

# Data Visualization in R with `ggplot2`

The Structure of `ggplot2` (Part 3)

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Photo by Richard Strozyński

Part 3

# Multipanel Plots

# ggplot2: Build a data MASTERpiece



Illustration by Allison Horst ([github.com/allisonhorst/stats-illustrations](https://github.com/allisonhorst/stats-illustrations))

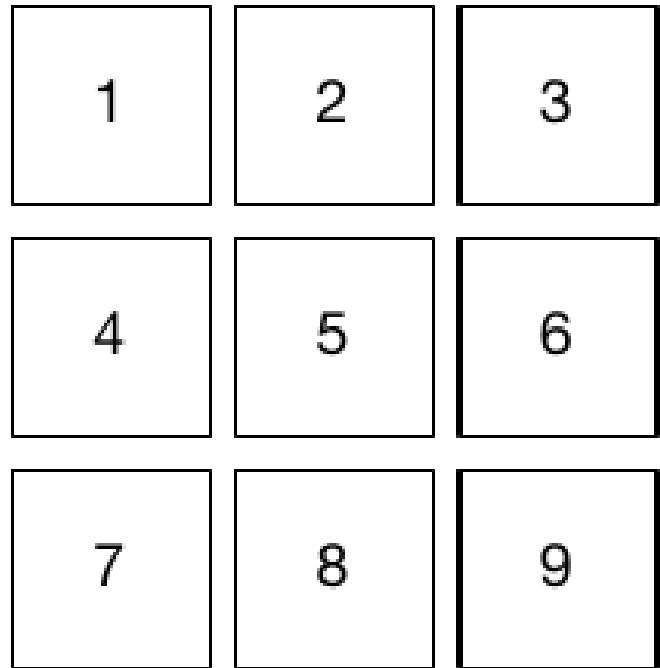
# The Structure of `ggplot2`

Layer	Function	Explanation
Data	<code>ggplot(data)</code>	The raw data that you want to visualise.
Aesthetics	<code>aes()</code>	Aesthetic mappings of the geometric and statistical objects.
Layers	<code>geom_*</code> () and <code>stat_*</code> ()	The geometric shapes and statistical summaries representing the data.
Scales	<code>scale_*</code> ()	Maps between the data and the aesthetic dimensions.
Coordinate System	<code>coord_*</code> ()	Maps data into the plane of the data rectangle.
Facets	<code>facet_*</code> ()	The arrangement of the data into a grid of plots.
Visual Themes	<code>theme()</code> and <code>theme_*</code> ()	The overall visual defaults of a plot.
Annotations	<code>annotate()</code>	Add additional labels, geometries or images to a plot.

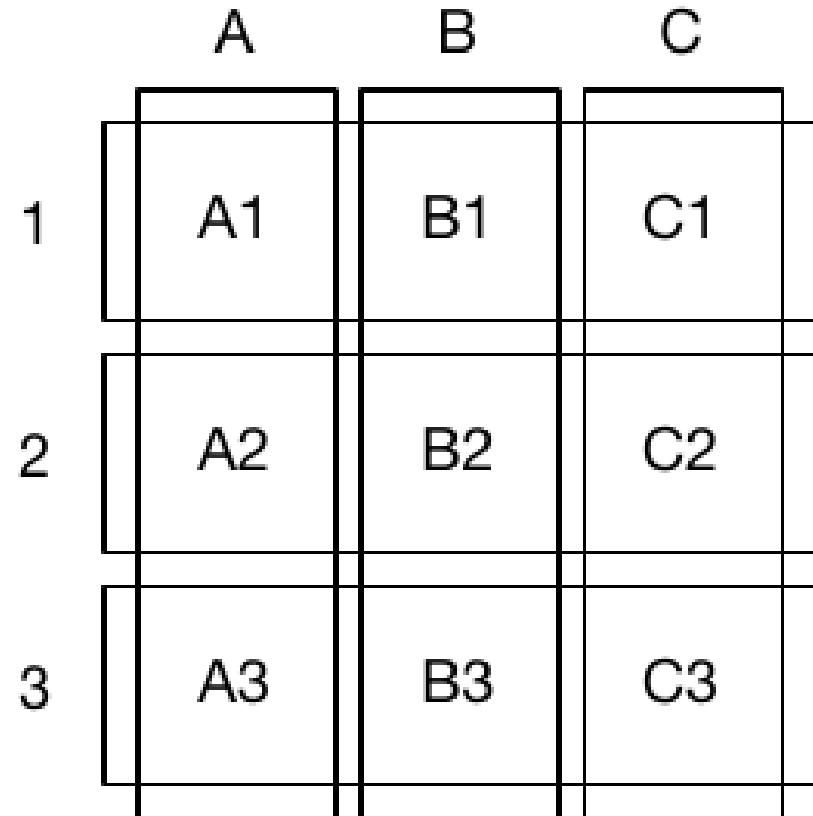
# Facets

**facet\_\***( )

# **facet\_\***( )



**facet\_wrap**



**facet\_grid**

*Adapted from "ggplot2: Elegant Graphics for Data Analysis" by Hadley Wickham*

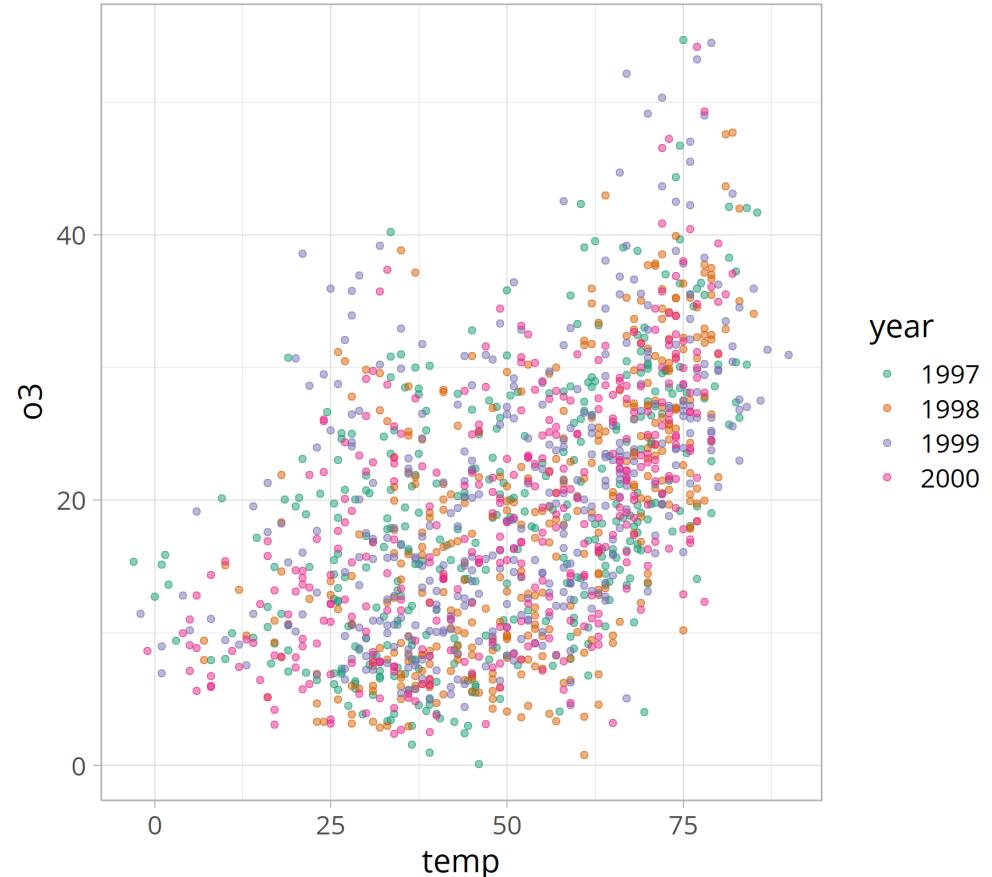
# Facets

**facet\_wrap()**

# facet\_wrap()

`facet_wrap()` splits the data into small multiples based on one grouping variable:

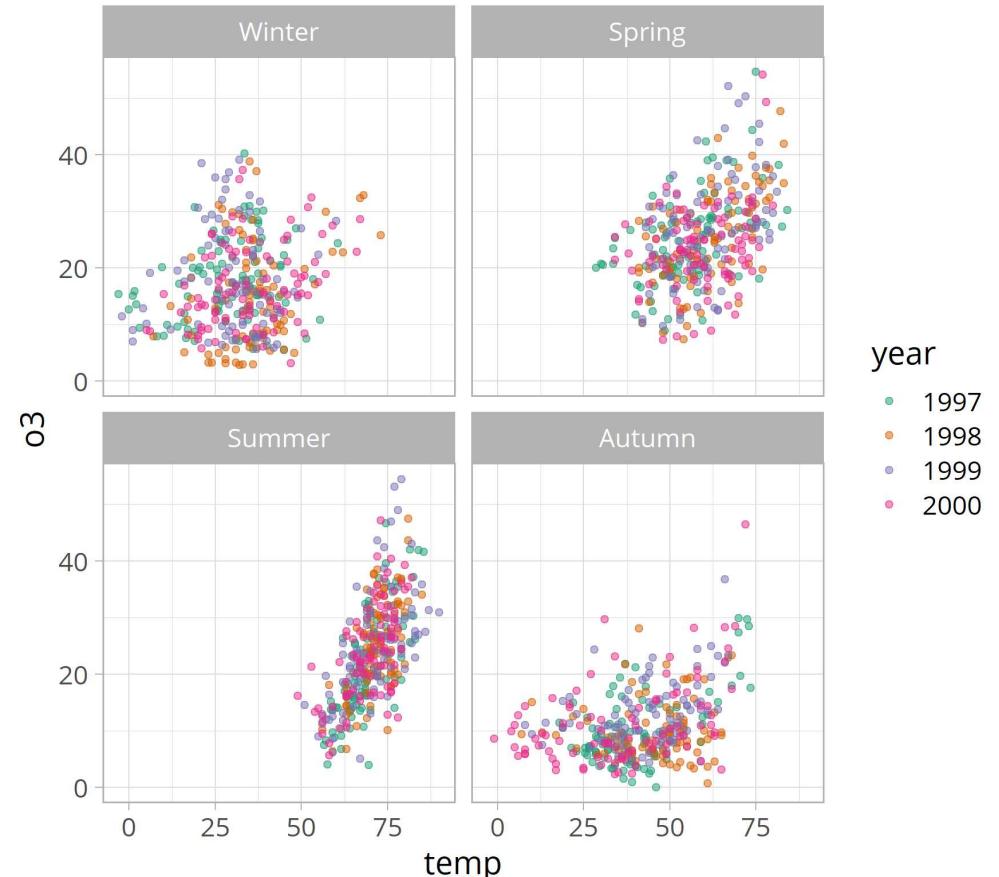
```
ggplot(chic, aes(temp, o3)) +  
  geom_point(  
    aes(color = year),  
    alpha = .5  
  ) +  
  scale_color_brewer(  
    palette = "Dark2"  
  )
```



# facet\_wrap()

`facet_wrap()` splits the data into small multiples based on one grouping variable:

