Project sizes: exploratory plots

Overview

This notebook explores Q5: "How frequently have you contributed to projects of the following size?".

Import packages and utilities

```
project_root <- here::here() # requires that you be somewhere in the
# project directory (not above it)
# packages
suppressMessages(source(file.path(project_root, "scripts/packages.R")))
# functions and objects used across scripts
suppressMessages(source(file.path(project_root, "scripts/utils.R")))
```

Load data

```
sizes_raw <- load_qualtrics_data("clean_data/project_size_Q5.tsv")
other_quant <- load_qualtrics_data("clean_data/other_quant.tsv")
```

Wrangle data

Drop rows with no data

```r
sizes <- exclude_empty_rows(sizes_raw)
nrow(sizes)
```

```
[1] 233
```

Let's create a long-format version for plotting.

```r
sizes_long <- sizes %>%
  pivot_longer(
    cols = everything(),
    names_to  = "size",
    values_to = "frequency"
  )

sizes_long
```

```
# A tibble: 699 x 2
   size   frequency
   <chr>  <chr>
 1 Small  Relatively frequently
 2 Medium Occasionally
 3 Large  Relatively infrequently
 4 Small  Occasionally
 5 Medium Relatively infrequently
 6 Large  Never
 7 Small  Occasionally
 8 Medium Relatively infrequently
 9 Large  Never
10 Small  Relatively frequently
# i 689 more rows
```

Inspect data

Let's look at the counts.

```r
sizes_counts <- sizes_long %>%
  count(size, frequency, name = "n")

sizes_counts[
```

```
  order(
    sizes_counts$n,
    decreasing = TRUE
  ),
]
```

```
# A tibble: 12 x 3
   size   frequency                 n
   <chr>  <chr>                 <int>
 1 Small  Relatively frequently   109
 2 Large  Never                    82
 3 Large  Relatively infrequently  74
 4 Medium Relatively infrequently  69
 5 Medium Occasionally             68
 6 Small  Occasionally             67
 7 Medium Relatively frequently    53
 8 Medium Never                    43
 9 Small  Relatively infrequently  41
10 Large  Occasionally             39
11 Large  Relatively frequently    38
12 Small  Never                    16
```

