\n- In {years} we collected {grand_total} pieces of plastic.")
```

```
## - In 2019 we collected 858462 pieces of plastic.
## - In 2020 we collected 346494 pieces of plastic.
```

epoxy, like superglue

```
```{epoxy}
- In {years} we collected {grand_total} pieces of plastic.

```
```

- In 2019 we collected 858462 pieces of plastic.
- In 2020 we collected 346494 pieces of plastic.

epoxy, like superglue

#tidytuesday

Break Free From Plastics

```
library(dplyr)

# plastics <- tidytuesdayR::tt_load(2021, week = 5)$plastics
plastics <- readr::read_csv(here::here("data", "plastics.csv"))

plastics_grand_summary <-
  plastics %>%
  group_by(country, year, num_events, volunteers) %>%
  summarize(
    grand_total = sum(grand_total, na.rm = TRUE),
    .groups = "drop"
  ) %>%
  arrange(year, desc(grand_total))
```

epoxy, like superglue

```
plastics_grand_summary
```

```
## # A tibble: 107 × 5
##    country                        year num_events volunteers grand_total
##    <chr>                         <dbl>      <dbl>      <dbl>       <dbl>
##  1 Taiwan_ Republic of China …  2019          2      31318      241292
##  2 NIGERIA                      2019         14       1648      161140
##  3 EMPTY                        2019        145       1416      113910
##  4 Philippines                  2019         20       3751       74032
##  5 Indonesia                    2019         32       6850       26618
##  6 ECUADOR                      2019          1        455       25430
##  7 Vietnam                      2019          4        400       21774
##  8 Kenya                        2019          5       1560       18988
##  9 Cameroon                     2019         10        387       17190
## 10 Switzerland                  2019          6        327       15002
## # ℹ 97 more rows
```

epoxy, like superglue

```
plastics_year_summary <-
  plastics_grand_summary %>%
  group_by(year) %>%
  summarize(
    countries = n(),
    across(c(num_events, volunteers, grand_total), sum, na.rm = TRUE)
  ) %>%
  mutate(across(-(1:2), format, big.mark = ","))
```

epoxy, like superglue

```
plastics_year_summary
```

```
## # A tibble: 2 × 5
##    year countries num_events volunteers grand_total
##   <dbl>     <int> <chr>      <chr>      <chr>
## 1  2019        52 483        72,236     858,462
## 2  2020        55 575        14,734     346,494
```

epoxy, like superglue

```
```{epoxy data = plastics_year_summary}
- **In {year}**, _Break Free From Plastic_ engaged {volunteers} volunteers in
  {countries} countries to conduct {num_events} brand audits.
  These volunteers collected {grand_total} pieces of plastic waste.

```
```

epoxy, like superglue

- **In 2019**, *Break Free From Plastic* engaged 72,236 volunteers in 52 countries to conduct 483 brand audits. These volunteers collected 858,462 pieces of plastic waste.

- **In 2020**, *Break Free From Plastic* engaged 14,734 volunteers in 55 countries to conduct 575 brand audits. These volunteers collected 346,494 pieces of plastic waste.

shinyComponents

R Markdown all the things

👉 gadenbuie/shinyComponents

Resources

Links and Further Reading

- epoxy
- shinyComponents
- R Markdown Cookbook
- Wrap Vectors in Markdown Formatting • gluedown
- Yihui Xie - New developments in knitr and R Markdown v2 (2014)
- Yihui Xie - Interview by DataScience.LA at useR 2014