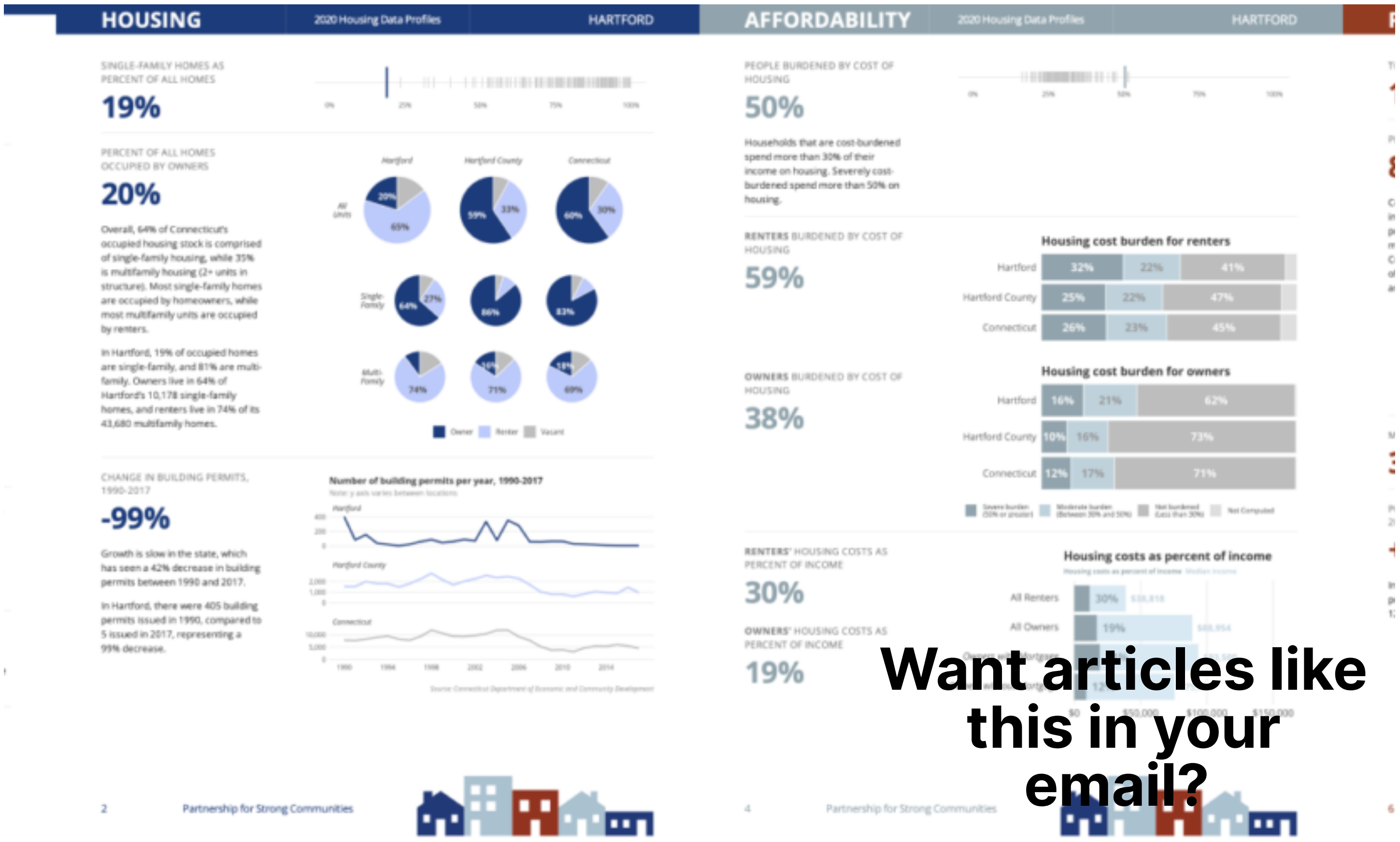
How to Create Multicolumn Layouts in RMarkdown