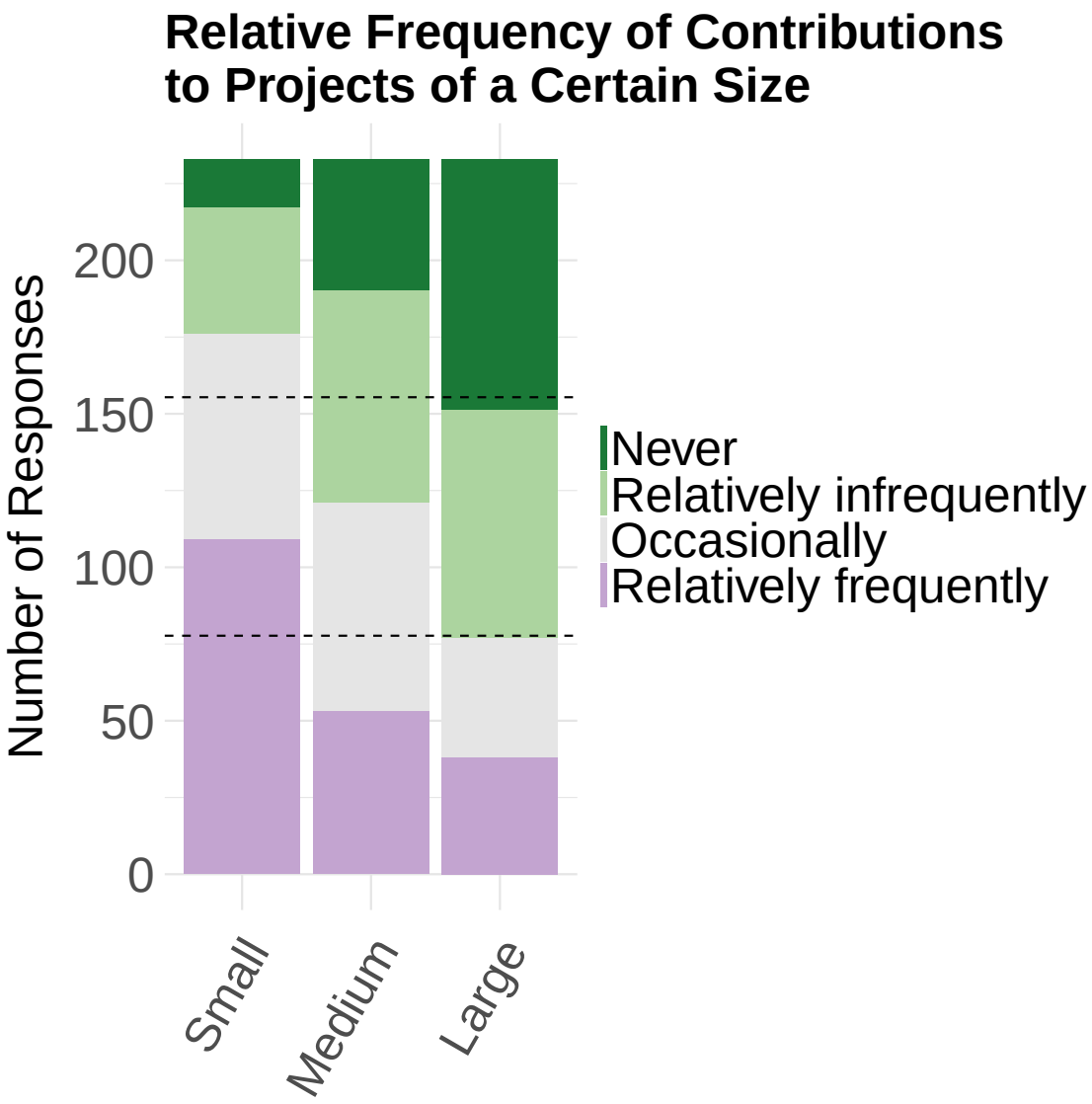
Reorder factor levels

```
ordered_freqs <- c(
  "Never",
  "Relatively infrequently",
  "Occasionally",
  "Relatively frequently"
)

sizes_counts$frequency <- factor(
  sizes_counts$frequency,
  levels = ordered_freqs
)

ordered_sizes <- c(
  "Small",
  "Medium",
  "Large"
)
```

```r
sizes_counts$size <- factor(
  sizes_counts$size,
  levels = ordered_sizes
)
```

Stacked bar chart

```r
stacked_bar <- stacked_bar_chart(
  sizes_counts,
  x_var = "size",
  y_var = "n",
  fill = "frequency",
  title = "Relative Frequency of Contributions\nto Projects of a Certain Size",
  cpalette = c(
    "#1a7937", # dark green
    "#acd49f", # light green
    "#e5e5e5", # light gray
    "#c3a4d0", # light purple
    "#752a82" # dark purple
  )
)
stacked_bar <- stacked_bar +
  geom_hline(yintercept = 155.4, linetype = "dashed", color = "black") +
  geom_hline(yintercept = 77.7, linetype = "dashed", color = "black")
stacked_bar
```



The dashed lines indicate 1/3 and 2/3 of the total number of responses.

Save the plot

```
save_plot("proj_sizes_bar.tiff", 8, 6, p=stacked_bar)
```

Incorporate job category

```
sizes_job <- cbind(sizes_raw, other_quant$job_category)
# Rename column
names(sizes_job)[ncol(sizes_job)] <- "job_category"
# Filter out people who didn't answer either question
sizes_job <- exclude_empty_rows(sizes_job, strict = TRUE)
```

```
sizes_job_long <- sizes_job %>%
  pivot_longer(
    cols = -job_category,
    names_to = "size",
    values_to = "frequency"
  )
```

```
# three way cross tabs (xtabs) and flatten the table
# code from: https://ladal.edu.au/tutorials/regression/regression.html
ftable(xtabs(~ job_category + size + frequency, data = sizes_job_long))
```

```
                          frequency Never Occasionally Relatively frequently Relatively in
job_category         size
Faculty              Large               26           6                     8
                     Medium              13          17                    10
                     Small                6          17                    28
Grad Student         Large               11           7                     1
                     Medium               8          10                     2
                     Small                0           7                    14
Non-research Staff   Large               15          17                    20
                     Medium              11          28                    22
                     Small               10          25                    33
Other research staff Large               17           5                     8
                     Medium               6           8                    14
                     Small                0          11                    22
Post-Doc             Large                8           3                     1
                     Medium               1           4                     4
                     Small                0           6                     8
Undergraduate        Large                5           1                     0
                     Medium               4           1                     1
                     Small                0           1                     4
```

