

Drawing a Christmas card with the ggplot2 package

Ken Vu Cascadia R Conference | June 22, 2024

I. Introduction

Since get my MS in Stats, I was slowly losing my R knowledge



...

I wanted to spread joy for the Christmas holiday season



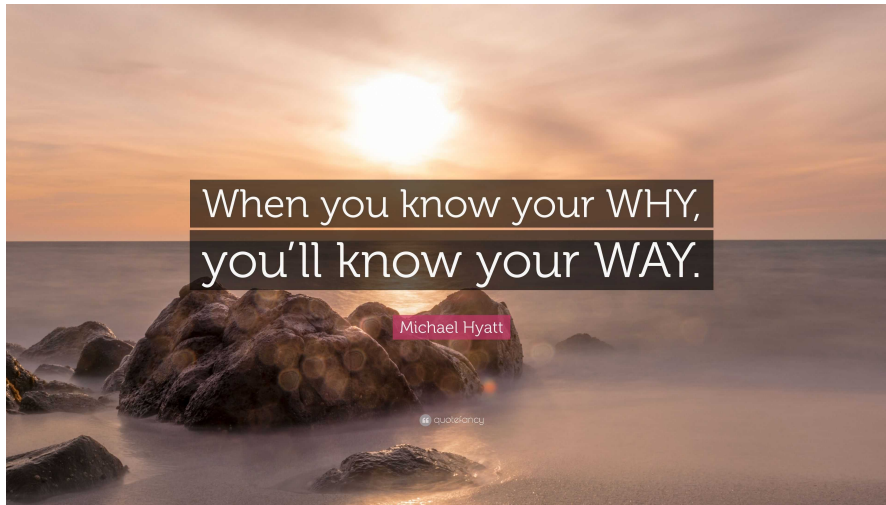
So what did I decide to do then?