David
November 16, 2021

0 Comments



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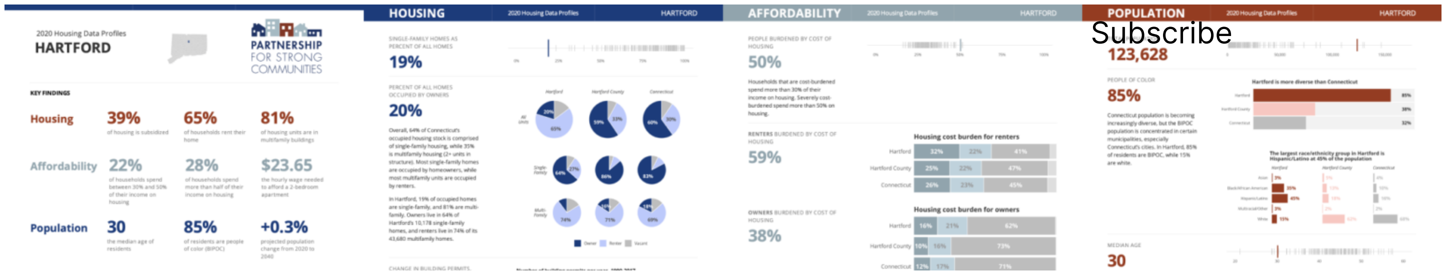
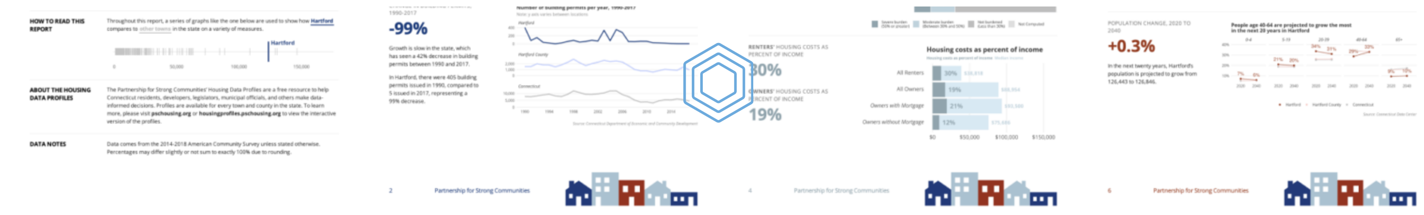
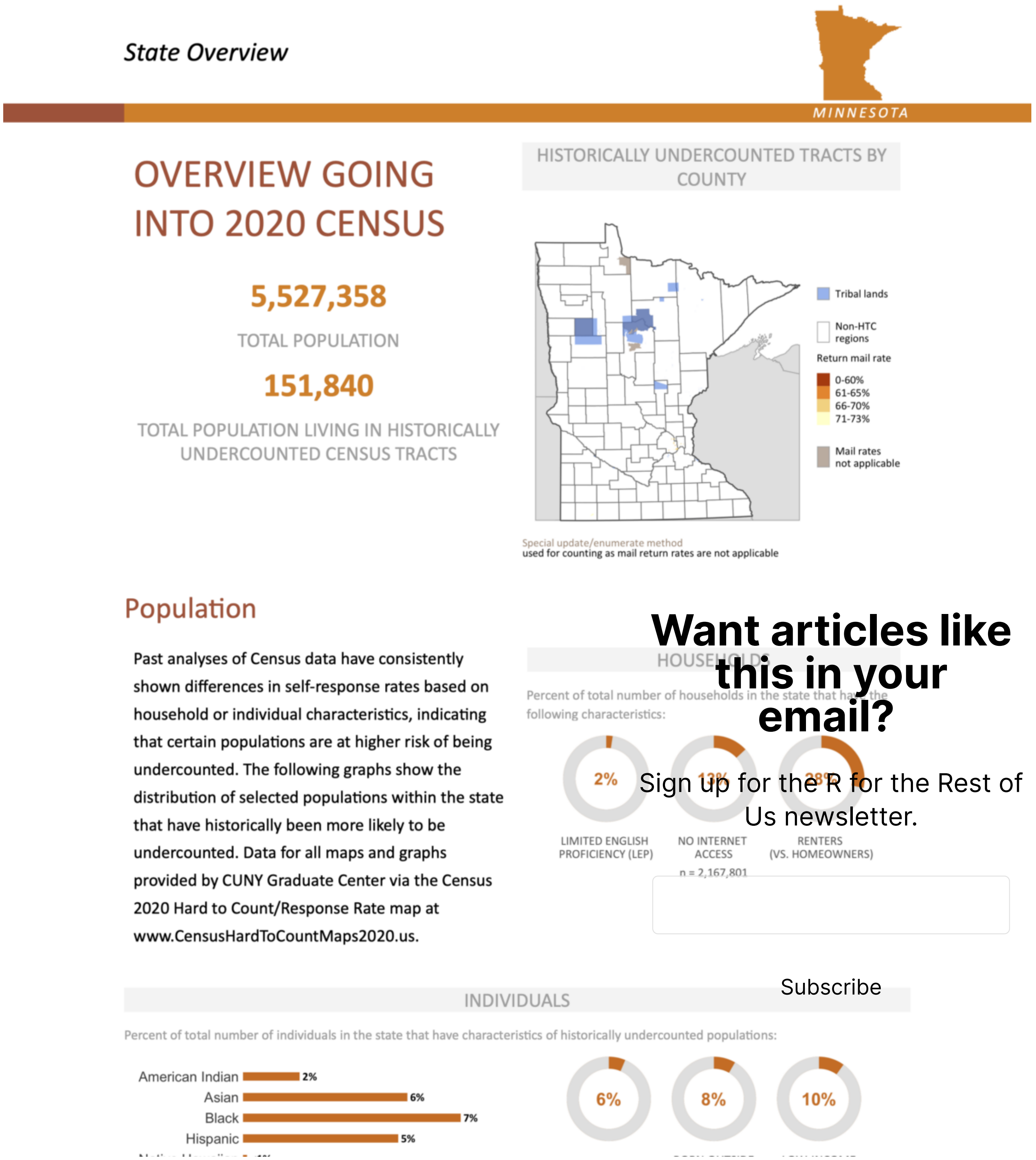
In a lot of the consulting work that R for the Rest of Us does, we do complex layouts of the sort are typically done with page layout software like Adobe InDesign. For example, in the reports we did on demographic and housing data in Connecticut, the charts were laid out in a complex grid across multiple pages.