For each job category, what percent of respondents in that category said they contribute to large projects occasionally or relatively frequently?

```
high_freq <- c("Occasionally", "Relatively frequently")

pct_large_by_job <- sizes_job %>%
  group_by(job_category) %>%
  summarise(
    n_total   = n(),
    n_large   = sum(Large %in% high_freq, na.rm = TRUE),
    pct_large = round(100 * mean(Large %in% high_freq, na.rm = TRUE), 1)
  ) %>%
  arrange(desc(pct_large))

pct_large_by_job
```

```
# A tibble: 6 x 4
  job_category         n_total n_large pct_large
  <chr>                  <int>   <int>     <dbl>
1 Non-research Staff        86      37      43
2 Other research staff      40      13      32.5
3 Grad Student              26       8      30.8
4 Post-Doc                  15       4      26.7
5 Faculty                   59      14      23.7
6 Undergraduate              7       1      14.3
```

Let's do the same for small projects.

```
pct_small_by_job <- sizes_job %>%
  group_by(job_category) %>%
  summarise(
    n_total   = n(),
    n_small   = sum(Small %in% high_freq, na.rm = TRUE),
    pct_small = round(100 * mean(Small %in% high_freq, na.rm = TRUE), 1)
  ) %>%
  arrange(desc(pct_small))

pct_small_by_job
```

```
# A tibble: 6 x 4
  job_category         n_total n_small pct_small
```

```
  <chr>                  <int>   <int>     <dbl>
1 Post-Doc                  15      14      93.3
2 Other research staff      40      33      82.5
3 Grad Student              26      21      80.8
4 Faculty                   59      45      76.3
5 Undergraduate              7       5      71.4
6 Non-research Staff        86      58      67.4
```

Merge the two data frames.

```
merged <- inner_join(
  pct_small_by_job,
  pct_large_by_job,
  by = c("job_category", "n_total")
) %>%
  select(job_category, n_total, n_small, pct_small, n_large, pct_large)

merged
```

```
# A tibble: 6 x 6
  job_category         n_total n_small pct_small n_large pct_large
  <chr>                  <int>   <int>     <dbl>   <int>     <dbl>
1 Post-Doc                  15      14      93.3       4      26.7
2 Other research staff      40      33      82.5      13      32.5
3 Grad Student              26      21      80.8       8      30.8
4 Faculty                   59      45      76.3      14      23.7
5 Undergraduate              7       5      71.4       1      14.3
6 Non-research Staff        86      58      67.4      37      43
```

Save for supplement.

```
write_df_to_file(merged, "supplementary_tables/project_sizes_perc_by_job.tsv")
```

What if we add a row for academics? (Just summing up all rows except nr staff)

```
tmp <- pct_large_by_job %>%
  filter(job_category != "Non-research Staff")

rbind(
  tmp,
  c(
```

```
    "Academic",
    sum(tmp$n_total),
    sum(tmp$n_large),
    round(sum(tmp$n_large) / sum(tmp$n_total) * 100, 2)
  )
)
```

```
# A tibble: 6 x 4
  job_category         n_total n_large pct_large
  <chr>                <chr>   <chr>   <chr>
1 Other research staff 40      13      32.5
2 Grad Student         26      8       30.8
3 Post-Doc             15      4       26.7
4 Faculty              59      14      23.7
5 Undergraduate        7       1       14.3
6 Academic             147     40      27.21
```

Maybe we should fold in the smaller job categories, like we did with the regressions.

```
combined <- sizes_job_long %>%
  mutate(
    job_category = recode(
      job_category,
      "Post-Doc" = "Postdocs and Staff Researchers",
      "Other research staff" = "Postdocs and Staff Researchers"
    )
  )

combined <- combined %>%
  mutate(
    job_category = recode(
      job_category,
      "Grad Student" = "Students",
      "Undergraduate" = "Students"
    )
  )
```

What if we separated this stacked bar into academics vs. non-research staff (or IT, maybe)? Maybe just do small and large, to make things visually simpler. Let's build each plot separately and then stitch them together using patchwork.