- **BUILD A CHRISTMAS CARD...WITH R CODE!!!**

II. The Design Process

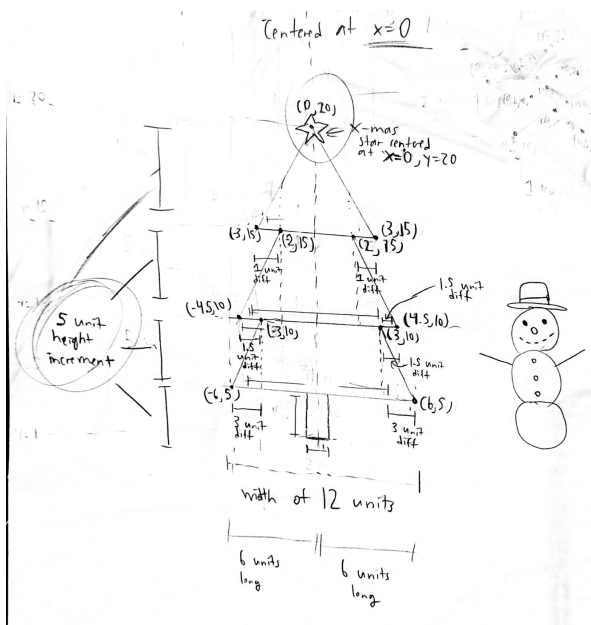
STEP 1: Brainstorm the idea

Find my motivation



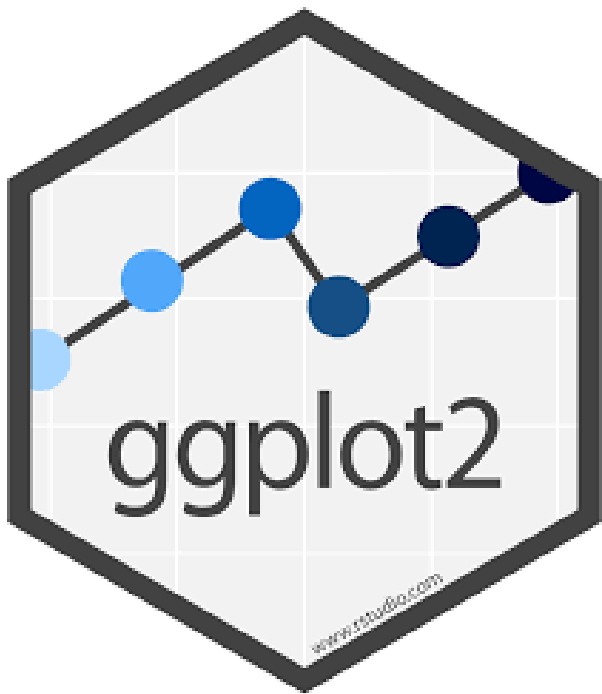
STEP 1: Brainstorm the idea

Visualize the outcome



STEP 2: Research your tools

Chose the ggplot2 package due to popularity, familiarity, and customization



STEP 2: Research your tools

- Additional packages
 - `extrafont`: for loading in custom fonts
 - `dplyr`: for wrangling and working with data frames
 -

STEP 3: Build the card

- With plotting any `ggplot2` object
 - First, find the right `ggplot2` function to plot what you want
 - Next, set up some data points that work with it
 - Then, plot and adjust output through `ggplot2` object parameters (ie., `size`, `color`, etc)

STEP 3: Build the card

- Ex. Build the base of the Christmas tree
- First, find a function to meet your needs (i.e., `geom_polygon` for drawing shapes)

STEP 3: Build the card

Set up coordinates for the tree base and tree trunk to fit `geom_polygon`'s plotting requirements

```
xmas_tree <- tribble(
  ~x, ~y,

  # left side of tree base
  -6, 5,
  -3, 10,
  -4.5, 10,
  -2, 15,

  # top of tree
  -3, 15,
  0, 20,
  3, 15,

  # right side of tree base
  2, 15,
  4.5, 10,
  3, 10,
  6, 5
)

# coordinates for the tree trunk
xmas_trunk <- tribble(
  ~x, ~y,
  -1, 5,
  1, 5,
  1, 0,
  -1, 0
)
```

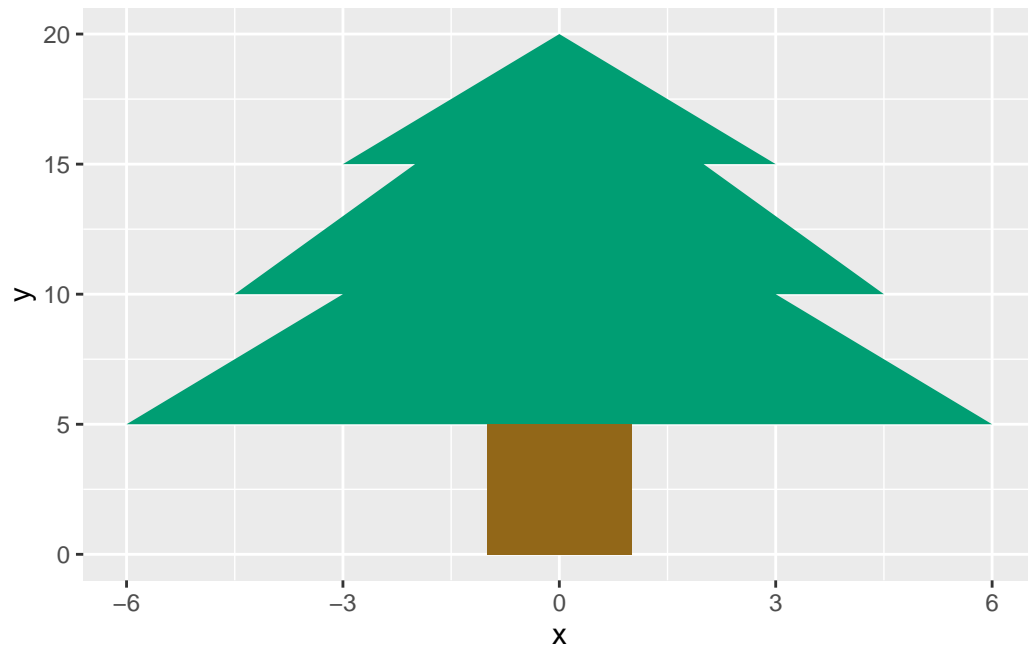
STEP 3: Build the card

Use `geom_polygon()` to draw shapes with coordinates (i.e., tree base and trunk)

```
xmas_ggplot <- ggplot() +  
  
  # adding tree  
  geom_polygon(data = xmas_tree,  
              mapping = aes(x, y),  
              fill = "#009E73") +  
  
  # adding trunk  
  geom_polygon(data = xmas_trunk,  
              mapping = aes(x, y),  
              fill = "#926718"  
              )
```