Or take a look at these reports, done in partnership with the Democracy Funders Collaborative's Census Subgroup and ORS Impact, that provide an overview of efforts to promote the 2020 Census across the United States.



State Overview

MINNESOTA

OVERVIEW GOING INTO 2020 CENSUS

5,527,358

TOTAL POPULATION

151,840

TOTAL POPULATION LIVING IN HISTORICALLY UNDERCOUNTED CENSUS TRACTS

HISTORICALLY UNDERCOUNTED TRACTS BY COUNTY

Special update/enumerate method used for counting as mail return rates are not applicable

Population

Past analyses of Census data have consistently shown differences in self-response rates based on household or individual characteristics, indicating that certain populations are at higher risk of being undercounted. The following graphs show the distribution of selected populations within the state that have historically been more likely to be undercounted. Data for all maps and graphs provided by CUNY Graduate Center via the Census 2020 Hard to Count/Response Rate map at www.CensusHardToCountMaps2020.us.

HOUSEHOLDS

Percent of total number of households in the state that have the following characteristics:

2%	13%	28%
LIMITED ENGLISH PROFICIENCY (LEP)	NO INTERNET ACCESS	RENTERS (VS. HOMEOWNERS)

n = 2,167,801

INDIVIDUALS

Percent of total number of individuals in the state that have characteristics of historically undercounted populations:

American Indian	2%
Asian	6%
Black	7%
Hispanic	5%

6% 8% 10%

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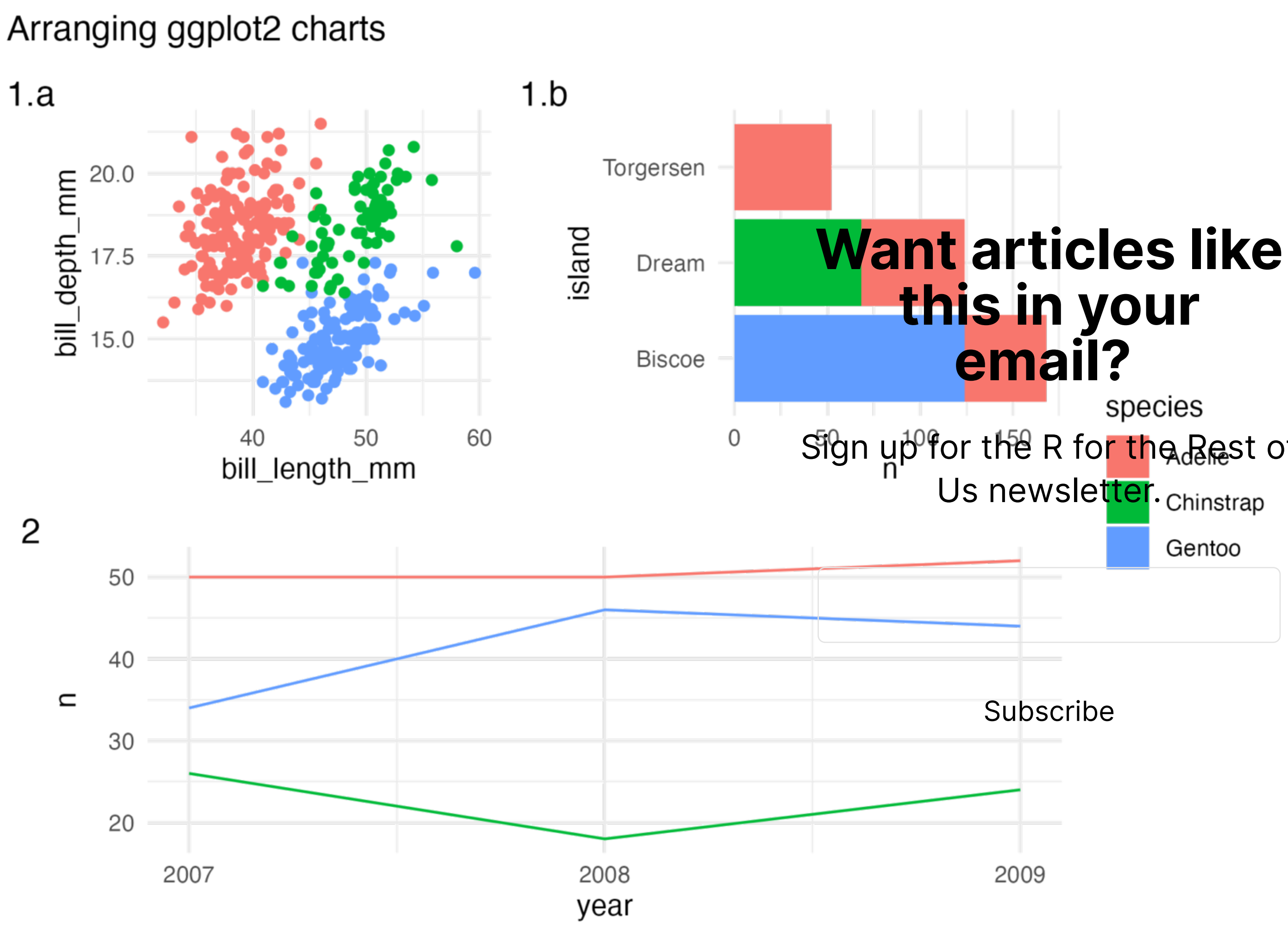
I'm often asked how we did these layouts. The truth is, it can be a bit complicated, and the answer varies depending on a number of factors. But, when an R in 3 Months participant asked this same question recently, I knew I had to come up with an answer to share.

Fortunately for me, I work with the very talented Charlie Hadley, who makes detailed videos explaining complex concepts to R learners. I asked Charlie to put together on some tips on the topic and she made some great videos showing how to make multicolumn layouts in RMarkdown. Here they are.

