Assignment 1

Data Visualization

Misha Ash

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Part 1: Visualization critique

The Allen Institute for Brain Science has developed a range of publically available research tools for neuroscientists, including a number of brain atlases. Among these is the Reference Atlas of the Adult Human Brain, which is one of the most accurate representations of the structure of the human brain to date. According to Ding et al. (2016):

> [It is] the first digital human brain atlas to incorporate neuroimaging, high-resolution histology, and chemoarchitecture across a complete adult female brain, consisting of magnetic resonance imaging (MRI), diffusion-weighted imaging (DWI), and 1,356 large-format cellular resolution (1µm/pixel) Nissl and immunohistochemistry anatomical plates.

The team of scientists working at the Allen Institute collaborate with the global neuroscience community to develop and share information resources for advancing understanding of the brain. Moreover, the images that constitute the Human Brain Atlas were created through a highly controlled protocol. One possible limitation of the images might be that the slices are not equidistant (ranging from 0.4 mm to 3.4 mm), which is comperable to an axis with unequal units, though this may be relatively insignificant given the purposes of the images (it is also clearly stated). Therefore, this interactive visualization is truthful in its attempt to provide a more accurate, proportionate map of human brain structures.

The purpose of the this atlas is to inform and drive research, so it is designed to be useful primarily to scientists. The anatomical structures are highly detailed and can be individually selected. On the left pane, a hierarchical outline displays both abbreviations and full names of the structures, which puts the structure in the broader context of structural organization. The structure can thus be selected either by clicking it on the brain section or by name. The central image is a coronal slice of the left lobe, and each slice (from anterior to posterior) can be seen as a thumbnail along the bottom. Interactivity also includes the capacity to zoom and select between alternative coordinate systems as background images. It is not clear why only the left lobe is displayed, and the lateral view, which orients the viewer along the sagittal (front-to-back) axis, remains the same size, making it difficult to see at some zoom levels. A legend shows scale (in microns).

Furthermore, many elements can be toggled (description, metadata, thumbnails, outlines, ontology colors), selection color can be chosen, and individually configured atlas images can be downloaded. Therefore, descpite its few apparent shortcomings are minor, and the features of this visualization make it both functional and valuable to researchers exploring the details of brain anatomy.

The aesthetics of the visualization are appealing and, combined with the interesting, complex, convoluted structure of the brain, it is beautiful. Despite the complex data presented, it does not appear cluttered and irrelevant details are not included. The tool can also be insightful, and indeed it is designed to foster insight. Highlighting structures and it is easy to imagine that seeing relations between structures at high resolution can yeild insight into the architecture of the brain. One limitation of this tool might be the inability to navigate and explore these structures in three dimensions, however, which may be more insightful.

Finally, the visualization may also be said to be enlightening. Understanding the human brain—often recognized as the most complex piece of matter in the known universe—is no small feat, and every advance brings possiblities of developments of new treatments and interventions closer to the horizon. Advancing understanding of the brain is valuable and, in light of the prevalence and impact of mental illnesses, significant.

Part 2: ggplot2 and the grammar of graphics

```
# transformed and anonymized data; removed original files
STAFF_PYRL <- read_csv(here::here("data", "STAFF_PYRL.csv"))
```