STEP 3: Build the card

```
xmas_ggplot
```



STEP 3: Build the card

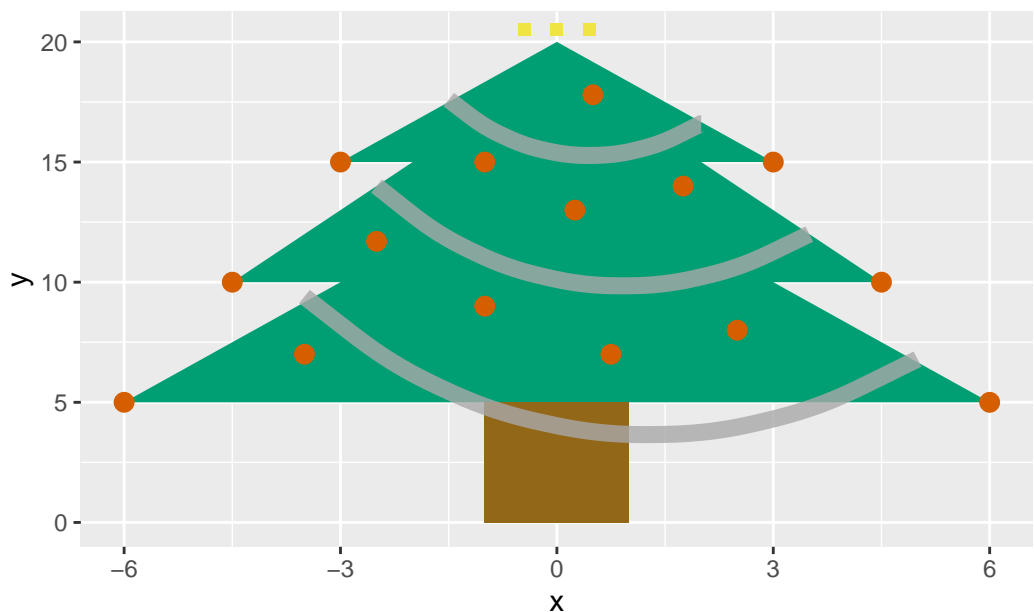
This approach used for almost every aspect of the card to get this so far...

```
Warning in grid.Call.graphics(C_points, x$x, x$y, x$pch, x$size): conversion
failure on ' ' in 'mbsToSbcs': dot substituted for <e2>
```

```
Warning in grid.Call.graphics(C_points, x$x, x$y, x$pch, x$size): conversion
failure on ' ' in 'mbsToSbcs': dot substituted for <98>
```

```
Warning in grid.Call.graphics(C_points, x$x, x$y, x$pch, x$size): conversion
failure on ' ' in 'mbsToSbcs': dot substituted for <85>
```

```
Warning in grid.Call.graphics(C_points, x$x, x$y, x$pch, x$size): font metrics
unknown for Unicode character U+2605
```



Made with RStudio

STEP 3: Build the card

Replace data viz elements (i.e., tick marks, axes labels, gridlines, etc) with festive aesthetics

```
xmas_ggplot <- xmas_ggplot +  
  theme(  
    # make panel background black  
    panel.background = element_rect(fill = "black"),  
  
    # removing misc plotting elements  
    axis.title = element_blank(),  
    axis.ticks = element_blank(),  
    axis.text = element_blank(),  
    panel.grid = element_blank(),  
  
    # adding brown frame around photo  
    plot.background = element_rect(fill = "#926718"),  
  
    # removing plotting legend  
    legend.position = "none"  
  )
```