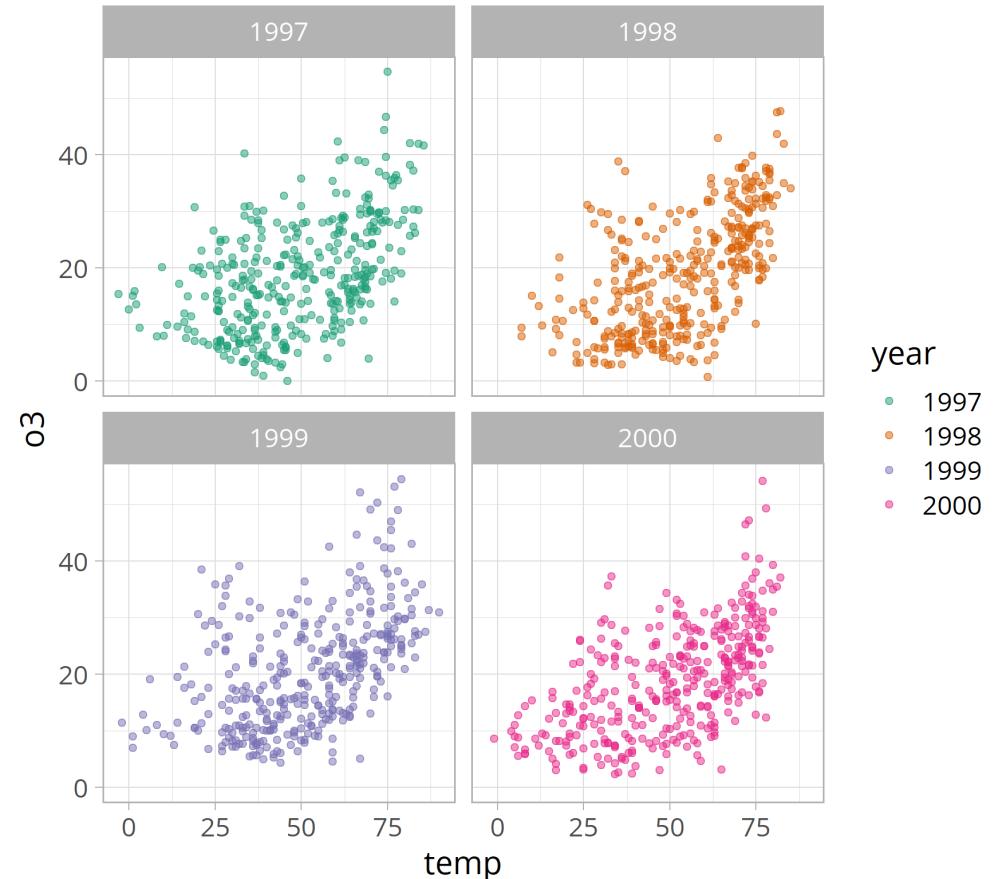
```
ggplot(chic, aes(temp, o3)) +  
  geom_point(  
    aes(color = year),  
    alpha = .5  
  ) +  
  scale_color_brewer(  
    palette = "Dark2"  
  ) +  
  facet_wrap(~ season)
```



# facet\_wrap()

`facet_wrap()` splits the data into small multiples based on one grouping variable:

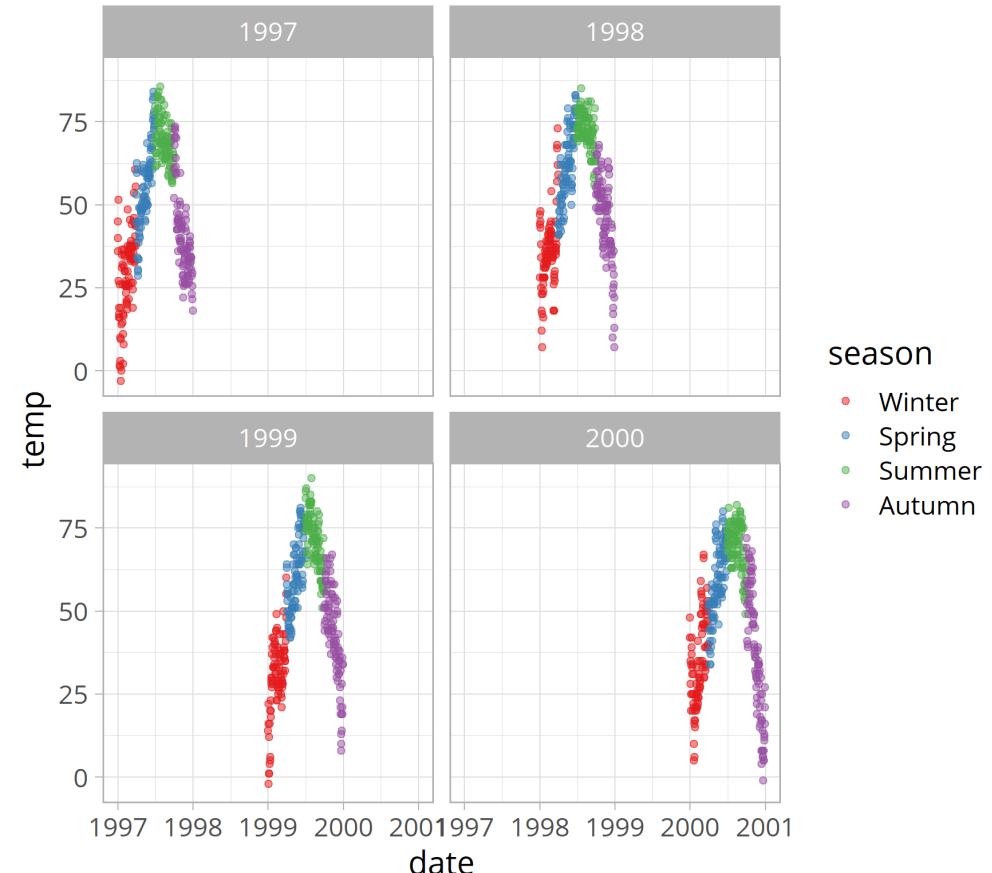
```
ggplot(chic, aes(temp, o3)) +  
  geom_point(  
    aes(color = year),  
    alpha = .5  
  ) +  
  scale_color_brewer(  
    palette = "Dark2"  
  ) +  
  facet_wrap(~ year)
```



# facet\_wrap()

`facet_wrap()` splits the data into small multiples based on one grouping variable:

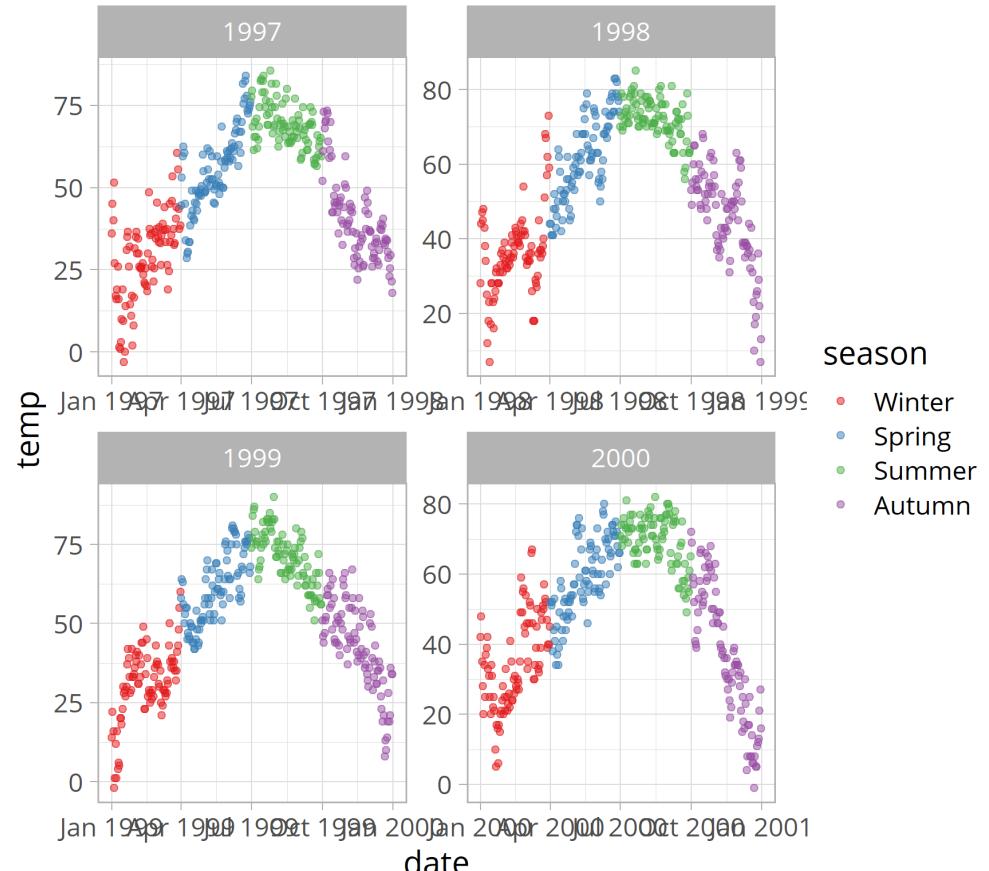
```
ggplot(chic, aes(date, temp)) +  
  geom_point(  
    aes(color = season),  
    alpha = .5  
  ) +  
  scale_color_brewer(  
    palette = "Set1"  
  ) +  
  facet_wrap(~ year)
```



# facet\_wrap()

`facet_wrap()` splits the data into small multiples based on one grouping variable:

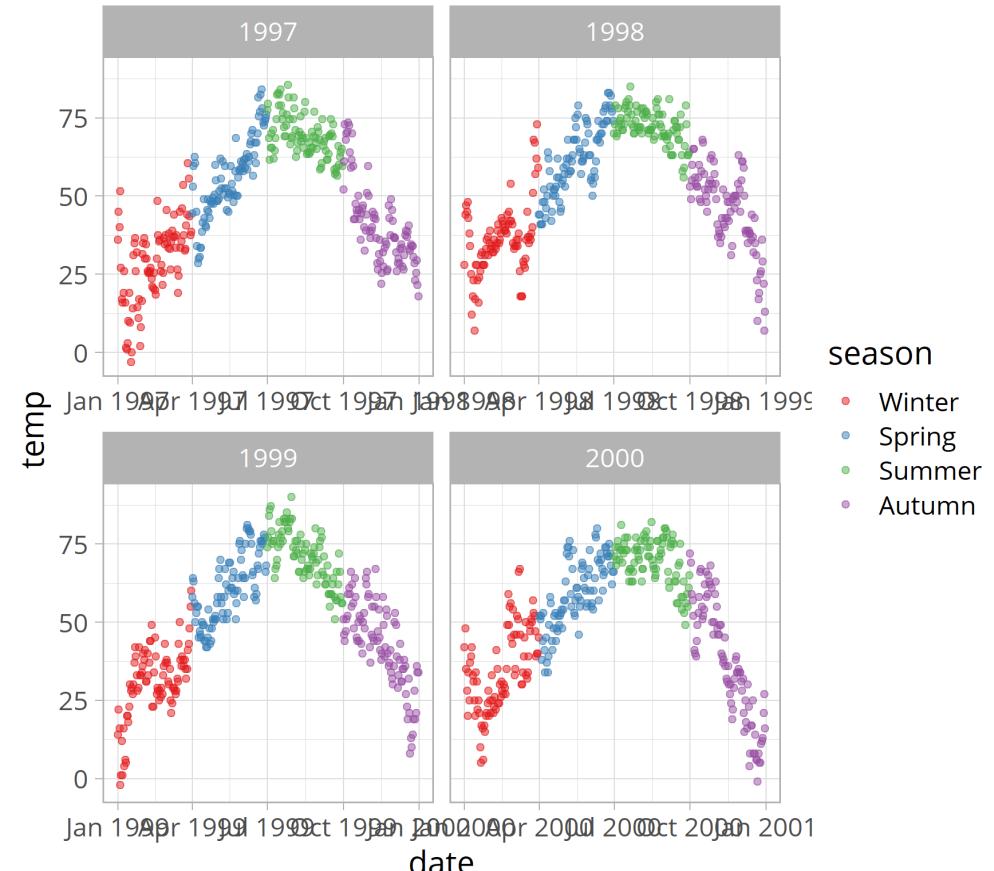
```
ggplot(chic, aes(date, temp)) +  
  geom_point(  
    aes(color = season),  
    alpha = .5  
  ) +  
  scale_color_brewer(  
    palette = "Set1"  
  ) +  
  facet_wrap(  
    ~ year,  
    scales = "free"  
  )
```



