VISUALIZING BIG DATA WITH TRELLISCOPE

Trelliscope in the Tidyverse

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Stock Market Data

```r
library(dplyr)
glimpse(stocks)
```

```
Observations: 125,928
Variables: 8
$ symbol   <chr> "TWOU", "TWOU", "TWOU", "TWOU", "TWOU", "TWOU", "TWOU", "T...
$ date     <date> 2016-01-04, 2016-01-05, 2016-01-06, 2016-01-07, 2016-01-0...
$ open     <dbl> 27.21, 26.92, 26.19, 25.84, 25.31, 24.87, 23.82, 23.40, 21...
$ high     <dbl> 27.500, 27.420, 26.530, 26.470, 25.790, 24.870, 24.100, 23...
$ low      <dbl> 26.360, 26.280, 25.950, 24.523, 24.220, 23.220, 22.430, 21...
$ close    <dbl> 27.04, 26.54, 26.38, 25.23, 24.32, 23.72, 23.27, 21.85, 22...
$ volume   <dbl> 530200, 448800, 297200, 635200, 364500, 404900, 1012100, 6...
$ adjusted <dbl> 27.04, 26.54, 26.38, 25.23, 24.32, 23.72, 23.27, 21.85, 22...
```

Visualizing Stock Data

```r
library(dplyr)
library(plotly)

candlestick_plot <- function(d)
  plot_ly(d, x = ~date, type = "candlestick",
    open = ~open, close = ~close,
    high = ~high, low = ~low)

candlestick_plot(filter(stocks, symbol == "AAPL"))
```

Tidyverse: Nested Data Frames

```
by_symbol <- stocks %>%
  group_by(symbol) %>%
  nest()

by_symbol
```

```
# A tibble: 500 x 2
   symbol data
   <chr>  <list>
 1 TWOU   <tibble [252 × 7]>
 2 JOBS   <tibble [252 × 7]>
 3 ABMD   <tibble [252 × 7]>
 4 ACHC   <tibble [252 × 7]>
 5 ACAD   <tibble [252 × 7]>
 6 ACIW   <tibble [252 × 7]>
 7 ATVI   <tibble [252 × 7]>
 8 ADBE   <tibble [252 × 7]>
 9 AAAP   <tibble [252 × 7]>
10 AEIS   <tibble [252 × 7]>
# ... with 490 more rows
```

Tidyverse: Computing on Nested Data Frames

The `purrr map_*()` **functions**

```r
by_symbol <- mutate(by_symbol,
  last_close = map_dbl(data, function(x) tail(x$close, 1)))

by_symbol
```

```
# A tibble: 500 x 3
   symbol data                last_close
   <chr>  <list>                   <dbl>
 1 TWOU   <tibble [252 × 7]>        30.2
 2 JOBS   <tibble [252 × 7]>        33.8
 3 ABMD   <tibble [252 × 7]>       113
 4 ACHC   <tibble [252 × 7]>        33.1
 5 ACAD   <tibble [252 × 7]>        28.8
 6 ACIW   <tibble [252 × 7]>        18.2
 7 ATVI   <tibble [252 × 7]>        36.1
 8 ADBE   <tibble [252 × 7]>       103
 9 AAAP   <tibble [252 × 7]>        26.8
10 AEIS   <tibble [252 × 7]>        54.8
# ... with 490 more rows
```