STEP 3: Build the card

Add some falling snow

```
# TRIVIA: the seed number is the release date # of the song "Last Christmas" by Wham! (aka  
set.seed(120384)  
  
snow_points <- data.frame(  
  x = runif(n = 300, min = -20, max = 17),  
  y = runif(n = 300, min = -2, max = 36)  
)  
  
xmas_ggplot <- xmas_ggplot +  
  geom_point(data = snow_points,  
            mapping = aes(x, y),  
            color = "white"  
            )
```

STEP 3: Build the card

Add a snowy ground

```
# add points marking peaks of bumpy snowy
# ground
xmas_snowground <- tribble(
  ~x, ~y,
  -30, 2.5,
  -10, 0.5,
  -5, 1.5,
  0, 0.2,
  5, 0.8,
  12, 0.4,
  30, 1
)
```

STEP 3: Build the card

Add a snowy ground

```
xmas_ggplot<- xmas_ggplot +  
  # plotting an uneven snowy ground  
  geom_ribbon(data = xmas_snowground,  
             aes(x = x, ymax=y),  
             xmin = -Inf,  
             xmax = Inf,  
             ymin = 0,  
             fill="white") +  
  
  # adding a flat horizontal line for the snowy ground  
  geom_hline(yintercept = seq(0.5, -50, -0.01),  
             color = "white")
```

STEP 3: Build the card

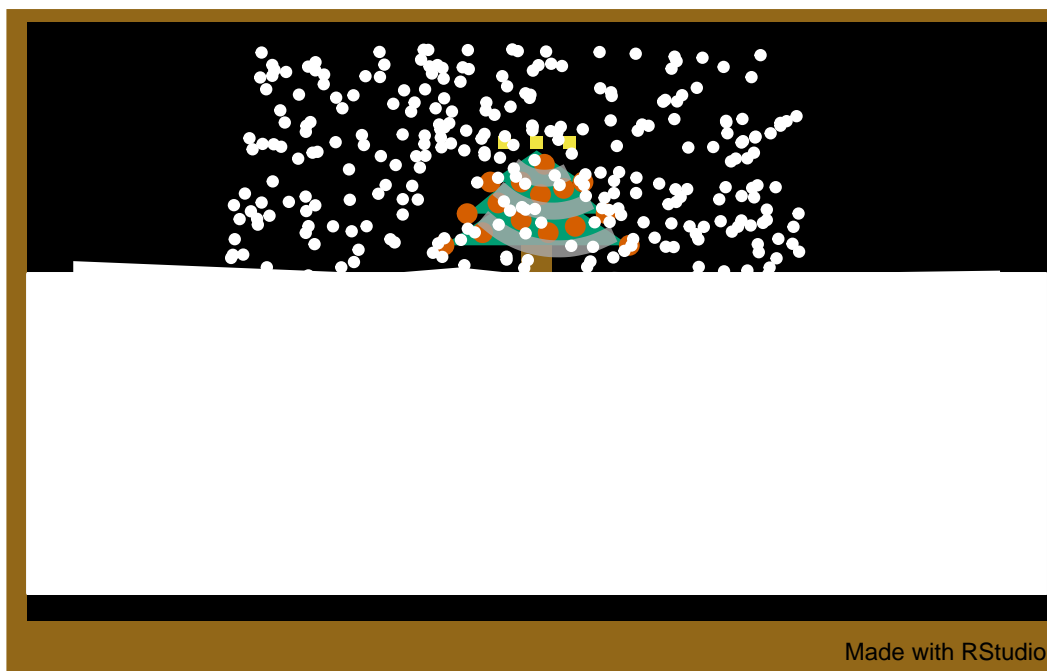
```
xmas_ggplot
```

```
Warning in grid.Call.graphics(C_points, x$x, x$y, x$pch, x$size): conversion  
failure on ' ' in 'mbcsToSbcs': dot substituted for <e2>
```

```
Warning in grid.Call.graphics(C_points, x$x, x$y, x$pch, x$size): conversion  
failure on ' ' in 'mbcsToSbcs': dot substituted for <98>
```

```
Warning in grid.Call.graphics(C_points, x$x, x$y, x$pch, x$size): conversion  
failure on ' ' in 'mbcsToSbcs': dot substituted for <85>
```

```
Warning in grid.Call.graphics(C_points, x$x, x$y, x$pch, x$size): font metrics  
unknown for Unicode character U+2605
```