# facet\_wrap()

`facet_wrap()` splits the data into small multiples based on one grouping variable:

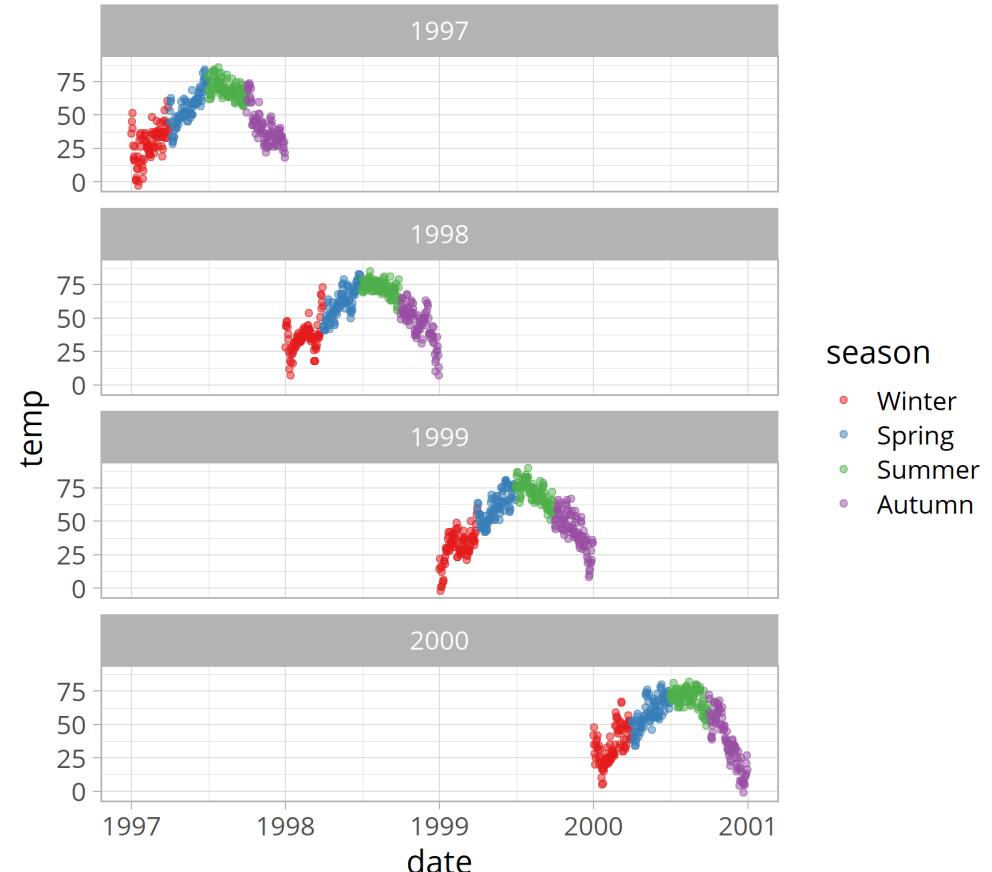
```
ggplot(chic, aes(date, temp)) +  
  geom_point(  
    aes(color = season),  
    alpha = .5  
  ) +  
  scale_color_brewer(  
    palette = "Set1"  
  ) +  
  facet_wrap(  
    ~ year,  
    scales = "free_x"  
  )
```



# facet\_wrap()

`facet_wrap()` splits the data into small multiples based on one grouping variable:

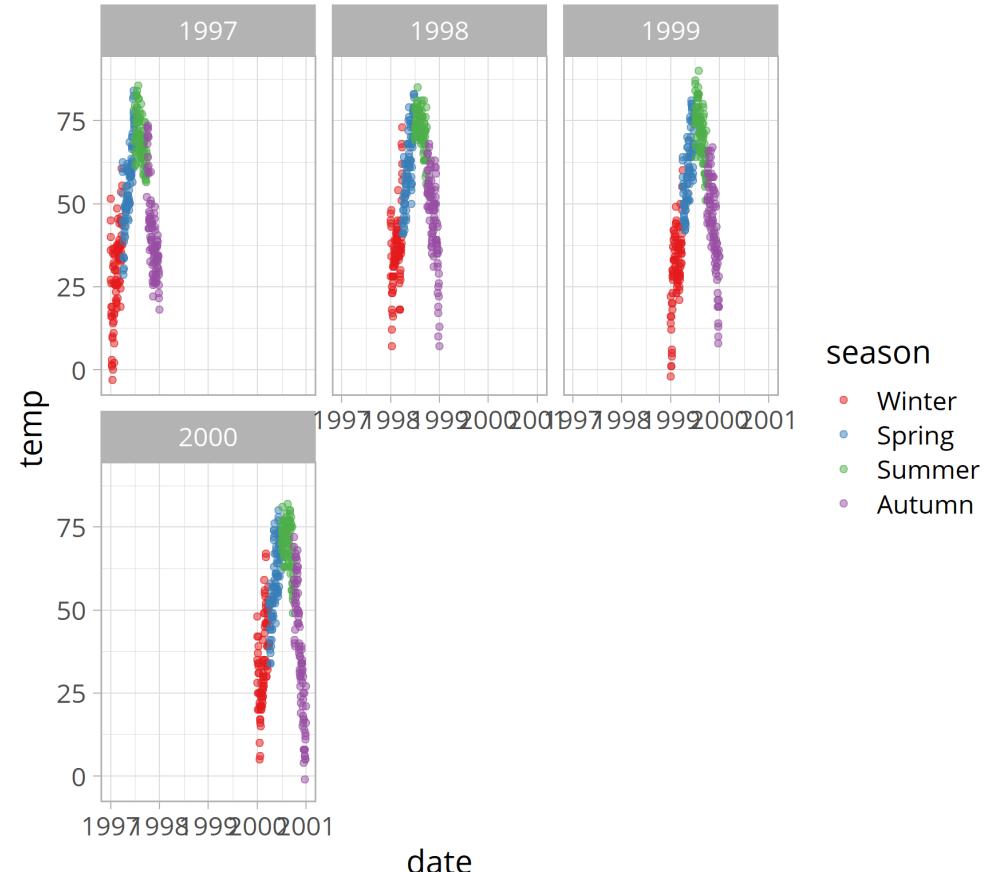
```
ggplot(chic, aes(date, temp)) +  
  geom_point(  
    aes(color = season),  
    alpha = .5  
  ) +  
  scale_color_brewer(  
    palette = "Set1"  
  ) +  
  facet_wrap(  
    ~ year,  
    nrow = 4  
  )
```



# facet\_wrap()

`facet_wrap()` splits the data into small multiples based on one grouping variable:

```
ggplot(chic, aes(date, temp)) +  
  geom_point(  
    aes(color = season),  
    alpha = .5  
  ) +  
  scale_color_brewer(  
    palette = "Set1"  
  ) +  
  facet_wrap(  
    ~ year,  
    ncol = 3  
  )
```



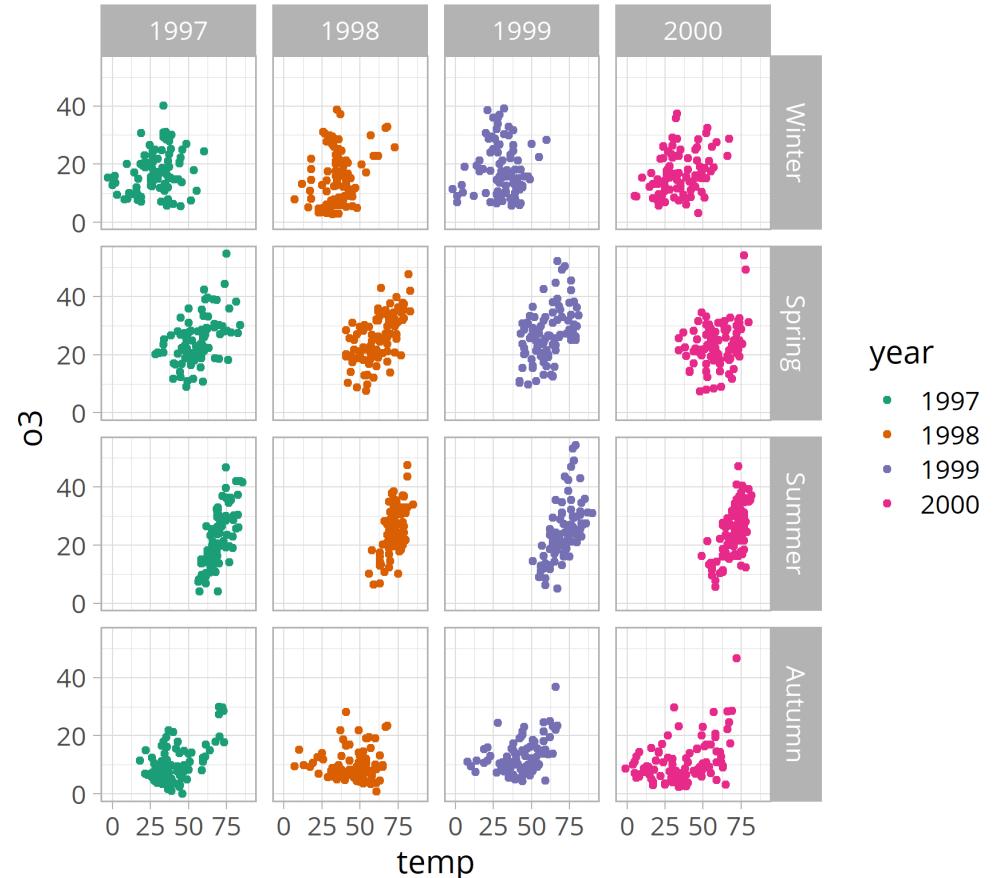
# Facets

`facet_grid()`

# facet\_grid()

`facet_grid()` spans a grid of each combination of two grouping variables:

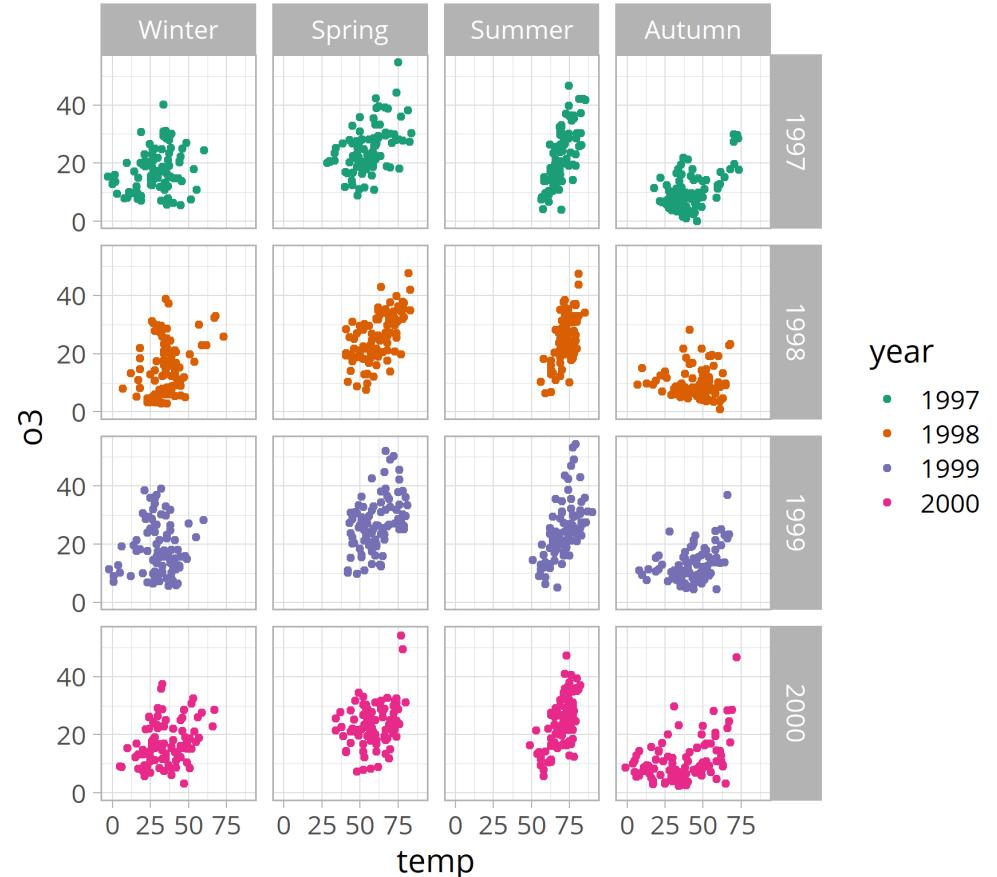
```
ggplot(chic, aes(temp, o3)) +  
  geom_point(aes(color = year)) +  
  scale_color_brewer(  
    palette = "Dark2"  
  ) +  
  facet_grid(season ~ year)
```