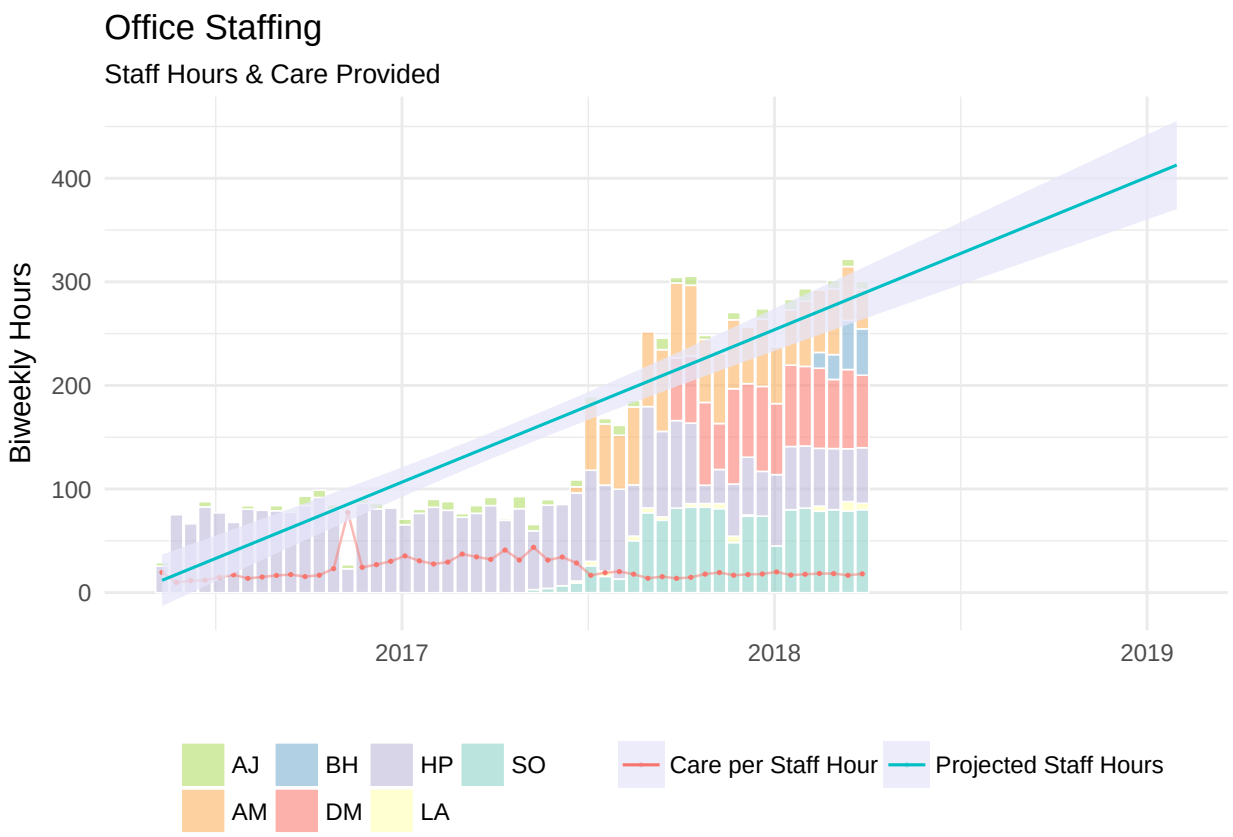
```
## Parsed with column specification:
## cols(
##   X1 = col_integer(),
##   Date = col_date(format = ""),
##   Name = col_character(),
##   Hours = col_double()
## )
```

```
STAFF_CARE_C <- read_csv(here::here("data", "STAFF_CARE_C.csv"))
```

```
## Parsed with column specification:
## cols(
##   .default = col_double(),
##   X1 = col_integer(),
##   Date = col_date(format = ""),
##   `<NA>` = col_integer(),
##   Name.x = col_character(),
##   Name.y = col_character(),
##   CYCLE = col_character()
## )
```