Trelliscope in the Tidyverse: Plot Columns

map_plot()

```r
library(trelliscopejs)

by_symbol <- mutate(by_symbol,
  panel = map_plot(data, candlestick_plot))
```
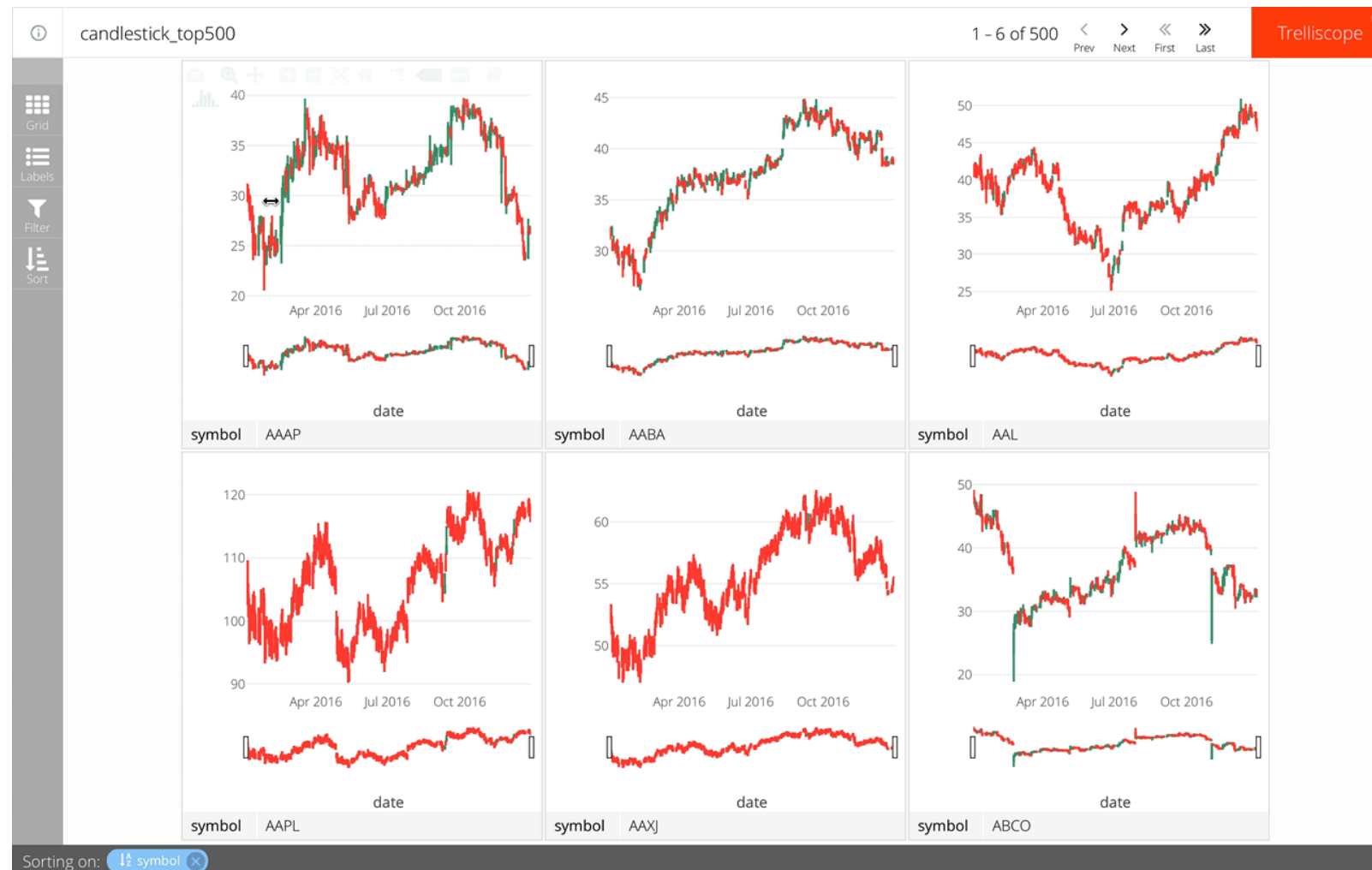
```
# A tibble: 500 x 4
    symbol data                 last_close panel
    <chr>  <list>                    <dbl> <list>
 1  TWOU   <tibble [252 × 7]>         30.2 <S3: plotly>
 2  JOBS   <tibble [252 × 7]>         33.8 <S3: plotly>
 3  ABMD   <tibble [252 × 7]>        113   <S3: plotly>
 4  ACHC   <tibble [252 × 7]>         33.1 <S3: plotly>
 5  ACAD   <tibble [252 × 7]>         28.8 <S3: plotly>
 6  ACIW   <tibble [252 × 7]>         18.2 <S3: plotly>
 7  ATVI   <tibble [252 × 7]>         36.1 <S3: plotly>
 8  ADBE   <tibble [252 × 7]>        103   <S3: plotly>
 9  AAAP   <tibble [252 × 7]>         26.8 <S3: plotly>
10  AEIS   <tibble [252 × 7]>         54.8 <S3: plotly>
# ... with 490 more rows
```

Creating the Display

```
trelliscope(by_symbol,
  name = "candlestick_top500",
  nrow = 2, ncol = 3)
```

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Let's practice!