STEP 3: Build the card

- Used `coord_cartesian` to zoom in where tree is without throwing out points out of range

```
xmas_ggplot <- xmas_ggplot +  
  
# expand plotting limits  
coord_cartesian(ylim = c(0, 35), xlim = c(-15, 15))
```

STEP 3: Build the card

Now, add a holiday greeting

```
font_import(paths = getwd(), prompt = F)
loadfonts()

xmas_ggplot <- xmas_ggplot +
# adding holiday greeting
  geom_text(aes(label = "Happy Holidays!",
                x = 0, y = 29),
            color = "#F0E442",
            size = 16,
            family = "Segoe Script") +

# adjusting the caption text
  theme(plot.caption = element_text(family = "Segoe Script", face = "bold"))
```

STEP 3: Build the card

So far, looks good...

```
xmas_ggplot
```

```
Warning in grid.Call(C_stringMetric, as.graphicsAnnot(x$label)): font metrics  
unknown for character 0x4d
```

```
Warning in grid.Call(C_stringMetric, as.graphicsAnnot(x$label)): font width  
unknown for character 0x67
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Warning in grid.Call(C_stringMetric, as.graphicsAnnot(x$label)): font width  
unknown for character 0x6a
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```
Warning in grid.Call(C_stringMetric, as.graphicsAnnot(x$label)): font width  
unknown for character 0x70
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unknown for character 0x71
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Warning in grid.Call(C_stringMetric, as.graphicsAnnot(x$label)): font width  
unknown for character 0x79
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```
Warning in grid.Call(C_stringMetric, as.graphicsAnnot(x$label)): font width  
unknown for character 0x51
```

```
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font  
width unknown for character 0x4d
```

```
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font  
width unknown for character 0x61
```

```
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font  
width unknown for character 0x64
```

```
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font  
width unknown for character 0x65
```


Warning in grid.Call(C_textBounds, as.graphicsAnnot(x\$label), x\$x, x\$y, : font width unknown for character 0x20

Warning in grid.Call(C_textBounds, as.graphicsAnnot(x\$label), x\$x, x\$y, : font width unknown for character 0x77

Warning in grid.Call(C_textBounds, as.graphicsAnnot(x\$label), x\$x, x\$y, : font width unknown for character 0x69

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Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, : font width unknown for character 0x48

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, : font width unknown for character 0x61

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font metrics unknown for character 0x4d

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font width unknown for character 0x4d

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font width unknown for character 0x74

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font width unknown for character 0x68

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font width unknown for character 0x74

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font width unknown for character 0x75

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font width unknown for character 0x64

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font width unknown for character 0x69

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font width unknown for character 0x6f

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font metrics unknown for character 0x4d





STEP 3: Build the card

- Building the snowman's head, chest, torso involves the same set of steps used for the tree
- Ex. First, find a function to fit your plotting needs
- I.e., `geom_point` for three oversized points for snowman's body

STEP 3: Build the card

Set up coordinates for where parts of the body will be

```
# coordinates for three snowballs forming snowman's body
snowman_body <- tribble(
  ~x_val, ~y_val,
  10, 3,
  10, 8,
  10, 12,
)
```


STEP 3: Build the card

- Then, plot them
- Make aesthetic changes if needed (i.e., size, color)

```
xmas_ggplot <- xmas_ggplot +  
  
  # plotting snowman's body  
  geom_point(data = snowman_body[1,],  
            mapping = aes(x_val, y_val),  
            size = 25,  
            color = "white") +  
  geom_point(data = snowman_body[2,],  
            mapping = aes(x_val, y_val),  
            size = 19,  
            color = "white") +  
  geom_point(data = snowman_body[3,],  
            mapping = aes(x_val, y_val),  
            size = 16,  
            color = "white")
```