Option #1: Use `patchwork` or `cowplot` to combine multiple `ggplot2` plots

There are two packages, `patchwork` and `cowplot`, that allow you to put multiple plots together. You can use this technique to make a multicolumn layout, as in this example:



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Watch the video below as Charlie explains how this was made and follow her code below that.

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~~~
---
title: "Two column ggplot2 charts"
output: html_document
---

```{r setup, include=FALSE}
knitr::opts_chunk$set(
        echo = TRUE,
        message = FALSE,
        warning = FALSE
)
library(tidyverse)
library(patchwork)
library(cowplot)
library(palmerpenguins)
~~~

```{r original_charts, include=FALSE}
gg_penguin_scatter <- penguins %>%
  ggplot(aes(x = bill_length_mm,
             y = bill_depth_mm,
             color = species)) +
```

```
  geom_point()

gg_penguin_bar_chart <- penguins %>%
  count(island, species) %>%
  ggplot(aes(x = n,
             y = island,
             fill = species)) +
  geom_col()

gg_penguins_timeline <- penguins %>%
  count(year, species) %>%
  ggplot(aes(x = year,
             y = n,
             color = species)) +
  geom_line() +
  scale_x_continuous(n.breaks = 3)
```

# Intro

Often you'll want to arrange multiple {ggplot2} charts together with tags and titles, eg:

```{r echo=FALSE}
ptchw_chart <- ( ( gg_penguin_scatter | gg_penguin_bar_chart ) + plot_layout(tag_level = 'new')

gg_ptch_chart <- ptchw_chart &
  guides(color = guide_none()) &
  plot_annotation(tag_levels = c('1', 'a'), tag_sep = ".")
  plot_annotation(title = "Arranging ggplot2 charts") &
  theme_minimal()

ggsave("gg_ptch_chart.png",
       gg_ptch_chart)

gg_ptch_chart
```

There are two different packages you can choose from, {cowplot} and {patchwork}. They are both

- {cowplot}

  - Charts are explicitly built within a grid using `plot_grid()`. The layout is controlled by

  - Nested `plot_grid()` are required to get a single chart to span multiple rows or columns.

  - Themes need to be applied to individual charts.

  - Legends need to be extracted from charts and manually placed within a `plot_grid()`.

> {cowplot} allows extreme precision over your charts. Complex collections of charts with inset

- {patchwork}

  - Charts are built using `(p1 + p2) / p3` syntax, `p3` will be placed under `p1` and `p2`.

  - Because there is no grid system `p3` will automatically span the entire width of the chart.

  - Themes can be applied to the entire patchwork chart.

  - Legends can be automatically collected.

> {patchwork} feels and behaves like a ggplot2 extension, a lot of things are automated. It can

## cowplot

We need to create a nested plot_grid() for the timeline chart to span the width of the chart:

```{r}
plot_grid(plot_grid(gg_penguin_scatter, gg_penguin_bar_chart),
          plot_grid(gg_penguins_timeline),
          nrow = 2)
```

In the chart below our goal is to collect together the legends and change the theme:

- The legend is extracted from the bar chart with `get_legend()`

- The legends for all charts are disabled with `theme(legend.position = "none")`

- The legend is attached to the chart using another `plot_grid()`

- The theme has to be changed for all individual charts.

```{r}
cwp_legend <- get_legend(gg_penguin_bar_chart)

cwp_collected <-
```

```
  plot_grid(
    plot_grid(
      gg_penguin_scatter + theme_minimal() + theme(legend.position = "none"),
      gg_penguin_bar_chart + theme_minimal() + theme(legend.position = "none")
    ),
    plot_grid(gg_penguins_timeline + theme_minimal() + theme(legend.position = "none")),
    nrow = 2
  )

plot_grid(
  cwp_collected,
  cwp_legend,
  ncol = 2,
  rel_widths = c(8, 1)
)
```

Automatic labelling only works within an individual `plot_grid()`. We therefore need to add manu

```{r}
cwp_labelled <-
  plot_grid(
    plot_grid(
      gg_penguin_scatter + theme_minimal() + theme(legend.position = "none"),
      gg_penguin_bar_chart + theme_minimal() + theme(legend.position = "none"),
      labels = c("1.a", "1.b")
    ),
    plot_grid(gg_penguins_timeline + theme_minimal() + theme(legend.position = "none"),
              labels = "2"),
    nrow = 2
  )

plot_grid(
  cwp_labelled,
  cwp_legend,
  ncol = 2,
  rel_widths = c(8, 1)
)
```