# facet\_grid()

`facet_grid()` spans a grid of each combination of two grouping variables:

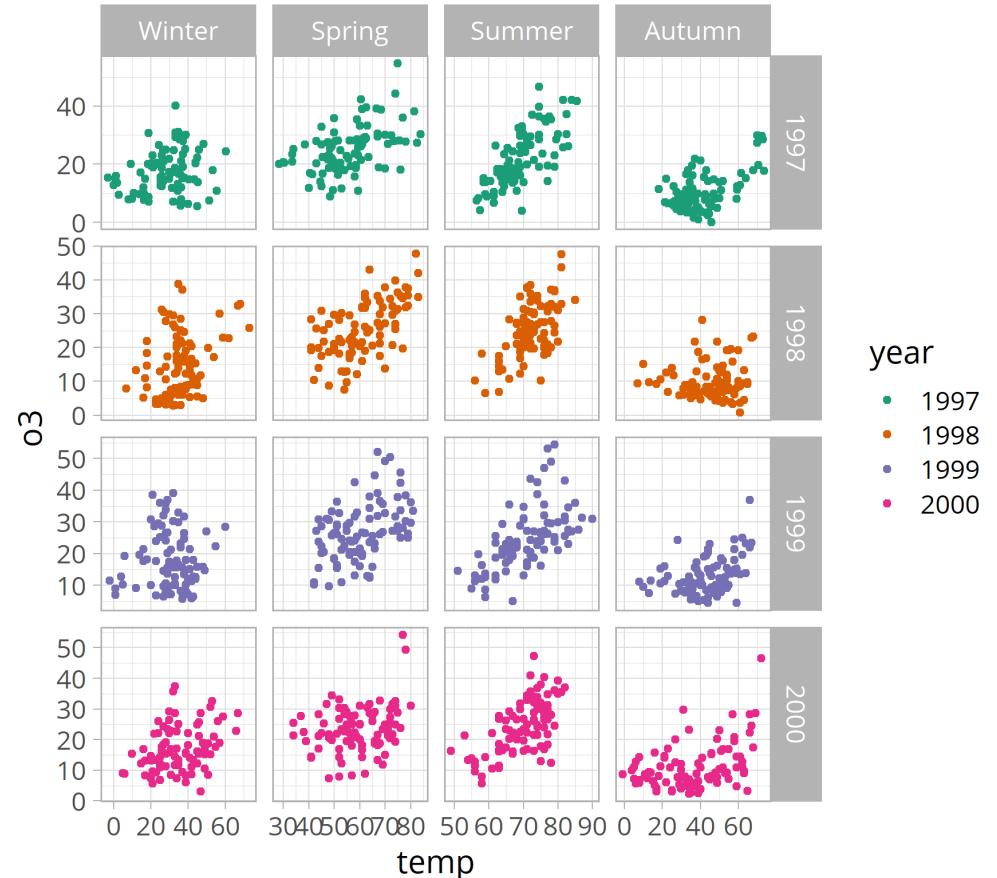
```
ggplot(chic, aes(temp, o3)) +  
  geom_point(aes(color = year)) +  
  scale_color_brewer(  
    palette = "Dark2"  
  ) +  
  facet_grid(year ~ season)
```



# facet\_grid()

`facet_grid()` spans a grid of each combination of two grouping variables:

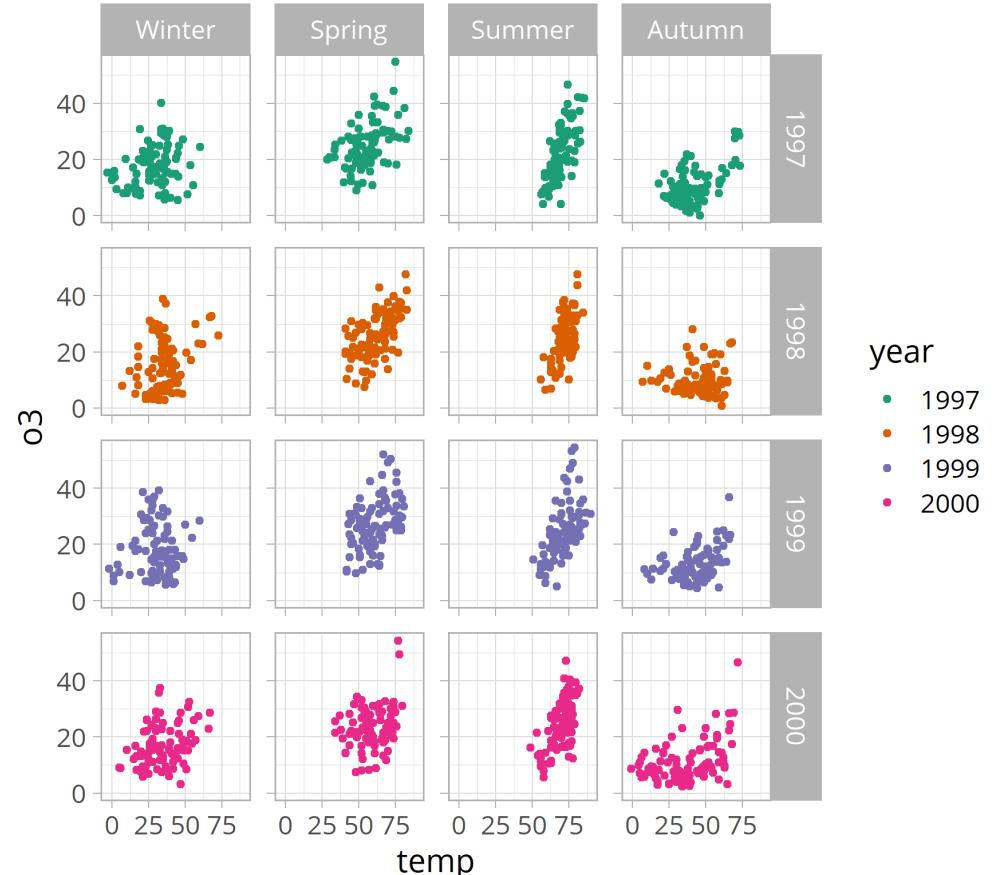
```
ggplot(chic, aes(temp, o3)) +  
  geom_point(aes(color = year)) +  
  scale_color_brewer(  
    palette = "Dark2"  
  ) +  
  facet_grid(  
    year ~ season,  
    scales = "free"  
  )
```



# facet\_rep\_grid()

`facet_rep_grid()` from the `lemon` package allows you to draw axis lines and ticks for all facets:

```
ggplot(chic, aes(temp, o3)) +  
  geom_point(aes(color = year)) +  
  scale_color_brewer(  
    palette = "Dark2"  
  ) +  
  lemon::facet_rep_grid(  
    year ~ season  
)
```





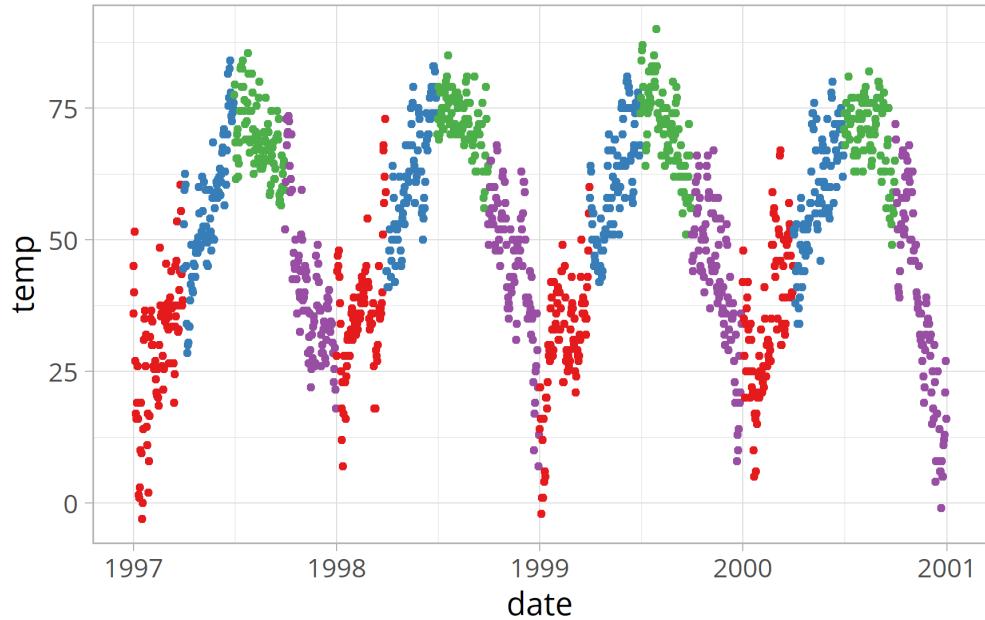
# The **patchwork** Package

## The Composer of Plots

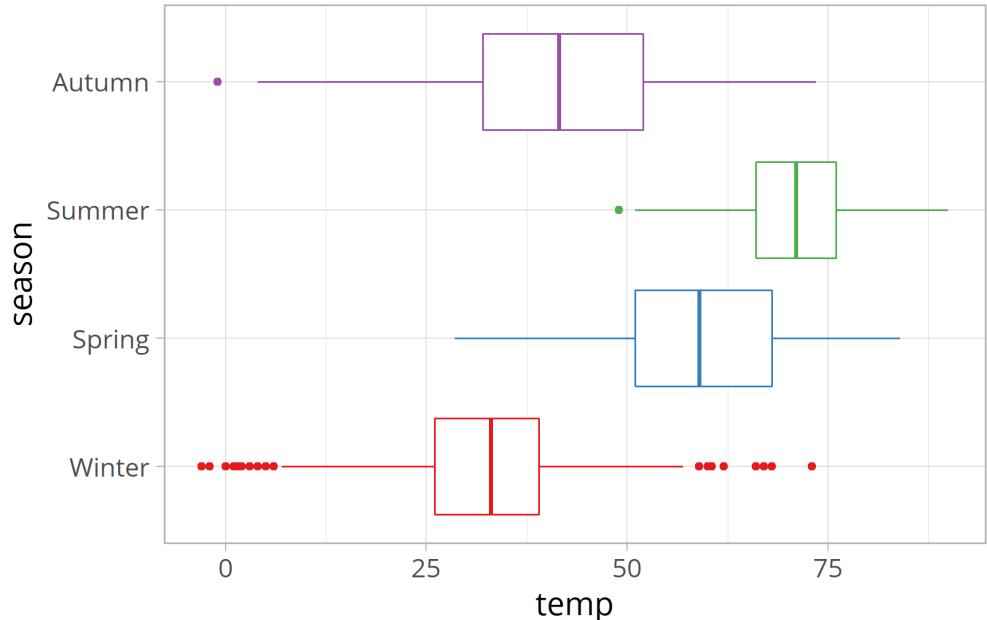
# The patchwork package

Build up your multipanel plot sequentially using The Composer of Plots:

```
(time <- ggplot(chic, aes(date, temp)) +  
  geom_point(aes(color = season)) +  
  scale_color_brewer(palette = "Set1",  
                     guide = FALSE))
```