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Cognostics

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Variables = Cognostics

```
by_symbol
```

```
# A tibble: 500 x 4
   symbol data                  last_close panel
   <chr>  <list>                     <dbl> <list>
 1 TWOU   <tibble [252 × 7]>          30.2 <S3: plotly>
 2 JOBS   <tibble [252 × 7]>          33.8 <S3: plotly>
 3 ABMD   <tibble [252 × 7]>         113   <S3: plotly>
 4 ACHC   <tibble [252 × 7]>          33.1 <S3: plotly>
 5 ACAD   <tibble [252 × 7]>          28.8 <S3: plotly>
 6 ACIW   <tibble [252 × 7]>          18.2 <S3: plotly>
 7 ATVI   <tibble [252 × 7]>          36.1 <S3: plotly>
 8 ADBE   <tibble [252 × 7]>         103   <S3: plotly>
 9 AAAP   <tibble [252 × 7]>          26.8 <S3: plotly>
10 AEIS   <tibble [252 × 7]>          54.8 <S3: plotly>
# ... with 490 more rows
```

Adding Cognostics to the Stock Data

```
stocks_meta
```

```
# A tibble: 500 x 6
   symbol company              market_cap ipo_year sector    industry
   <chr>  <chr>                     <dbl>    <dbl> <chr>     <chr>
 1 AAPL   Apple Inc.          791730000000     1980 Technol… Computer Manufa…
 2 GOOGL  Alphabet Inc.       668500000000       NA Technol… Computer Softwa…
 3 GOOG   Alphabet Inc.       657890000000     2004 Technol… Computer Softwa…
 4 MSFT   Microsoft Corporation 568960000000     1986 Technol… Computer Softwa…
 5 FB     Facebook, Inc.      490030000000     2012 Technol… Computer Softwa…
 6 AMZN   Amazon.com, Inc.    459430000000     1997 Consume… Catalog/Special…
 7 CMCSA  Comcast Corporation 178260000000       NA Consume… Television Serv…
 8 INTC   Intel Corporation   177760000000       NA Technol… Semiconductors
 9 CSCO   Cisco Systems, Inc. 165150000000     1990 Technol… Computer Commun…
10 AMGN   Amgen Inc.          135330000000     1983 Health … Biotechnology: …
# ... with 490 more rows
```

```
library(dplyr)
by_symbol <- left_join(by_symbol, stocks_meta)
```

Cognostics as Nested Data Frames

```r
by_symbol <- mutate(by_symbol,
  volume_stats = map(data, function(x) {
    data_frame(
      min_volume = min(x$volume),
      max_volume = max(x$volume)
    )
  }))
```

```r
> by_symbol %>% select(symbol, data, volume_stats) %>% head(3)
# A tibble: 3 x 3
  symbol data                 volume_stats
  <chr>  <list>               <list>
1 TWOU   <tibble [252 × 8]>   <tibble [1 × 2]>
2 JOBS   <tibble [252 × 8]>   <tibble [1 × 2]>
3 ABMD   <tibble [252 × 8]>   <tibble [1 × 2]>
```

```r
> by_symbol$stats[[1]]
# A tibble: 1 x 2
  min_volume max_volume
       <dbl>      <dbl>
1     139800    1843900
```

Customizing Cognostics

`cog()` function allows specification of cognostic behaviors in the viewer:

- `desc`: a free text description

- `default_label`: should this cognostic be shown by default in the viewer?

```r
by_symbol <- mutate(by_symbol,
  company = cog(
    val = company,
    desc = "company name",
    default_label = TRUE
  )
)
```

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Trelliscope Options

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Trelliscope Options

`facet_trelliscope()` and `trelliscope()` provide several options for handling the display output:

- The directory in which to store the display

- Storing multiple displays in the same directory

- Providing more detailed descriptions of the display

- The plot aspect ratio

- Specifying the default viewer state

Specifying the Output Directory

```
trelliscope(dat, path = "...", ...)
```

```
ggplot(...) +
  ... +
  facet_trelliscope(path = "...", ...)
```
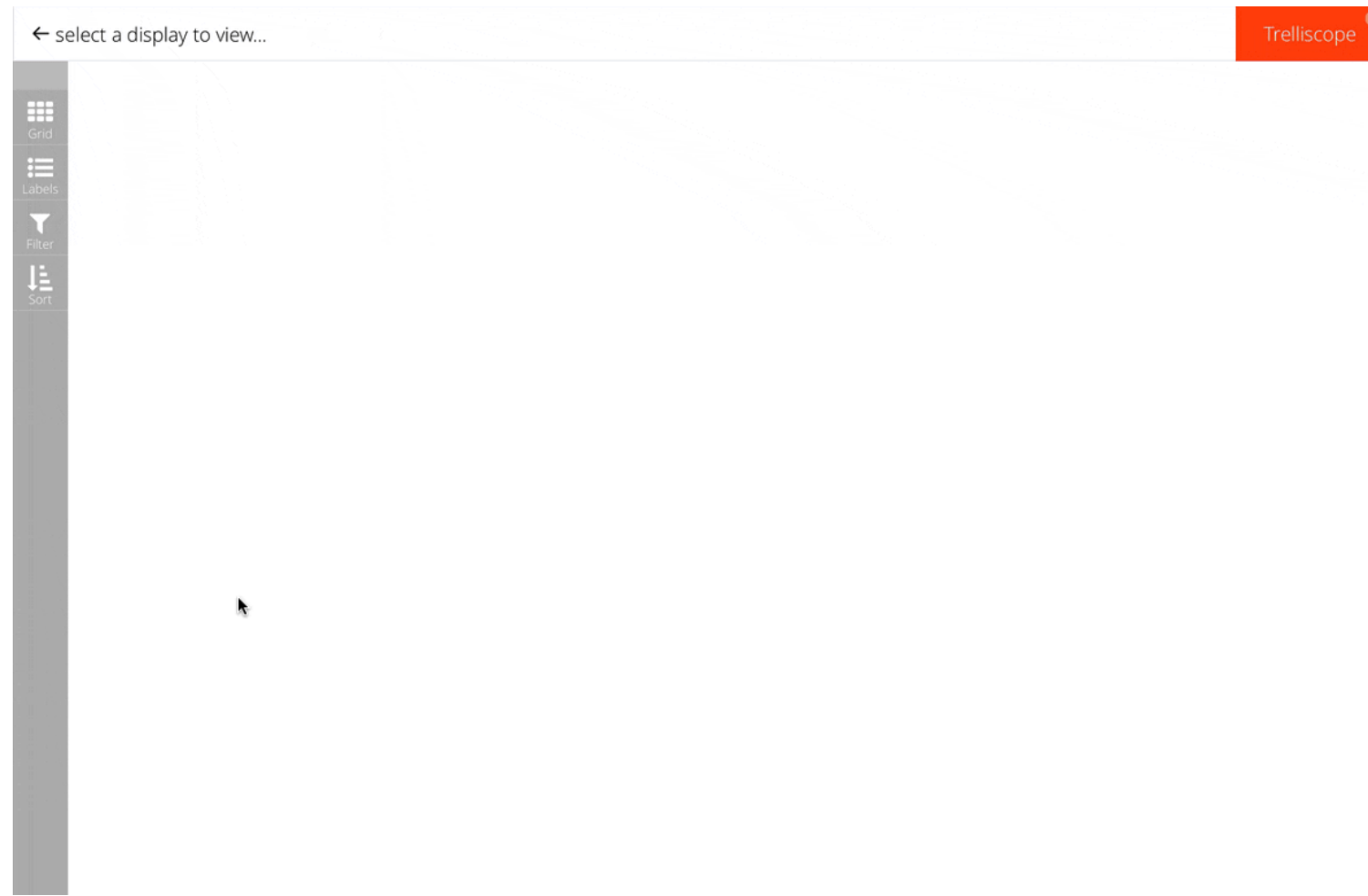
Detailed Descriptions

```
trelliscope(by_symbol,
  name = "candlestick_top500",
  desc = "Candlestick plot of the 500 most-traded NASDAQ stocks in 2016",
  md_desc = "
## Candlestick Plot

A [candlestick plot](https://en.wikipedia.org/wiki/Candlestick_chart)
is a financial plot...

...
")
```