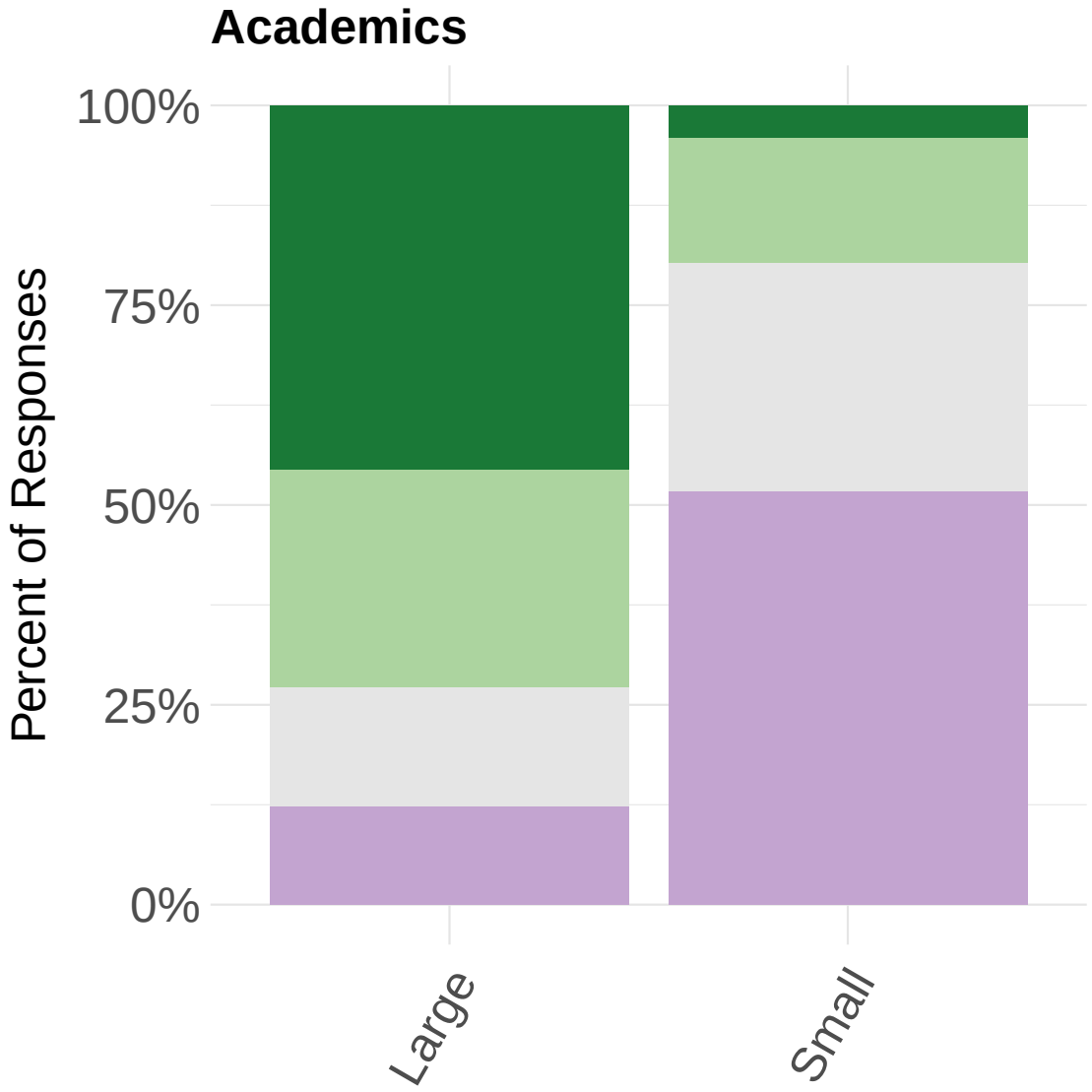
```r
# A version of the df where all academics
# have been relabeled to academic
combined_acad_nrstaff <- combined %>%
  mutate(
    job_category = recode(
      job_category,
      "Students" = "Academic",
      "Postdocs and Staff Researchers" = "Academic",
      "Faculty" = "Academic"
    )
  )

combined_acad_nrstaff$frequency <- factor(
  combined_acad_nrstaff$frequency,
  levels = ordered_freqs
  )

acad_counts <- combined_acad_nrstaff %>%
  filter(job_category == "Academic") %>%
  filter(size != "Medium") %>%
  count(size, frequency, name = "n")

nrstaff_counts <- combined_acad_nrstaff %>%
  filter(job_category != "Academic") %>%
  filter(size != "Medium") %>%
  count(size, frequency, name = "n")
```