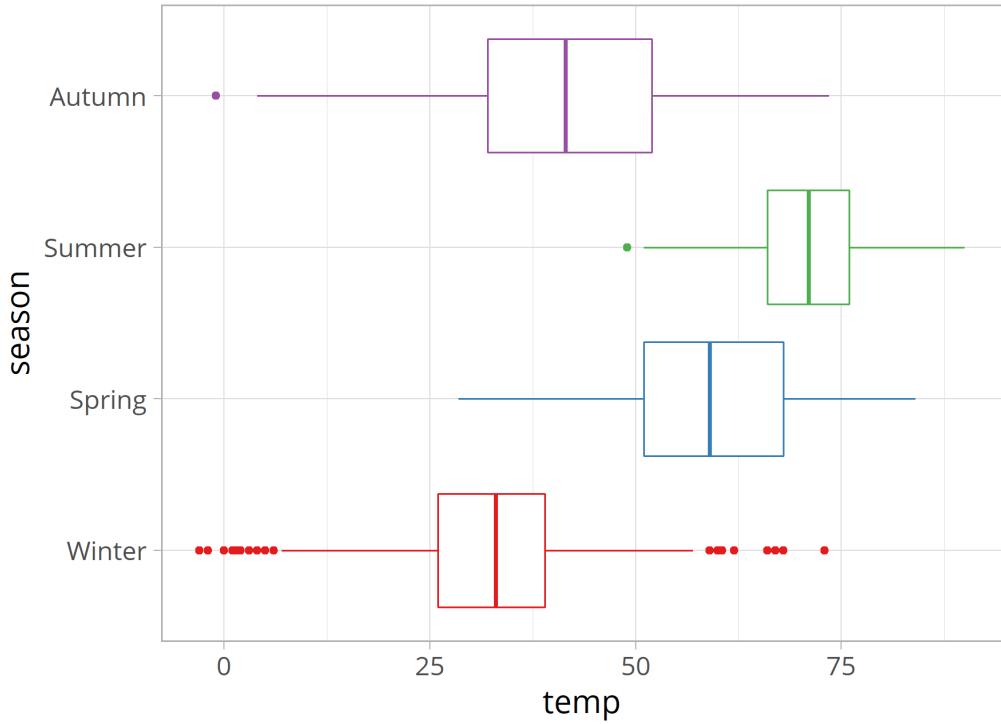
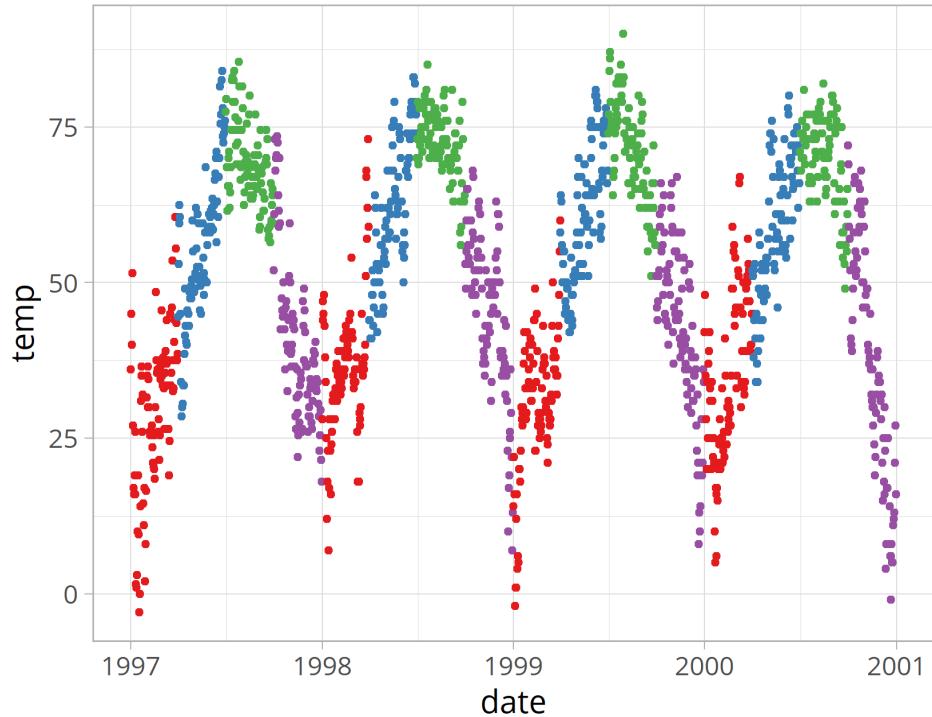
```
(box <- ggplot(chic, aes(temp, season)) +  
  geom_boxplot(aes(color = season)) +  
  scale_color_brewer(palette = "Set1",  
                     guide = FALSE))
```



# The patchwork package

Build up your multipanel plot sequentially using The Composer of Plots:

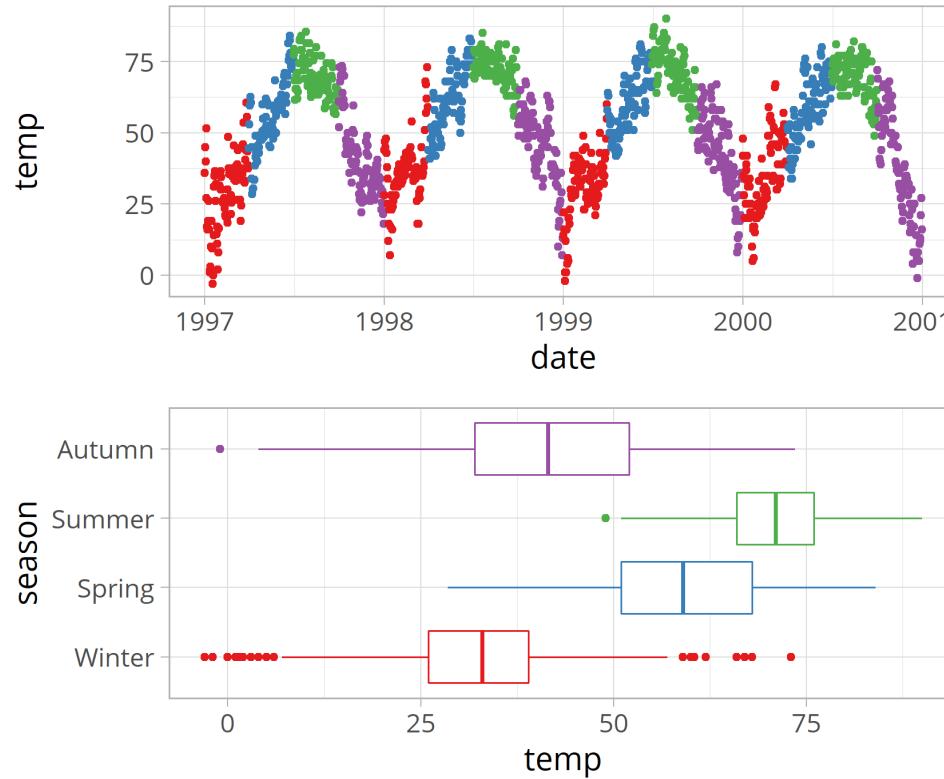
```
library(patchwork)  
time + box
```



# The patchwork package

Build up your multipanel plot sequentially using The Composer of Plots:

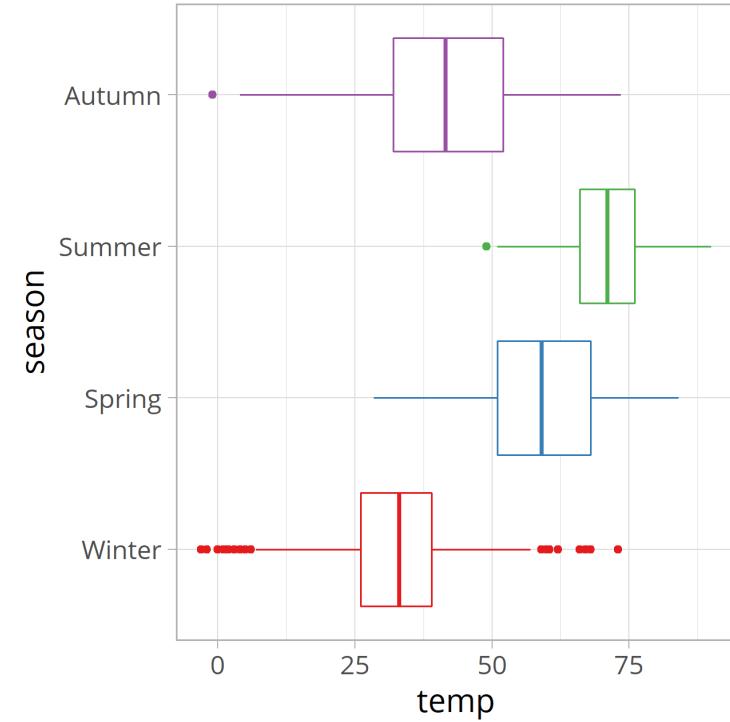
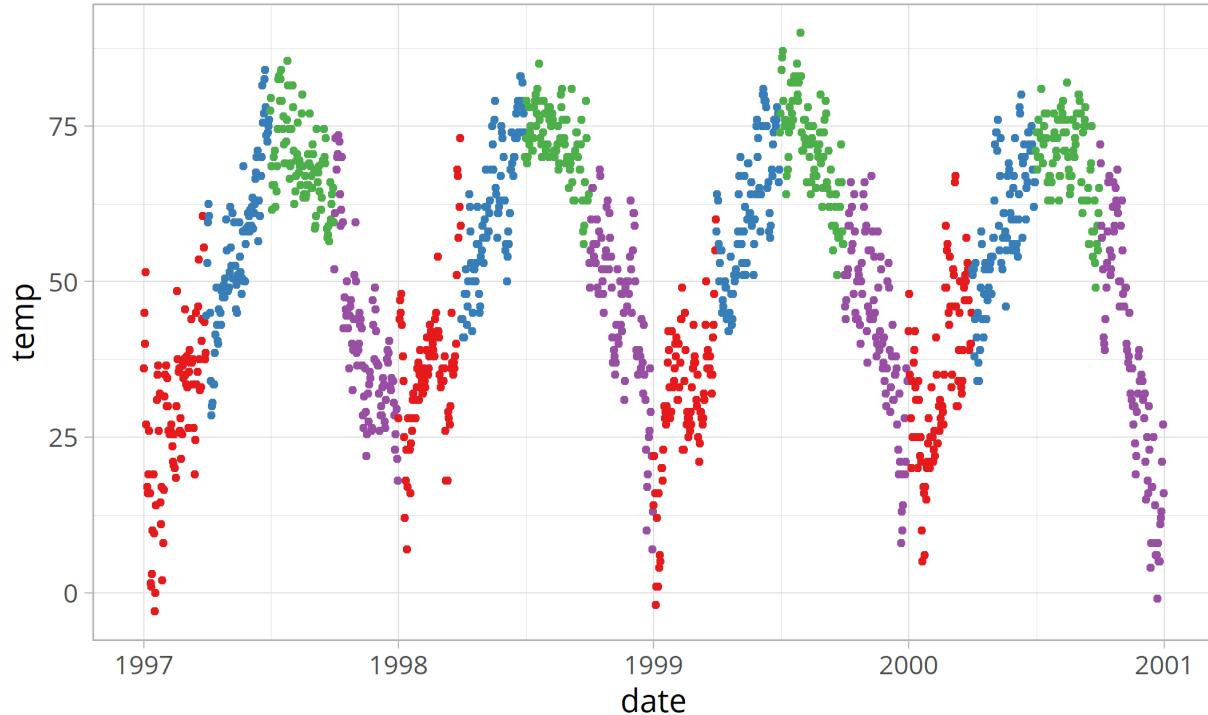
time / box



