Graphic Design with ggplot2

Concepts of the `{ggplot2}` Package Pt. 2:
Solution Exercise 1

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Exercise 1

- Have a look at the following visualization of the cumulative time that cosmo- and astronauts have spent in outer space. The data also contains information on the year of their first and last travel, respectively.
- Together with your group, discuss which layers and modifications are needed to create such a chart with `{ggplot2}`.
  - Note down the aesthetics, geometries, and scales used for each element of this graphic.
  - What is the coordinate system? Have any adjustments been made?
  - Which theme was used and how was it modified?

Layers

- **geom_point()**
  - aes(x = id, y = hours, size = hours)
- **geom_linerange()**
  - aes(x = id, ymin = 0, ymax = hours, color = hours, alpha = hours)
- **geom_point()**
  - aes(x = id, y = 0), shape = 15, color = "#808080"
- **geom_text()**
  - aes(x = id, y = 0, label = year), size = 4.5, hjust = 1.2
- **geom_text()**
  - aes(x = id, y = hours, label = max), size = 3.9, vjust = -.35

Scales

- **`scale_x_continuous()`**
  - `limits = c(-300, NA), expand = c(0, 0)`
- **`scale_y_continuous()`**
  - `limits = c(0, 230000), expand = c(0, 0)`
- **`scale_color_distiller()`**
  - `palette = "YlGnBu, direction = -1`
- **`scale_size()`**
  - `range = c(.001, 3)`
- **`scale_alpha()`**
  - `range = c(.33, .95)`

Coordinate System

- `coord_polar()`
  - `theta = "y"`

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Theme

- **`theme_void()`**
  - `legend.position = "none"`
  - `plot.background = element_rect(fill = "black")`
  - `plot.margin = margin(-70, -70, -70, -70)`
  - `plot.caption = element_text(hjust = .5, margin = margin(-100, 0, 100, 0), ...)`

Coordinate System

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  - `theta = "y"`

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- `theme_void()`
  - `legend.position = "none"`
  - `plot.background = element_rect(fill = "black")`
  - `plot.margin = margin(-70, -70, -70, -70)`
  - `plot.caption = element_text(...)`

Title

- 2 x `annotate(geom = "text", x = -300, y = 0, ...)`

Data Prep

```
library(tidyverse)

df_astro <- readr::read_csv(
  'https://raw.githubusercontent.com/rfordatascience/tidytuesday/master/data/2020/2020-07-14/astrona
)

df_missions <-
  df_astro %>%
  group_by(name) %>%
  summarize(
    hours = sum(hours_mission),
    year = min(year_of_mission),
    max_year = max(year_of_mission)
  ) %>%
  ungroup() %>%
  mutate(year = -year) %>%
  arrange(year) %>%
  mutate(id = row_number())
```

Code Pt. 1

```
# install.packages("scico")

g1 <-
  ggplot(df_missions, aes(x = id, y = hours, color = hours)
    ) +
    ## curves
    geom_linerange(aes(ymin = 0, ymax = hours, alpha = hours), size = .25) +
    ## baseline
    geom_point(aes(y = 0), shape = 15, size = .1, color = "#808080") +
    ## points
    geom_point(aes(y = hours, size = hours)) +
    ## turn into circular
    coord_polar(theta = "y", start = 0, clip = "off") +
    ## add axis spacings
    scale_x_continuous(limits = c(-300, NA), expand = c(0, 0)) +
    scale_y_continuous(limits = c(0, 23000), expand = c(0, 0)) +
    ## change colors, transparencies, and bubble sizes
    scale_color_distiller(palette = "YlGnBu", direction = -1) +
    scale_size(range = c(.001, 3)) +
```