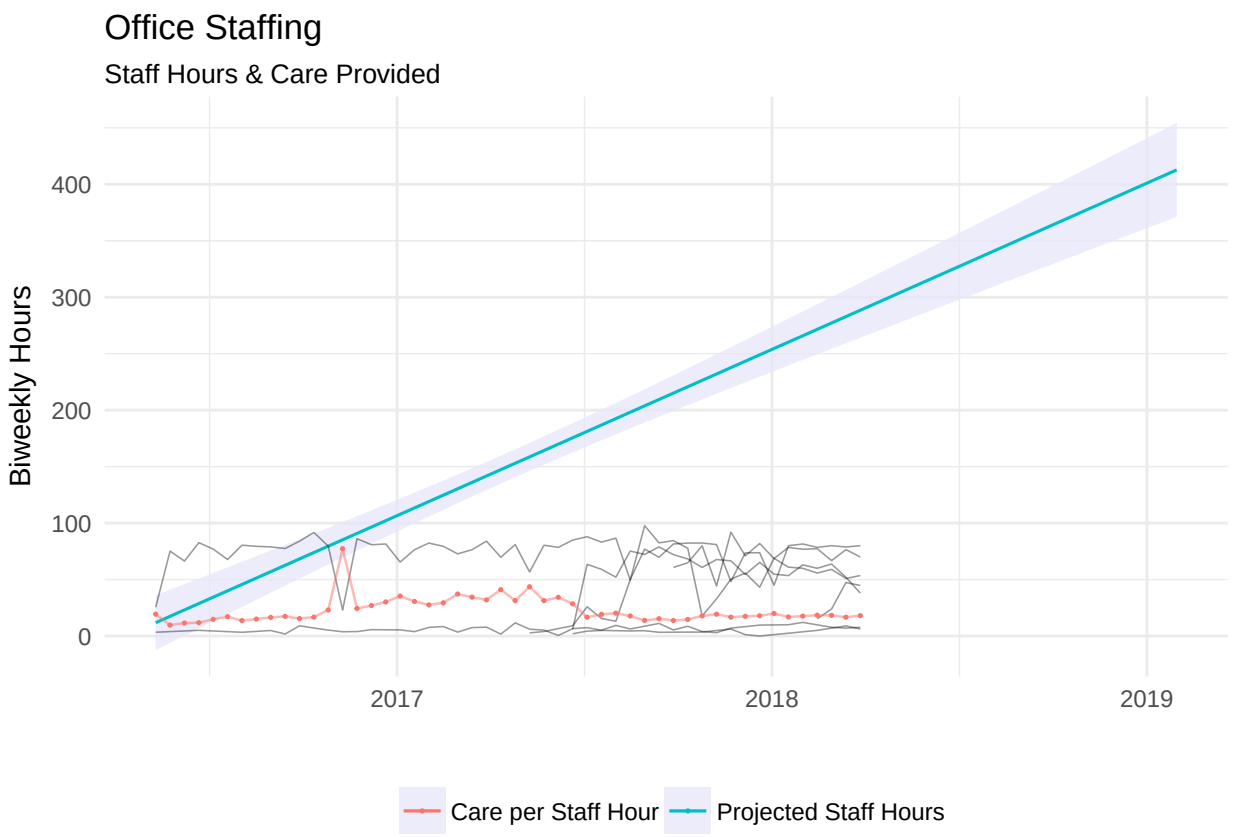
```
## See spec(...) for full column specifications.
```

```
ggplot(STAFF_PYRL, aes(Date, Hours)) +

  geom_col(aes(fill = Name), color = "white", size = 0.28, alpha = .6) +
  scale_fill_brewer(type = "qual", palette = "Set3", direction = -1) +
  theme_minimal() +
  theme(#panel.grid.major.x = element_blank(),
        #panel.grid.minor.x = element_blank(),
        legend.title = element_text(""), legend.position = "bottom" #,
        #axis.ticks.x = element_line()
        ) +

  geom_point(data = STAFF_CARE_C,
             aes(y = `CG PER STAFF`, color = "Care per Staff Hour"), size = .25) +

  geom_line(data = STAFF_CARE_C,
              aes(Date, `CG PER STAFF`, color = "Care per Staff Hour"),
              size = .45, alpha = .5) +

  stat_smooth(data = STAFF_CARE_C,
              aes(Date, `STAFF HOURS`, color = "Projected Staff Hours"),
              method = lm, fullrange = TRUE, size = .55, alpha = .75, fill = "lavender") +

  labs(x = "", y = "Biweekly Hours", fill="", colour = "",
       title = "Office Staffing",
       subtitle = "Staff Hours & Care Provided")
```




```
ggplot(STAFF_PYRL, aes(Date, Hours)) +

  stat_smooth(data = STAFF_CARE_C,
              aes(Date, `STAFF HOURS`, color = "Projected Staff Hours"),
              method = "gam", fullrange = TRUE, size = .55, alpha = .75, fill = "lavender") +

  geom_line(aes(Date, group=Name), size = 0.28, alpha = .4) +
  #scale_color_brewer(type = "qual", palette = "Set3", direction = -1) +
  theme_minimal() +
  theme(#panel.grid.major.x = element_blank(),
        #panel.grid.minor.x = element_blank(),
        legend.title = element_text(""), legend.position = "bottom") +

  geom_point(data = STAFF_CARE_C,
             aes(y = `CG PER STAFF`, color = "Care per Staff Hour"), size = .25) +

  geom_line(data = STAFF_CARE_C,
              aes(Date, `CG PER STAFF`, color = "Care per Staff Hour"),
              size = .45, alpha = .5) +

  labs(x = "", y = "Biweekly Hours", fill="", colour = "",
       title = "Office Staffing",
       subtitle = "Staff Hours & Care Provided")
```

```
## Warning: Removed 22 rows containing non-finite values (stat_smooth).

## Warning: Removed 22 rows containing missing values (geom_point).

## Warning: Removed 22 rows containing missing values (geom_path).
```


Office Staffing
Staff Hours & Care Provided
Biweekly Hours
400
300
200
100
0
2017
2018
2019
Care per Staff Hour
Projected Staff Hours