# The patchwork package

Build up your multipanel plot sequentially using The Composer of Plots:

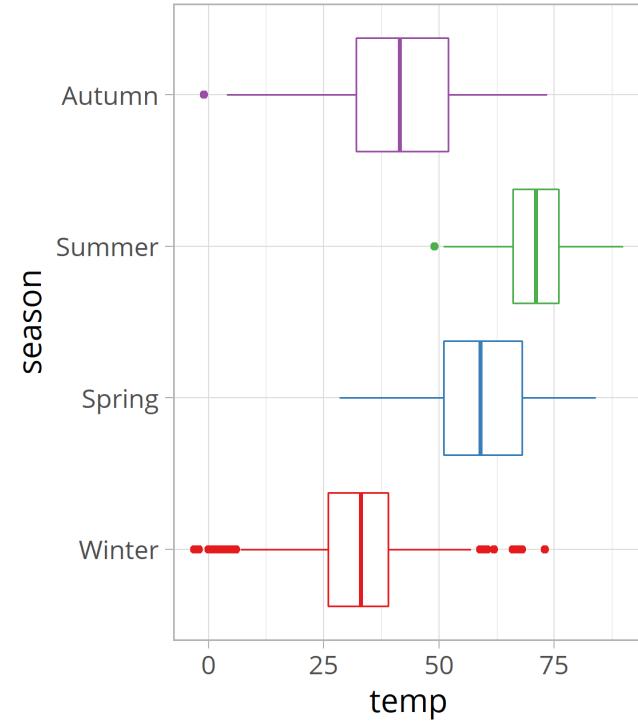
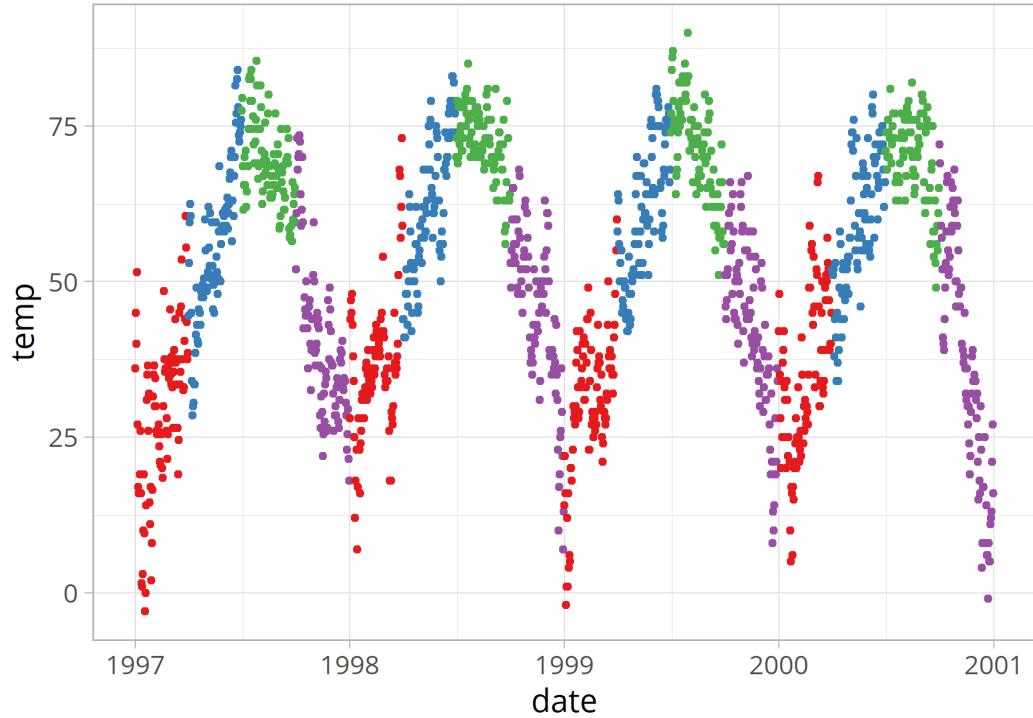
```
time + box + plot_layout(widths = c(2, 1))
```



# The patchwork package

Build up your multipanel plot sequentially using The Composer of Plots:

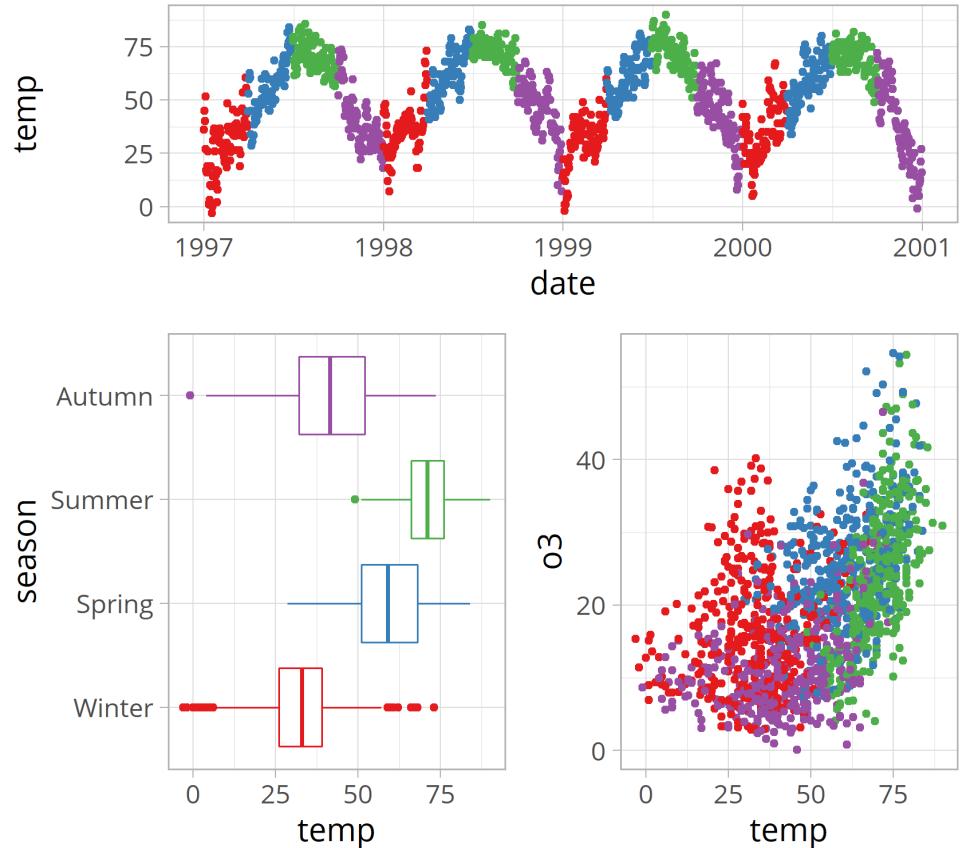
```
time + plot_spacer() + box + plot_layout(widths = c(2, .5, 1))
```



# The patchwork package

Build up your multipanel plot sequentially using The Composer of Plots:

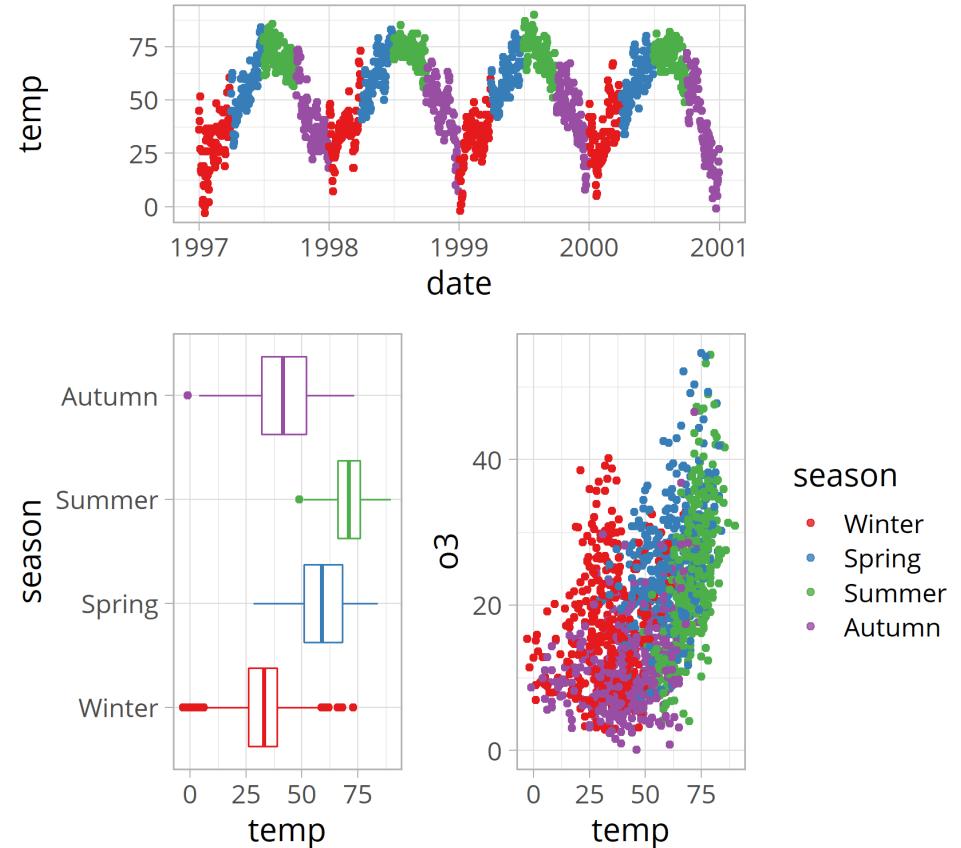
```
scatter <-  
  ggplot(  
    chic,  
    aes(temp, o3)  
  ) +  
  geom_point(aes(color = season)) +  
  scale_color_brewer(  
    palette = "Set1",  
    guide = FALSE  
  )  
  
time / (box + scatter) +  
  plot_layout(heights = c(1, 2))
```



# The patchwork package

Build up your multipanel plot sequentially using The Composer of Plots:

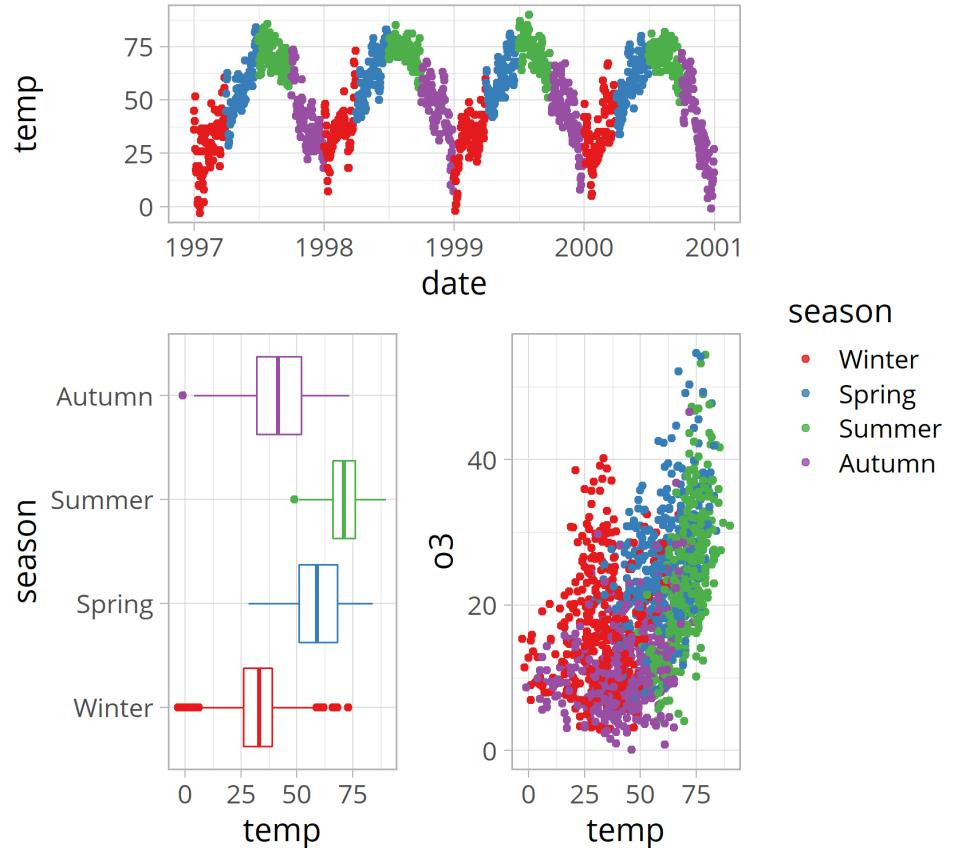
```
scatter <-  
  ggplot(  
    chic,  
    aes(temp, o3)  
  ) +  
  geom_point(aes(color = season)) +  
  scale_color_brewer(  
    palette = "Set1"#,  
    #guide = FALSE  
  ) + guides(color = guide_legend(override_order = 1))  
  
time / (box + scatter) +  
  plot_layout(heights = c(1, 2))
```



# The patchwork package

Build up your multipanel plot sequentially using The Composer of Plots:

```
time / (box + scatter) +
  plot_layout(
    heights = c(1, 2),
    guides = "collect"
  )
```

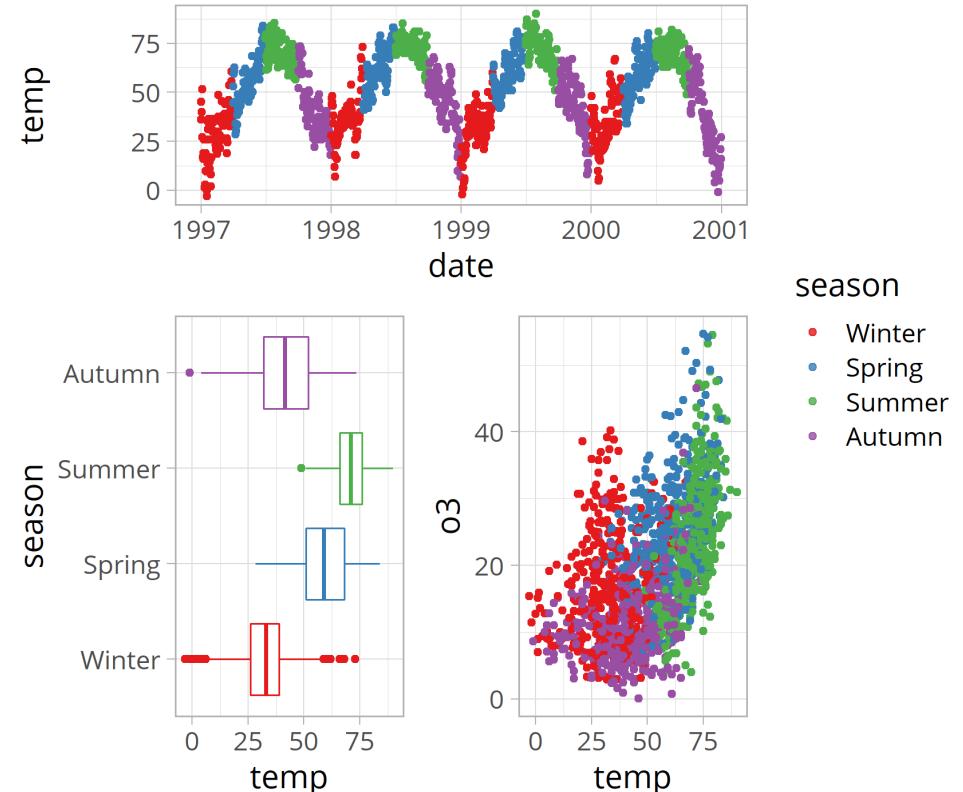


# The patchwork package

Build up your multipanel plot sequentially using The Composer of Plots:

```
time / (box + scatter) +
  plot_layout(
    heights = c(1, 2),
    guides = "collect"
  ) +
  plot_annotation(
    title = "Temperature & Ozone in Chicago, IL"
  )
```

Temperature & Ozone in Chicago, IL



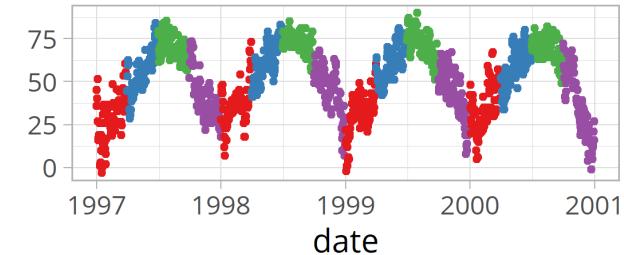
# The patchwork package

Build up your multipanel plot sequentially using The Composer of Plots:

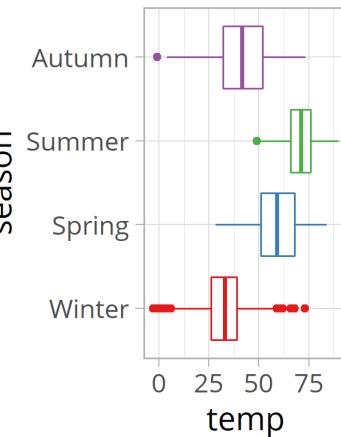
```
time / (box + scatter) +
  plot_layout(
    heights = c(1, 2),
    guides = "collect"
  ) +
  plot_annotation(
    title = "Temperature & Ozone in Chicago, IL",
    tag_levels = "A"
  )
```

Temperature & Ozone in Chicago, IL

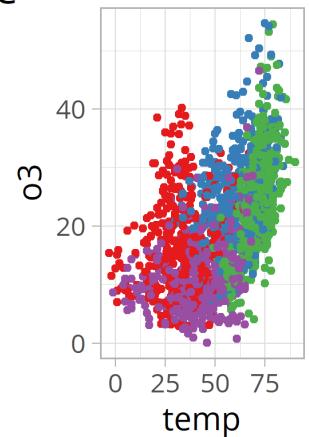
A



B

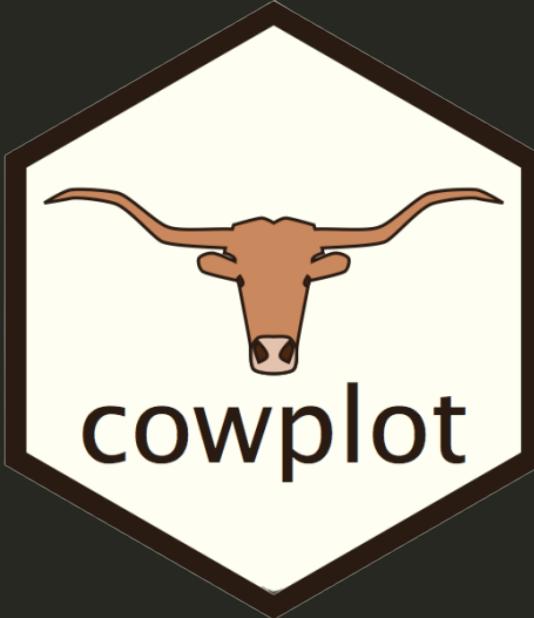


C



season

- Winter
- Spring
- Summer
- Autumn



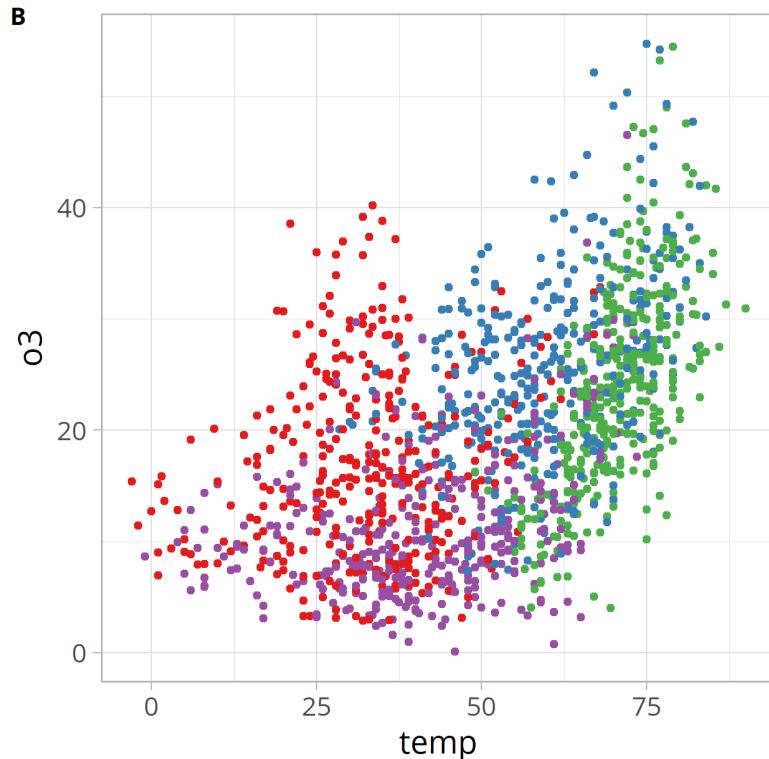
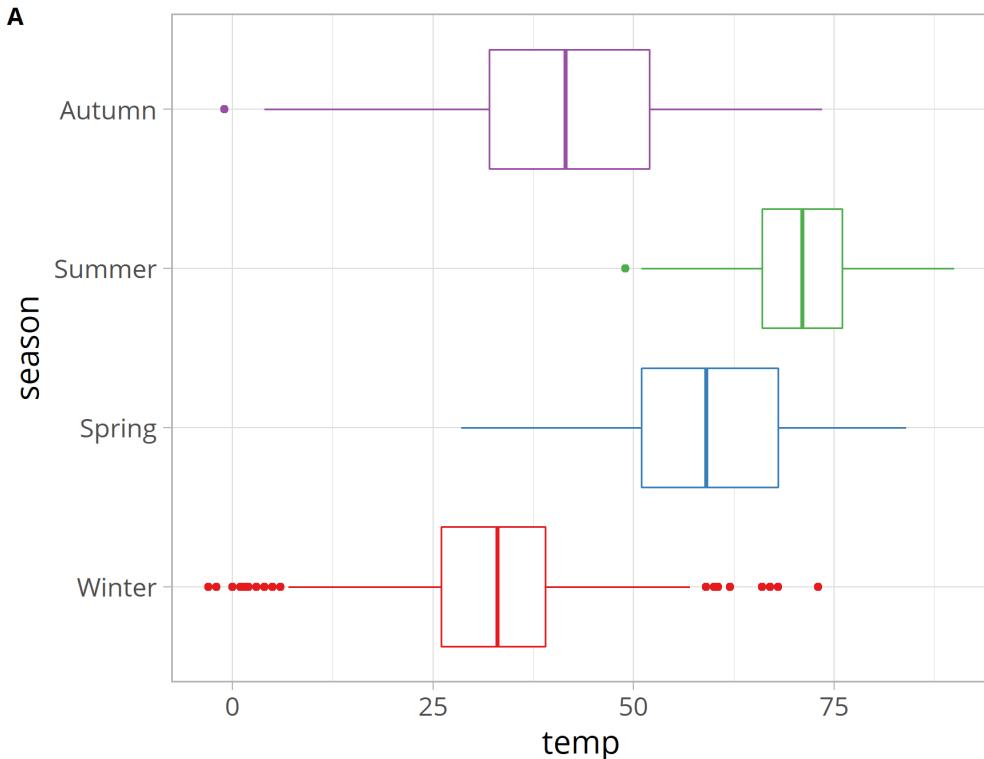
# The **cowplot** Package