Save data frames for fine-tuning of figure in a separate script.

```r
write_df_to_file(acad_counts, "data_for_plots/project_sizes_acad.tsv")
write_df_to_file(nrstaff_counts, "data_for_plots/project_sizes_staff.tsv")
```

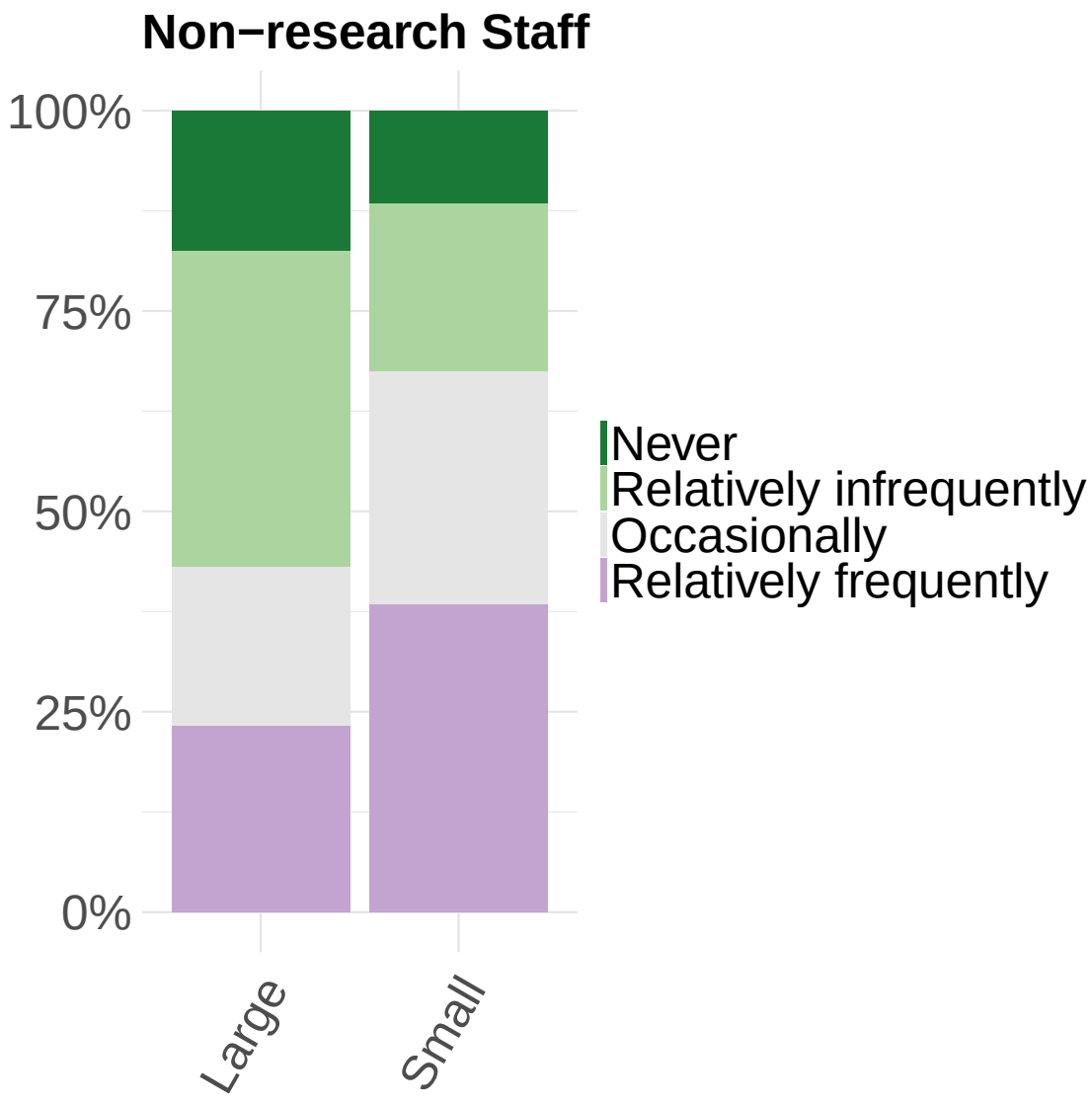
```r
stacked_bar_acad <- stacked_bar_chart(
  acad_counts,
  x_var = "size",
  y_var = "n",
  fill = "frequency",
  title = "Academics",
  ylabel = "Percent of Responses",
  proportional = TRUE,
  show_legend = FALSE,
```

```
  cpalette = c(
    "#1a7937", # dark green
    "#acd49f", # light green
    "#e5e5e5", # light gray
    "#c3a4d0", # light purple
    "#752a82" # dark purple
  )
)

stacked_bar_acad <- stacked_bar_acad +
  scale_y_continuous(labels = scales::percent)
# stacked_bar_acad <- stacked_bar_acad +
#   geom_hline(yintercept = 155.4, linetype = "dashed", color = "black") +
#   geom_hline(yintercept = 77.7, linetype = "dashed", color = "black")
stacked_bar_acad
```




```
stacked_bar_nrstaff <- stacked_bar_chart(
  nrstaff_counts,
  x_var = "size",
  y_var = "n",
  fill = "frequency",
  title = "Non-research Staff",
  ylabel = "Percent of Responses",
  proportional = TRUE,
  show_axis_title_y = FALSE,
```