Patchwork

Our basic layout is achieved as follows

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~~~
```{r}
(gg_penguin_scatter + gg_penguin_bar_chart ) / gg_penguins_timeline
```

To change the theme of all subplots we use `&`

```{r}
ptwc_basic <- (gg_penguin_scatter + gg_penguin_bar_chart ) / gg_penguins_timeline

ptwc_basic & theme_minimal()
```

To collect together the legends we go through two steps:

- Remove the guides for the `color` aesthetic, leaving only the fill guide.

- Use `plot_layout(guides = "collect")` to collect the remaining guides together

```{r}
ptchw_collected <- ( gg_penguin_scatter | gg_penguin_bar_chart ) / gg_penguins_timeline + plot_

ptchw_collected &
  guides(color = guide_none()) &
  theme_minimal()
```

{patchwork} can do automatic tagging, the documentation shows the different systems of counting

```{r}
ptchw_auto_tagging <- ( ( gg_penguin_scatter | gg_penguin_bar_chart ) + plot_layout(tag_level =

ptchw_auto_tagging &
  guides(color = guide_none()) &
  plot_annotation(tag_levels = c('1', 'a'), tag_sep = ".") &
  theme_minimal()
```

Manual tagging

```{r}
ptchw_manual_tagging <- ( gg_penguin_scatter + labs(tag = "scatter") | gg_penguin_bar_chart + la



ptchw_manual_tagging &
  guides(color = guide_none()) &
~~~

```
  guides(color = guide_none()) &
  theme_minimal()
```
```

**2-columns-ggplot.Rmd** hosted with ❤️ by **GitHub** **view raw**

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## Option #2: Use custom CSS in HTML files

If you're knitting your RMarkdown documents to HTML reports, you'll need to use custom CSS to add columns. You can do this using what's known as flexbox or bootstrap.

The video below demonstrates the differences between these two approaches (code follows):

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```
---
title: "Two Columns: html_document"
output: html_document

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

# Intro
```
```

~~~
There are two web frameworks available to us for creating multiple columns in html_document .Rmd

- [**flexbox**](https://css-tricks.com/snippets/css/a-guide-to-flexbox/):

  - Very flexible solution for controlling a single row of content

  - Disadvantage: flexbox columns don't reflow based on browser width, so may be difficult to re

  - Advantage: flexbox columns don't reflow, making them a very good choice


extremely flexible solution for reflowing content, it does not automatically scale to the width



- [**bootstrap**](https://getbootstrap.com/): designed to reflow content according to the browse

You could use either framework to achieve the same layouts, but they would require different coc

- Content in two columns **independent of browser width** using flexbox

- Content that reflows to one column when the browser becomes narrow using bootstrap

## HTML & `<div>` elements

Web pages are written in HTML. HTML is composed of open and close tags, for instance this is hov

```{html}
<h1>Heading</h1>
<h2>Sub heading</h2>
```

The `<div>` tag allows us to split up components of a web page. In this document we're using <di

In RMarkdown we have the choice between typing out <div> tags or using pairs of `:::`. Because


# Two columns independent of browser width

This uses **flexbox**

## Using :::

:::: {style="display: flex;"}
~~~

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~~~
:::: {style="display: flex;"}

::: {}

This is the first column (on the left)

```{r}
str(quakes)
~~~

:::

::: {}

... and this is the second column (on the right)

```{r}
str(chickwts)
```

:::

::::

Using `<div>`

<div style="display: flex;">

<div>

This is the first column (on the left)

```{r}
str(quakes)
```

</div>

<div>

... and this is the second column (on the right)

```{r}
str(chickwts)
```
```
```

~~~
</div>

</div>


# Two columns dependent on browser width

This uses **bootstrap**.