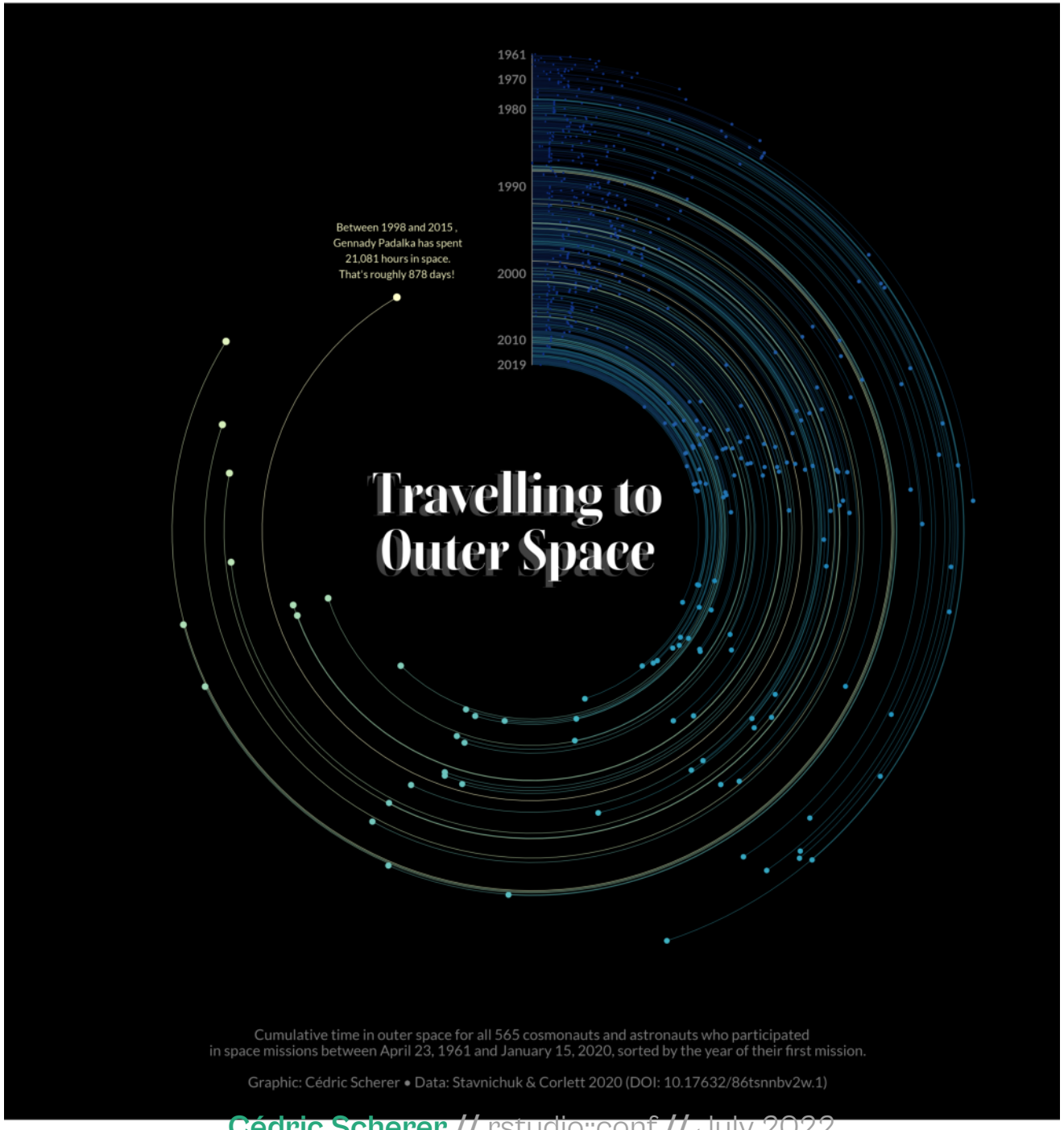
Data Prep Labels

```
df_labs <-
  df_missions %>%
  filter(year %in% -c(1961, 197:201*10, 2019)) %>%
  group_by(year) %>%
  filter(id == min(id))

df_max <-
  df_missions %>%
  arrange(-hours) %>%
  slice(1) %>%
  mutate(
    first_name = str_remove(name, ".*, "),
    last_name = str_remove(name, "(?<=),.*"),
    label = paste("Between", abs(year), "and", max_year, ",\n", first_name, last_name, "has spent\n"
  )
```