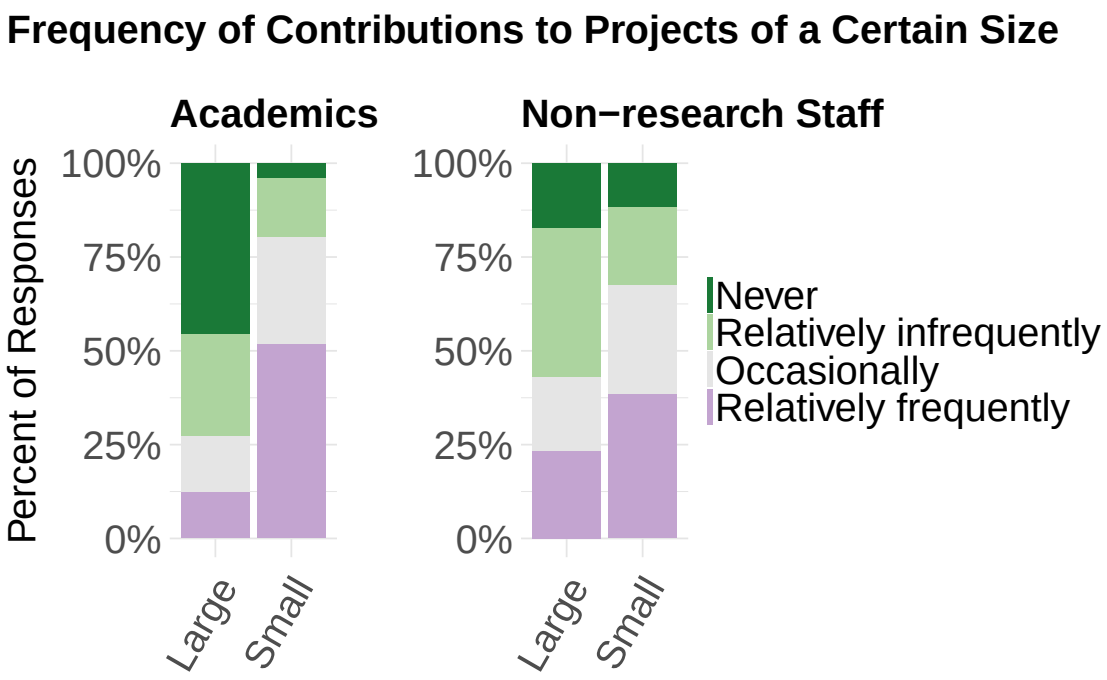
```
  cpalette = c(
    "#1a7937", # dark green
    "#acd49f", # light green
    "#e5e5e5", # light gray
    "#c3a4d0", # light purple
    "#752a82" # dark purple
  )
)

stacked_bar_nrstaff <- stacked_bar_nrstaff +
  scale_y_continuous(labels = scales::percent)

stacked_bar_nrstaff
```



Combine onto one plot

```
p_combined <- patchwork::wrap_plots(
  stacked_bar_acad,
  stacked_bar_nrstaff
) +
  plot_annotation(
    title = "Frequency of Contributions to Projects of a Certain Size",
    theme = theme(plot.title = element_text(size = 24, face = "bold"))
```

```
  )

p_combined
```



Save the plot

```
save_plot("proj_sizes_acad_nrstaff.tiff", 14, 6, p=p_combined)
```