Plot Aspect Ratio
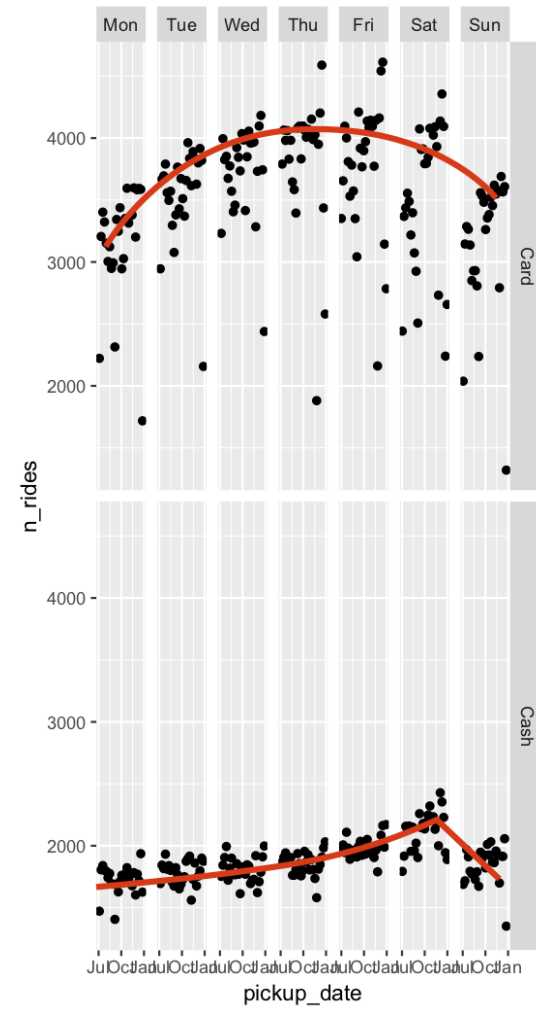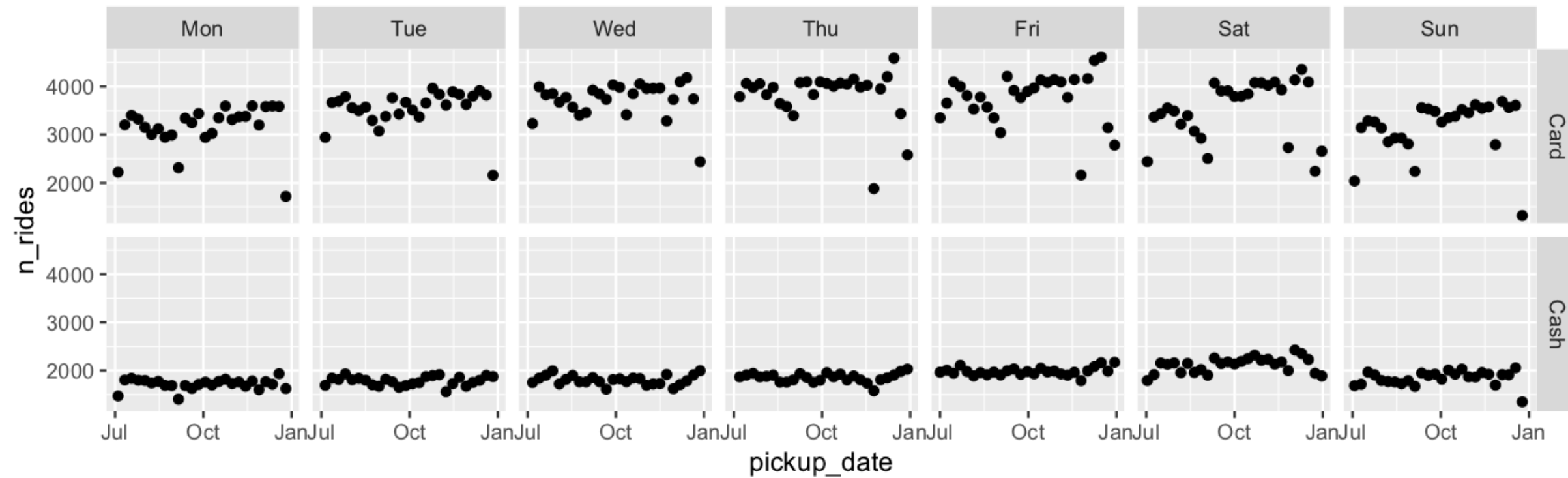
Plot Aspect Ratio