## Using `:::`

:::: {class='fluid-row'}

::: {class='col-md-6'}

1st column when browser is wide

```{r}
head(datasets::airmiles)
~~~

:::

::: {class='col-md-6'}

... 2nd column when browser is wide

```{r}
head(datasets::AirPassengers)
```

:::

::::

## Using `<div>`

<div class='fluid-row'>

<div class='col-md-6'>

1st column when browser is wide

```{r}
```

×

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```
head(datasets::airmiles)
```
~~~

</div>

<div class='col-md-6'>

... 2nd column when browser is wide

```{r}
head(datasets::AirPassengers)
~~~

</div>

</div>

```

flexbox-boostrap.Rmd hosted with ❤ by **GitHub** **view raw**

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While HTML as an export format is common, many people work in organizations that want PDFs. Fortunately, the `pagedown` package (and Thomas Vroylandt and my `pagedreport` package) actually create HTML documents that they the convert to PDFs. As a result, you can use CSS to create multicolumn layouts in `pagedown` , as Charlie demonstrates:

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```

~~~
---
title: "Pagedown"
output:
  pagedown::html_letter:
    self_contained: false
links-to-footnotes: true
paged-footnotes: true
---

```{r setup, include=FALSE}
knitr::opts_chunk$set(
        echo = FALSE,
        message = FALSE,
        warning = FALSE
)
library(tidyverse)
library(palmerpenguins)
```

::: from
Charlie Joey Hadley
Bristol
United Kingdom
Email: charlie@rfortherestofus.com
:::

Intro

[{pagedown}](https://github.com/rstudio/pagedown) is designed to solve an annoying problem in RM

> Formatting PDF RMarkdown documents is difficult and requires LaTeX.

The {pagedown} solution is to allow us to write HTML documents with pagination (and printing) as

- pagedown::thesis_paged

- pagedown::jss_paged

- pagedown::html_resume

~~~

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~~~
- pagedown::poster_relaxed

- pagedown::business_card

The **best** choice for creating multiple columns in {pagedown} is flexbox because it's browser

As before, we can use either `<div>` tags or `:::`

## Using ::: {.page-break-before}

:::: {style="display: flex;"}

::: {}

This is the first column (on the left)

```{r}
penguins %>%
  ggplot(aes(x = bill_length_mm,
             y = bill_depth_mm,
             color = species)) +
  geom_point()
~~~

:::

::: {}

... and this is the second column (on the right)

```{r}
penguins %>%
  ggplot(aes(x = bill_length_mm,
             y = bill_depth_mm,
             color = island)) +
  geom_point()
```

:::

::::

Using `<div>`

<div style="display: flex;">
```
```

~~~
<div style="display: flex;">

<div>

This is the first column (on the left)

```{r}
penguins %>%
  ggplot(aes(x = bill_length_mm,
             y = bill_depth_mm,
             color = species)) +
  geom_point()
~~~

</div>

<div>

... and this is the second column (on the right)

```{r}
penguins %>%
  ggplot(aes(x = bill_length_mm,
             y = bill_depth_mm,
             color = island)) +
  geom_point()
```

</div>

</div>
```

×

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Option #3: Use `officedown` and `officer` for multicolumn Word
```

## documents

If you need to export your RMarkdown document to Word, custom CSS won't work. You can, of course, use option #1 to create multicolumn plots and then put those into Word. Another approach for Word documents is to use the `officedown` and `officer` packages. Together, these two packages allow you to build rich Word documents directly from RMarkdown. This video shows how to create two columnsusing `output: officedown::rdocx_document` .

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~~~
---
title: "Two columns in Word Documents"
output: officedown::rdocx_document
---

```{r setup, include=FALSE}
knitr::opts_chunk$set(
        echo = TRUE,
        message = FALSE,
        warning = FALSE
)
library(officer)
library(tidyverse)
library(palmerpenguins)
```

Intro
~~~

~~~
# Intro

There are a collection of packages called [{officeverse}](https://ardata-fr.github.io/officevers

- {officedown}: This package provides additional RMarkdown output formats for creating .docx and

- {officer}: This package allows us to programmatically generate (and modify existing) .docx and

There are two steps to creating multiple columns:

1. Use a pair of HTML comments as follows:

<code>
&lt;!--BLOCK_MULTICOL_START---&gt;

&lt;!---BLOCK_MULTICOL_START---&gt;
</code>

1. Call `run_columnbreak()` as an inline expression at the beginning of the content for the seco

## What's an inline expression?

An inline R expression allows us to run R code within a Markdown content instead of in a code ch

```{yaml}
There are `r 2+2` lights
```

## Page break

I've manually inserted a page break here with `run_pagebreak()`

```{r}
run_pagebreak()
```


# Example two column layout

The two column content begins underneath the HTML comment. Remember that the HTML comment won't

<!---BLOCK_MULTICOL_START--->

This is the beginning of the first column

```{r echo=FALSE, fig.cap="Penguin scatter plot", fig.cap.style = "Image Caption", fig.width=3
~~~

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~~~
```{r echo=FALSE, fig.cap="Penguin scatter plot", fig.cap.style = "Image Caption", fig.width=3,
gg_penguin_scatter <- penguins %>%
  ggplot(aes(x = bill_length_mm,
             y = bill_depth_mm,
             color = species)) +
  geom_point() +
  theme_minimal(base_size = 8)

ggsave("gg_penguin_scatter.png",
       gg_penguin_scatter,
       width = 3,
       height = 3,
       unit = "in",
       dpi = 300)
knitr::include_graphics("gg_penguin_scatter.png")
~~~

`r run_columnbreak()`This sentence begins the second column.

```{r echo=FALSE, fig.cap="Penguin scatter plot", fig.cap.style = "Image Caption", fig.width=3,
gg_penguin_bar <- penguins %>%
  count(island, species) %>%
  ggplot(aes(x = n,
             y = island,
             fill = species)) +
  geom_col() +
  theme_minimal(base_size = 8)

ggsave("gg_penguin_bar.png",
       gg_penguin_bar,
       width = 3,
       height = 3,
       unit = "in",
       dpi = 300)
knitr::include_graphics("gg_penguin_bar.png")
```

The multi column will end after this sentence.

<!---BLOCK_MULTICOL_STOP--->

This text is just below the HTML comment so Word continues in single column mode. There's ar

```{r}
run_pagebreak()
```
```

×

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```

```
```

# Customising column appearance

By modifying the closing HTML comment it's possible to customise the appearance of the columns:

<!---BLOCK_MULTICOL_START--->

This is the beginning of the first column

```{r echo=FALSE, fig.cap="Penguin scatter plot", fig.cap.style = "Image Caption", fig.width=3,
gg_penguin_scatter <- penguins %>%
  ggplot(aes(x = bill_length_mm,
             y = bill_depth_mm,
             color = species)) +
  geom_point() +
  theme_minimal(base_size = 8)

ggsave("gg_penguin_scatter.png",
       gg_penguin_scatter,
       width = 3,
       height = 3,
       unit = "in",
       dpi = 300)
knitr::include_graphics("gg_penguin_scatter.png")
```

`r run_columnbreak()`This sentence begins the second column

```{r echo=FALSE, fig.cap="Penguin scatter plot", fig.cap.style = "Image Caption", fig.width=3,
gg_penguin_bar <- penguins %>%
  count(island, species) %>%
  ggplot(aes(x = n,
             y = island,
             fill = species)) +
  geom_col() +
  theme_minimal(base_size = 8)

ggsave("gg_penguin_bar.png",
       gg_penguin_bar,
       width = 3,
       height = 3,
       unit = "in",
       dpi = 300)
```

×

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```
knitr::include_graphics("gg_penguin_bar.png")
```

The multi column will end after this sentence.

<!---BLOCK_MULTICOL_STOP{widths: [3,3], space: 0.2, sep: true}--->
```

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View this gist on GitHub

Creating multicolumn layouts may seem like a small thing, but it can have a huge impact. Since the R for the Rest of Us team started using the techniques above, we've been able to create reports from start to finish in R. No longer do we need to bring in a graphic designer to do the final layout. It's a huge timesaver and also makes it possible to do things like automatically make 170+ reports.

Have any questions? Put them below and we will help you out!

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```

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