Code Pt. 2

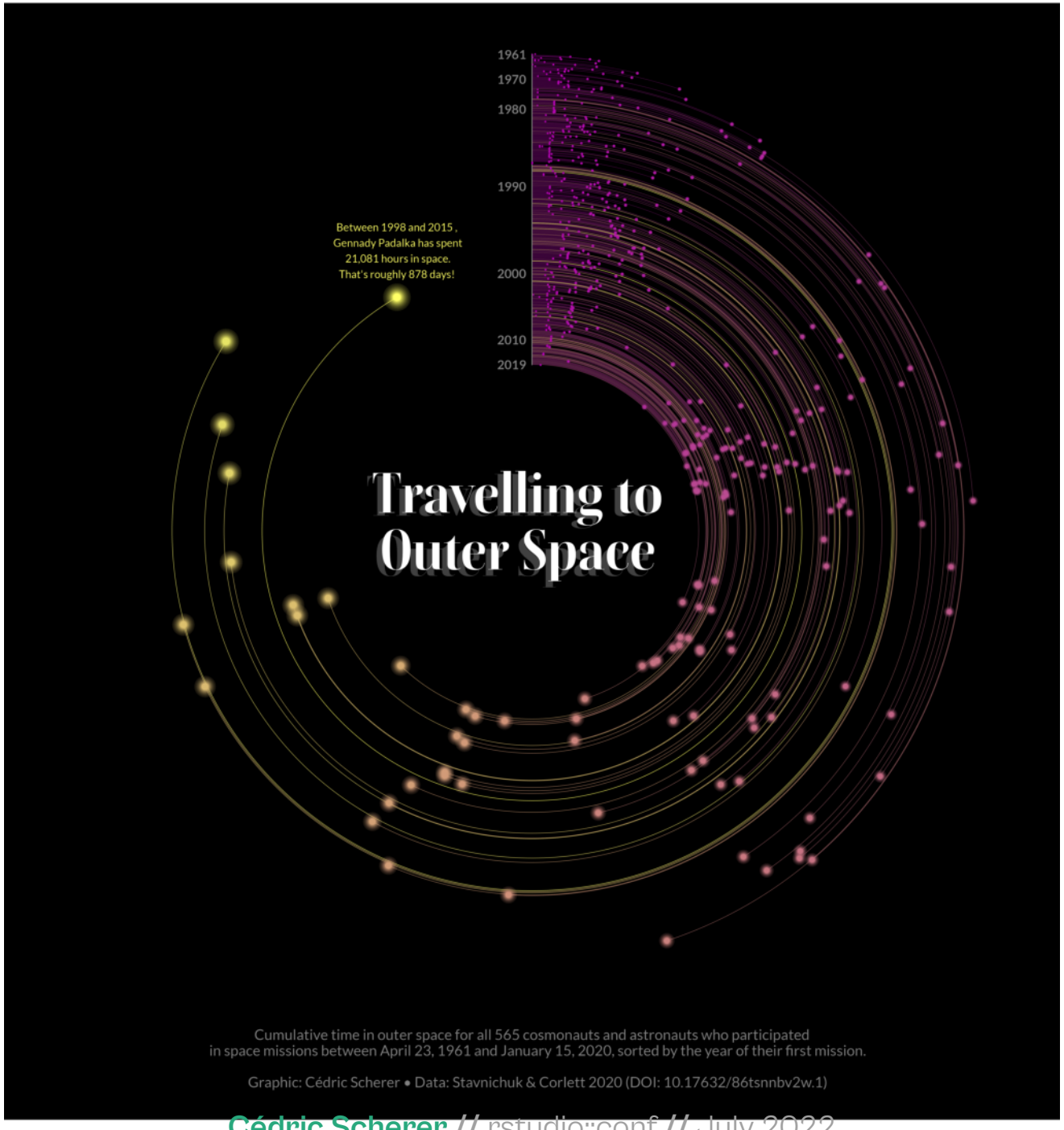
```
g2 <-
  g1 +
    ## labels years
    geom_text(
      data = df_labs, aes(y = 0, label = abs(year)),
      family = "Lato", fontface = "bold", color = "#808080",
      size = 4.5, hjust = 1.2
    ) +
    ## label max
    geom_text(
      data = df_max, aes(label = label),
      family = "Lato", size = 3.9, vjust = -.35
    ) +
    ## title shadow
    annotate(
      geom = "text", x = -300, y = 0, label = "Travelling to\nOuter Space",
      family = "Boska", fontface = "bold", lineheight = .9,
      size = 20, color = "white", hjust = .57, vjust = .45, alpha = .25
    ) +
```


1961
1970
1980
1990
2000
2010
2019
Between 1998 and 2015 ,
Gennady Padalka has spent
21,081 hours in space.
That's roughly 878 days!
Travelling to
Outer Space
Cumulative time in outer space for all 565 cosmonauts and astronauts who participated
in space missions between April 23, 1961 and January 15, 2020, sorted by the year of their first mission.
Graphic: Cédric Scherer • Data: Stavnichuk & Corlett 2020 (DOI: 10.17632/86tsnnbv2w.1)

Code with Special Extensions

```
# install.packages("ggforce")
# install.packages("scico")
# devtools::install_github("coolbutuseless/ggblur")

g_ext <-
  ggplot(df_missions, aes(x = id, y = hours, color = hours)) +
    ## geom_link() from {ggforce} to draw smooth curves
    ggforce::geom_link(aes(xend = id, yend = 0, alpha = hours), size = .25, n = 300) +
    geom_point(aes(y = 0), shape = 15, size = .1, color = "#808080") +
    ##geom_point_blur() from {ggblur} to add points with gradual fading
    ggblur::geom_point_blur(aes(size = hours, blur_size = hours), blur_steps = 25) +
    geom_text(
      data = df_labs, aes(y = 0, label = abs(year)),
      family = "Lato", fontface = "bold", color = "#808080",
      size = 4.5, hjust = 1.2
    ) +
    geom_text(
      data = df_max, aes(label = label),
      family = "Lato", size = 3.9, vjust = -.35
```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