What if we include IT? Start with non-research staff.

```
sizes_staff <- cbind(sizes_raw, other_quant$staff_categories)
# Rename column
names(sizes_staff)[ncol(sizes_staff)] <- "staff_categories"
# Filter out people who didn't answer either question
sizes_staff <- exclude_empty_rows(sizes_staff, strict = TRUE)

nrow(sizes_staff)
```

```
[1] 86
```

```
head(sizes_staff)
```

```
                    Small                   Medium                    Large
30   Relatively frequently Relatively infrequently                    Never
37            Occasionally   Relatively frequently Relatively infrequently
40 Relatively infrequently Relatively infrequently Relatively infrequently
49                  Never   Relatively frequently            Occasionally
74   Relatively frequently Relatively infrequently Relatively infrequently
82 Relatively infrequently            Occasionally   Relatively frequently
                 staff_categories
30                          Other
37 DevOps or System Administration
40 DevOps or System Administration
49     Information Technology (IT)
74 DevOps or System Administration
82                          Other
```

Now limit to just IT.

```
sizes_it <- sizes_staff %>%
  filter(staff_categories == "Information Technology (IT)")

nrow(sizes_it)
```

```
[1] 33
```

```
sizes_it_long <- sizes_it %>%
  pivot_longer(
    cols = -staff_categories,
    names_to = "size",
    values_to = "frequency"
  ) %>%
    select(-staff_categories)

sizes_it_long
```

```
# A tibble: 99 x 2
   size   frequency
   <chr>  <chr>
 1 Small  Never
```

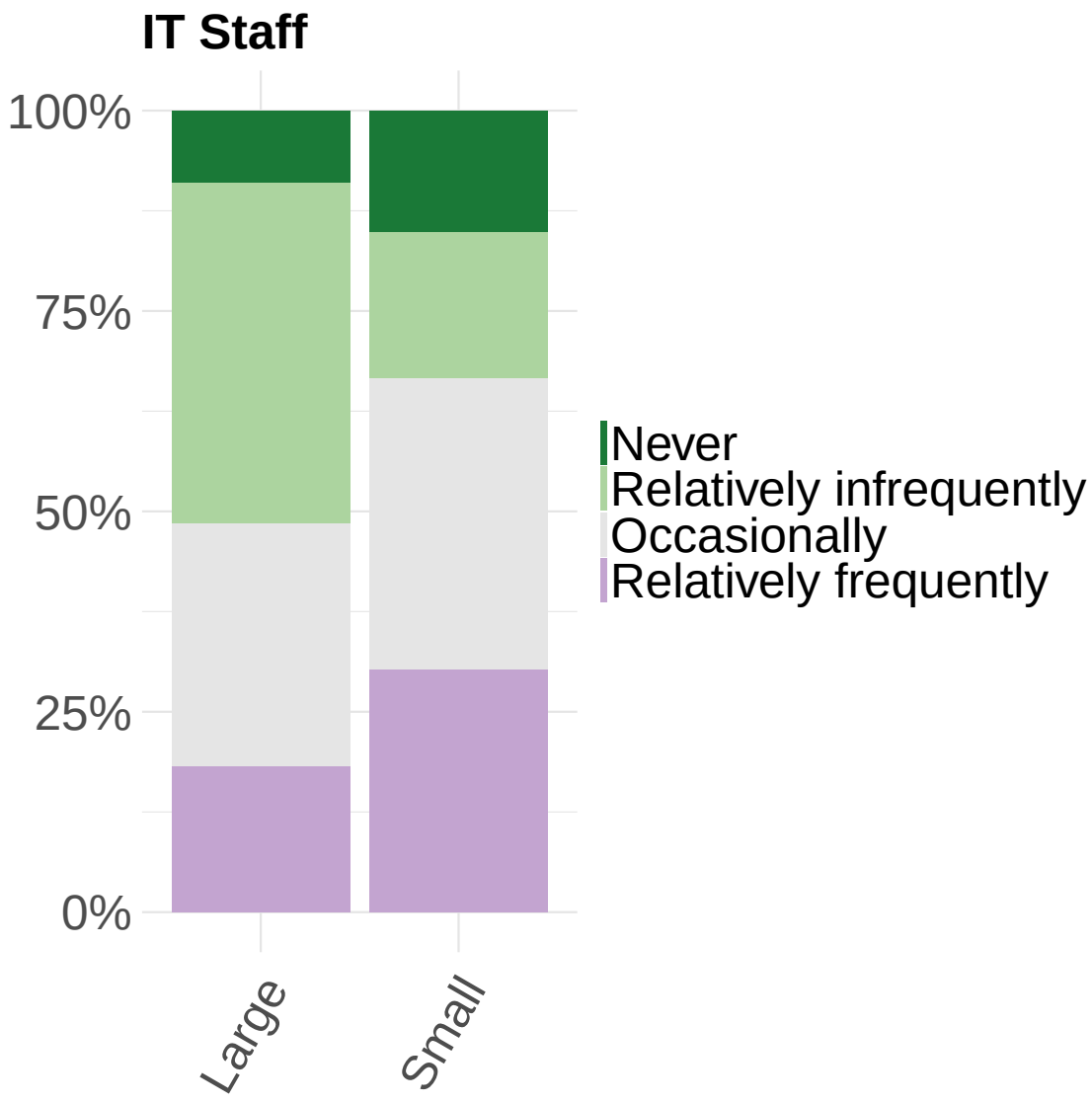
```
 2 Medium Relatively frequently
 3 Large  Occasionally
 4 Small  Relatively frequently
 5 Medium Relatively frequently
 6 Large  Occasionally
 7 Small  Occasionally
 8 Medium Relatively frequently
 9 Large  Relatively infrequently
10 Small  Relatively infrequently
# i 89 more rows
```

```
it_counts <- sizes_it_long %>%
  filter(size != "Medium") %>%
  count(size, frequency, name = "n")

# Re-order factor levels
#it_counts$size <- factor(it_counts$size, levels = c("Small", "Large"))
it_counts$frequency <- factor(it_counts$frequency, levels = ordered_freqs)
it_counts
```

```
# A tibble: 8 x 3
  size  frequency                   n
  <chr> <fct>                   <int>
1 Large Never                       3
2 Large Occasionally               10
3 Large Relatively frequently       6
4 Large Relatively infrequently    14
5 Small Never                       5
6 Small Occasionally               12
7 Small Relatively frequently      10
8 Small Relatively infrequently     6
```

```
stacked_bar_it <- stacked_bar_chart(
  it_counts,
  x_var = "size",
  y_var = "n",
  fill = "frequency",
  title = "IT Staff",
  ylabel = "Percent of Responses",
  proportional = TRUE,
  show_axis_title_y = FALSE,
  cpalette = c(
```

```
    "#1a7937", # dark green
    "#acd49f", # light green
    "#e5e5e5", # light gray
    "#c3a4d0", # light purple
    "#752a82" # dark purple
  )
)

stacked_bar_it <- stacked_bar_it +
  scale_y_continuous(labels = scales::percent)

stacked_bar_it
```