## Streamlined Plot Annotations

# The `cowplot` Package

The `cowplot` package provides the function `plot_grid()` to arrange plots into a grid and label them:

```
library(cowplot)
plot_grid(box, scatter, labels = c('A', 'B'), label_size = 12)
```



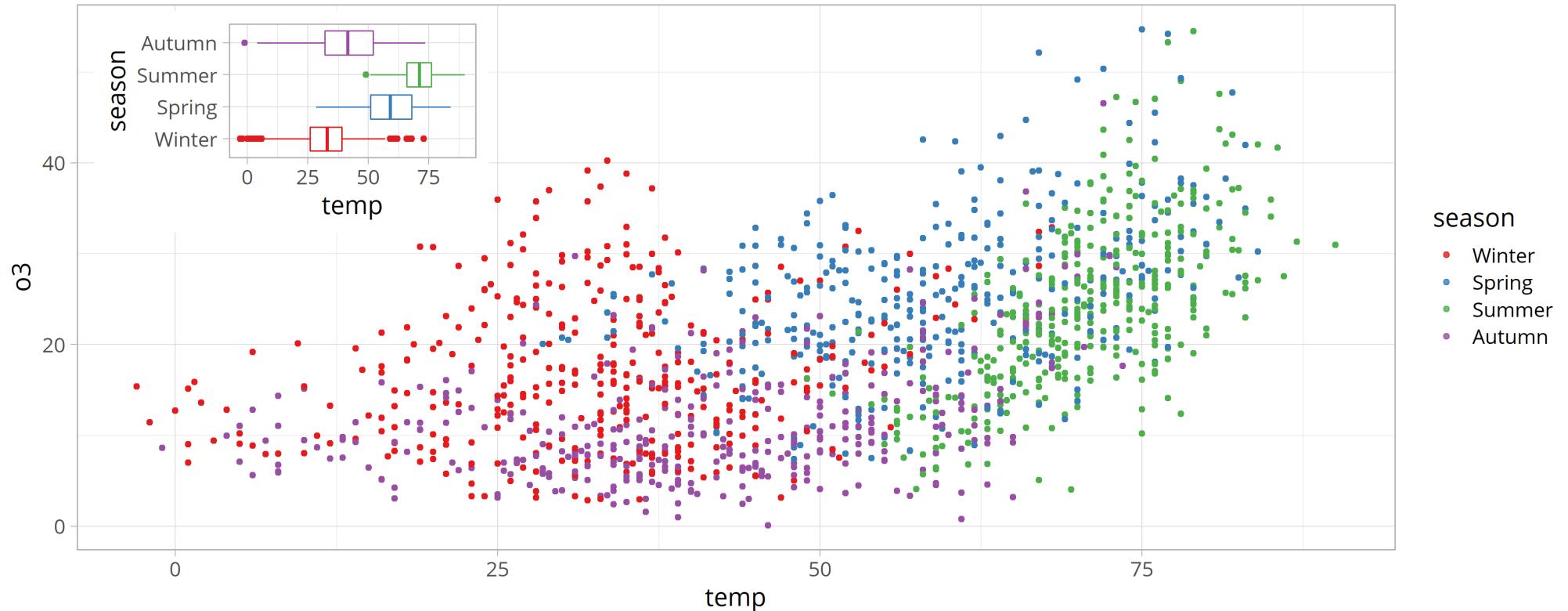
season

- Winter
- Spring
- Summer
- Autumn

# The `cowplot` Package

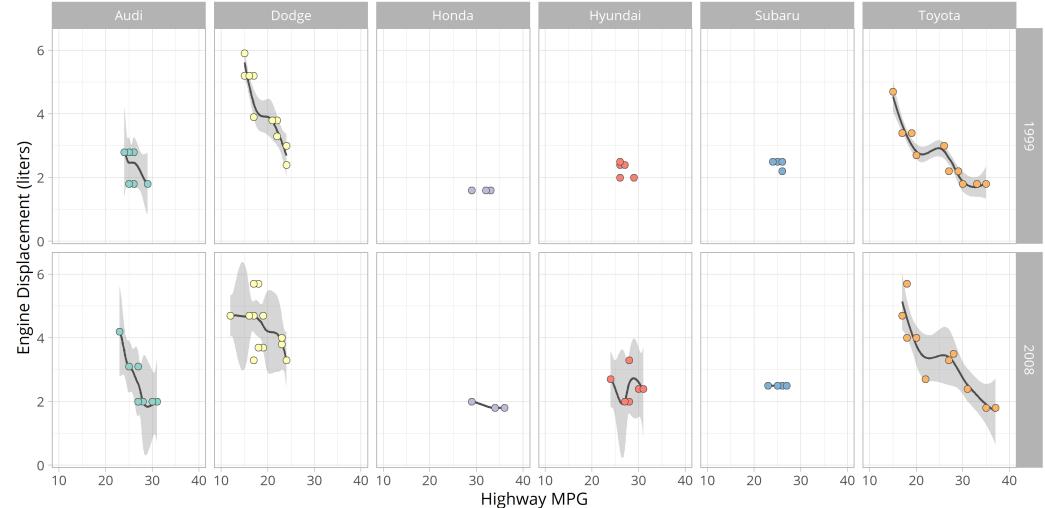
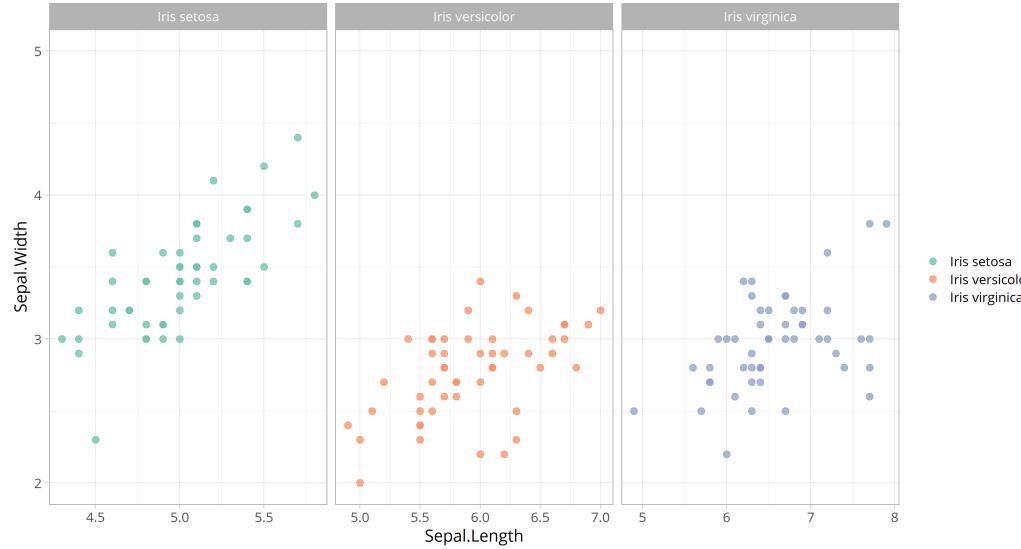
The `cowplot` package provides the function `plot_grid()` to arrange plots into a grid and label them:

```
ggdraw(scatter) + draw_plot(box, .06, .62, .25, .35)
```



# Your Turn!

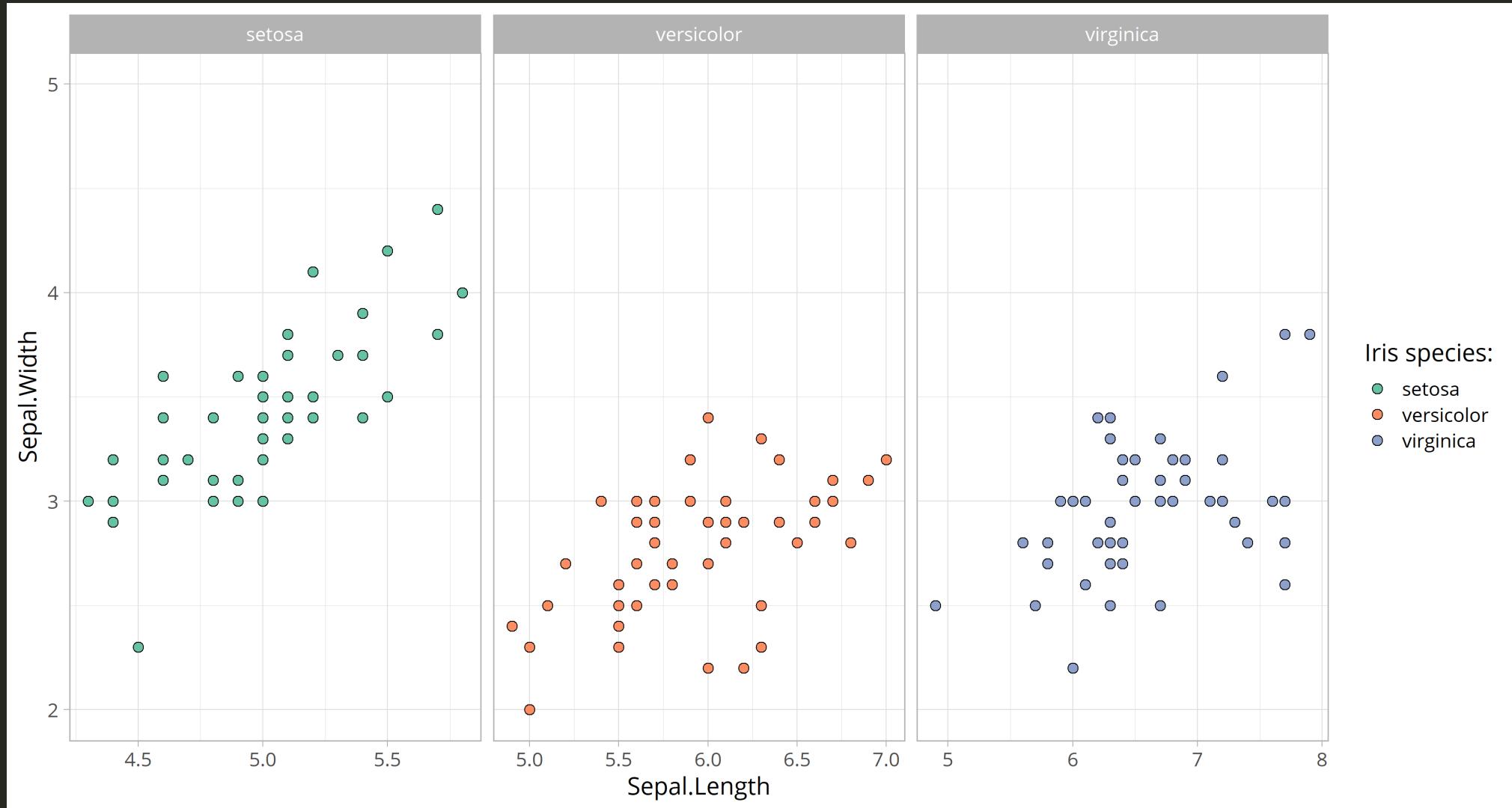
- Create the following two facets:



Data: EPA, available on [www.fueleconomy.gov](http://www.fueleconomy.gov).  
Note: Only manufacturers ending with a vowel are shown.

- Create three plots with legends for shape and fill. Combine them with **patchwork** or **cowplot**.

# Your Turn!



# Your Turn!