Plot Aspect Ratio

```r
trelliscope(dat, width = 600, height = 300, ...)
```

```r
ggplot(...) +
  ... +
  facet_trelliscope(width = 600, height = 300, ...)
```

Default Viewer State

```
trelliscope(dat, state = ..., ...)
```

```
ggplot(...) +
   ... +
   facet_trelliscope(state = ..., ...)
```

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Visualizing Databases of Images

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Pokemon!

```
> pokemon
# A tibble: 801 x 30
   pokemon       id species_id height weight base_experience type_1 type_2 attack
   <chr>      <int> <chr>       <int>  <int>           <int> <chr>  <chr>   <int>
 1 bulbasa…       1 1               7     69              64 grass  poison     49
 2 ivysaur        2 2              10    130             142 grass  poison     62
 3 venusaur       3 3              20   1000             236 grass  poison     82
 4 venusau…       4 3              24   1555             281 grass  poison    100
 5 charman…       5 4               6     85              62 fire   NA         52
 6 charmel…       6 5              11    190             142 fire   NA         64
 7 chariza…       7 6              17    905             240 fire   flying     84
 8 chariza…       8 6              17   1105             285 fire   dragon    130
 9 chariza…       9 6              17   1005             285 fire   flying    104
10 squirtle      10 7               5     90              63 water  NA         48
# ... with 791 more rows, and 21 more variables: defense <int>, hp <int>,
#   special_attack <int>, special_defense <int>, speed <int>, ability_1 <chr>,
#   ability_2 <chr>, ability_hidden <chr>, color_1 <chr>, color_2 <chr>,
#   color_f <chr>, egg_group_1 <chr>, egg_group_2 <chr>, url_image <chr>,
#   generation_id <chr>, evolves_from_species_id <chr>,
#   evolution_chain_id <chr>, shape_id <chr>, shape <chr>, pokebase <chr>,
#   pokedex <chr>
```

Image Panels

```
> select(pokemon, url_image)
# A tibble: 801 x 1
   url_image
   <chr>
 1 http://assets.pokemon.com/assets/cms2/img/pokedex/full/001.png
 2 http://assets.pokemon.com/assets/cms2/img/pokedex/full/002.png
 3 http://assets.pokemon.com/assets/cms2/img/pokedex/full/003.png
 4 http://assets.pokemon.com/assets/cms2/img/pokedex/full/003_f2.png
 5 http://assets.pokemon.com/assets/cms2/img/pokedex/full/004.png
 6 http://assets.pokemon.com/assets/cms2/img/pokedex/full/005.png
 7 http://assets.pokemon.com/assets/cms2/img/pokedex/full/006.png
 8 http://assets.pokemon.com/assets/cms2/img/pokedex/full/006_f2.png
 9 http://assets.pokemon.com/assets/cms2/img/pokedex/full/006_f3.png
10 http://assets.pokemon.com/assets/cms2/img/pokedex/full/007.png
# ... with 791 more rows
```

img_panel()

```r
pokemon <- mutate(pokemon,
  panel = img_panel(url_image))
```

```r
trelliscope(pokemon, name = "pokemon", nrow = 3, ncol = 6)
```

A Database of Images

Local Images

```r
path <- file.path(tempdir(), "pokemon_local")
dir.create(path)
for (url in pokemon$url_image)
  download.file(url, destfile = file.path(path, basename(url)))
```

```r
pokemon$image <- basename(pokemon$url_image)
pokemon <- mutate(pokemon,
  panel = img_panel_local(image))

trelliscope(pokemon, name = "pokemon", nrow = 3, ncol = 6,
  path = path)
```

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