STEP 3: Build the card

- Repeat aforementioned pattern of steps for other parts of the snowman
- I.e., eyes, nose, mouth, chest buttons, arms

Warning in grid.Call(C_textBounds, as.graphicsAnnot(x\$label), x\$x, x\$y, : font width unknown for character 0x4d

Warning in grid.Call(C_textBounds, as.graphicsAnnot(x\$label), x\$x, x\$y, : font width unknown for character 0x61

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Warning in grid.Call.graphics(C_points, x\$x, x\$y, x\$pch, x\$size): font metrics unknown for Unicode character U+2605

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, : font width unknown for character 0x48

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Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font width unknown for character 0x6f

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font metrics unknown for character 0x4d



STEP 3: Build the card

Add hat for snowman

```
# coordinates for top of the hat
snowman_hat_top <- tribble(
  ~x0, ~x1, ~y0, ~y1,
  9.25, 10.75, 14.5, 17
)

xmas_ggplot <- xmas_ggplot +
  # hat top
  geom_rect(
    data = snowman_hat_top,
    mapping = aes(xmin = x0, ymin = y0,
                  xmax = x1, ymax = y1),
    fill = "#2c2c2c"
  )
```

STEP 3: Build the card

Add hat for snowman

```
xmas_ggplot <- xmas_ggplot +  
  
  # hat base  
  geom_segment(  
    data = data.frame(x = 8.5, y = 14,  
                      xend = 11.5, yend = 14),  
    mapping = aes(x = x, y = y,  
                  xend = xend, yend = yend),  
    color = "#2c2c2c",  
    lineend = "round",  
    size = 2  
  ) +  
  
  # red hat band  
  geom_segment(  
    data = data.frame(x = 9.25, y = 14.45,  
                      xend = 10.75, yend = 14.45),  
    mapping = aes(x = x, y = y,  
                  xend = xend, yend = yend),  
    color = "#D55E00",  
    lineend = "round",  
    size = 2  
  )
```

Warning: Using `size` aesthetic for lines was deprecated in ggplot2 3.4.0.
i Please use `linewidth` instead.

STEP 3: Build the card

Add scarf

```
# two tribbles for coordinates for parts of the scarf
snowman_scarf <- tribble(
  ~x, ~y, ~xend, ~yend,
  9, 10, 11, 10
)

snowman_scarf2 <- tribble(
  ~x, ~y, ~xend, ~yend,
  9.25, 10, 8, 6
)
```

STEP 3: Build the card

Add scarf

```
xmas_ggplot <- xmas_ggplot +  
  
  # draw the scarf  
  geom_curve(data = snowman_scarf2,  
            mapping = aes(x = x, y = y,  
                          xend = xend,  
                          yend = yend),  
            linewidth = 3,  
            color = "#56B4E9",  
            curvature = -0.25) +  
  
  geom_curve(data = snowman_scarf,  
            mapping = aes(x = x, y = y,  
                          xend = xend,  
                          yend = yend),  
            linewidth = 3,  
            color = "#56B4E9")
```

...and, the moment you've been waitin for!

Ta da!

```
xmas_ggplot
```

```
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
width unknown for character 0x4d
```

```
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
width unknown for character 0x61
```

```
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
width unknown for character 0x64
```

```
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
width unknown for character 0x65
```

```
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
width unknown for character 0x20
```

```
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
width unknown for character 0x77
```

```
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
width unknown for character 0x69
```

```
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
width unknown for character 0x74
```

```
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
width unknown for character 0x68
```

```
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
width unknown for character 0x20
```

```
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
width unknown for character 0x52
```

Warning in grid.Call(C_textBounds, as.graphicsAnnot(x\$label), x\$x, x\$y, : font width unknown for character 0x53

Warning in grid.Call(C_textBounds, as.graphicsAnnot(x\$label), x\$x, x\$y, : font width unknown for character 0x74

Warning in grid.Call(C_textBounds, as.graphicsAnnot(x\$label), x\$x, x\$y, : font width unknown for character 0x75

Warning in grid.Call(C_textBounds, as.graphicsAnnot(x\$label), x\$x, x\$y, : font width unknown for character 0x64

Warning in grid.Call(C_textBounds, as.graphicsAnnot(x\$label), x\$x, x\$y, : font width unknown for character 0x69

Warning in grid.Call(C_textBounds, as.graphicsAnnot(x\$label), x\$x, x\$y, : font width unknown for character 0x6f

Warning in grid.Call(C_textBounds, as.graphicsAnnot(x\$label), x\$x, x\$y, : font metrics unknown for character 0x4d

Warning in grid.Call.graphics(C_points, x\$x, x\$y, x\$pch, x\$size): conversion failure on ' ' in 'mbcsToSbcs': dot substituted for <e2>

Warning in grid.Call.graphics(C_points, x\$x, x\$y, x\$pch, x\$size): conversion failure on ' ' in 'mbcsToSbcs': dot substituted for <98>

Warning in grid.Call.graphics(C_points, x\$x, x\$y, x\$pch, x\$size): conversion failure on ' ' in 'mbcsToSbcs': dot substituted for <85>

Warning in grid.Call.graphics(C_points, x\$x, x\$y, x\$pch, x\$size): font metrics unknown for Unicode character U+2605

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, : font width unknown for character 0x48

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, : font width unknown for character 0x61

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font width unknown for character 0x70
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font width unknown for character 0x70

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font width unknown for character 0x79

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font width unknown for character 0x20

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font width unknown for character 0x48

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font width unknown for character 0x6f

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font width unknown for character 0x6c

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font width unknown for character 0x69

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font width unknown for character 0x64

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font width unknown for character 0x61

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font width unknown for character 0x79

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font width unknown for character 0x73

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font width unknown for character 0x21

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font metrics unknown for character 0x4d

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font width unknown for character 0x4d

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font width unknown for character 0x61

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font width unknown for character 0x64

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font width unknown for character 0x65

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font width unknown for character 0x20

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font width unknown for character 0x77

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font width unknown for character 0x69

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font width unknown for character 0x74

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font width unknown for character 0x68

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
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font width unknown for character 0x53

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font width unknown for character 0x74

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font width unknown for character 0x75

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font width unknown for character 0x64

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font width unknown for character 0x69

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font width unknown for character 0x6f

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, :
font metrics unknown for character 0x4d



III. Conclusion

Three takeaways from this Christmas card project

1. I learned more about the ggplot2 library

- New functions like `geom_ribbon()`
- How the grammar of graphics works
- More practice with data viz

2. Honed in my process for better project management

- Knowing my why
- Creating a vision of the outcome
- Researching methods to achieve it
- Execution

These two lessons are valid, but not as important as this one...

3. Be true to yourself

- Not everyone learns or thinks the same way
- Everyone has a unique spark that makes them special
- So always believe that your perspective matters...

Because you KEN do it!



Thank you so much!

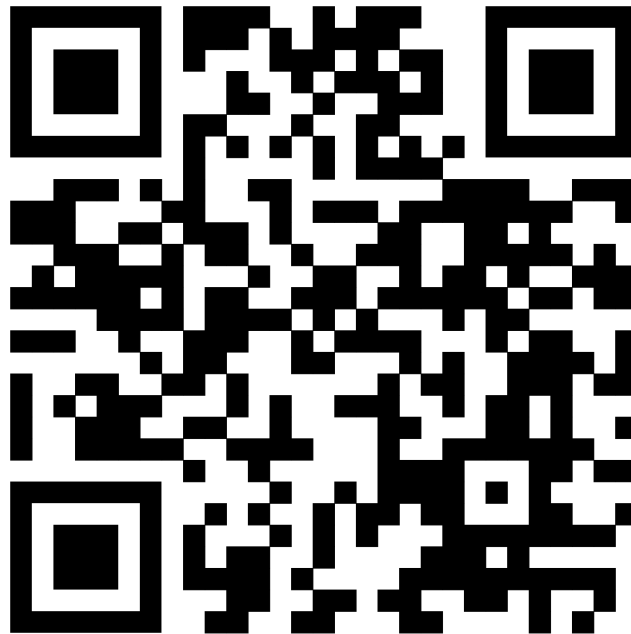
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