Meh, not that interesting. Looks very similar to the plot for non-research staff. Save it anyway.

Save the plot

```
save_plot("proj_sizes_it.tiff", 14, 6, p=stacked_bar_it)
```

Line plots

Reorder factor levels

```
ordered_jobs <- c(
  "Students",
  "Postdocs and Staff Researchers",
  "Faculty",
  "Non-research Staff"
)

combined$size <- factor(combined$size, levels = ordered_sizes)
combined$frequency <- factor(combined$frequency, levels = ordered_freqs)
combined$job_category <- factor(combined$job_category, levels = ordered_jobs)
```

Recode frequency from categorical to a numeric score

```
combined_coded_all <- combined %>%
  mutate(
    frequency_score = recode(
      frequency,
      "Never" = 0L,
      "Relatively infrequently" = 1L,
      "Occasionally" = 2L,
      "Relatively frequently" = 3L
    )
  ) %>%
    select(-frequency)

combined_coded_all
```

```
# A tibble: 699 x 3
   job_category                    size   frequency_score
   <fct>                           <fct>            <int>
 1 Faculty                         Small                3
 2 Faculty                         Medium               2
 3 Faculty                         Large                1
 4 Postdocs and Staff Researchers Small                 2
 5 Postdocs and Staff Researchers Medium                1
 6 Postdocs and Staff Researchers Large                 0
 7 Postdocs and Staff Researchers Small                 2
```

```
 8 Postdocs and Staff Researchers Medium               1
 9 Postdocs and Staff Researchers Large                0
10 Faculty                        Small                3
# i 689 more rows
```

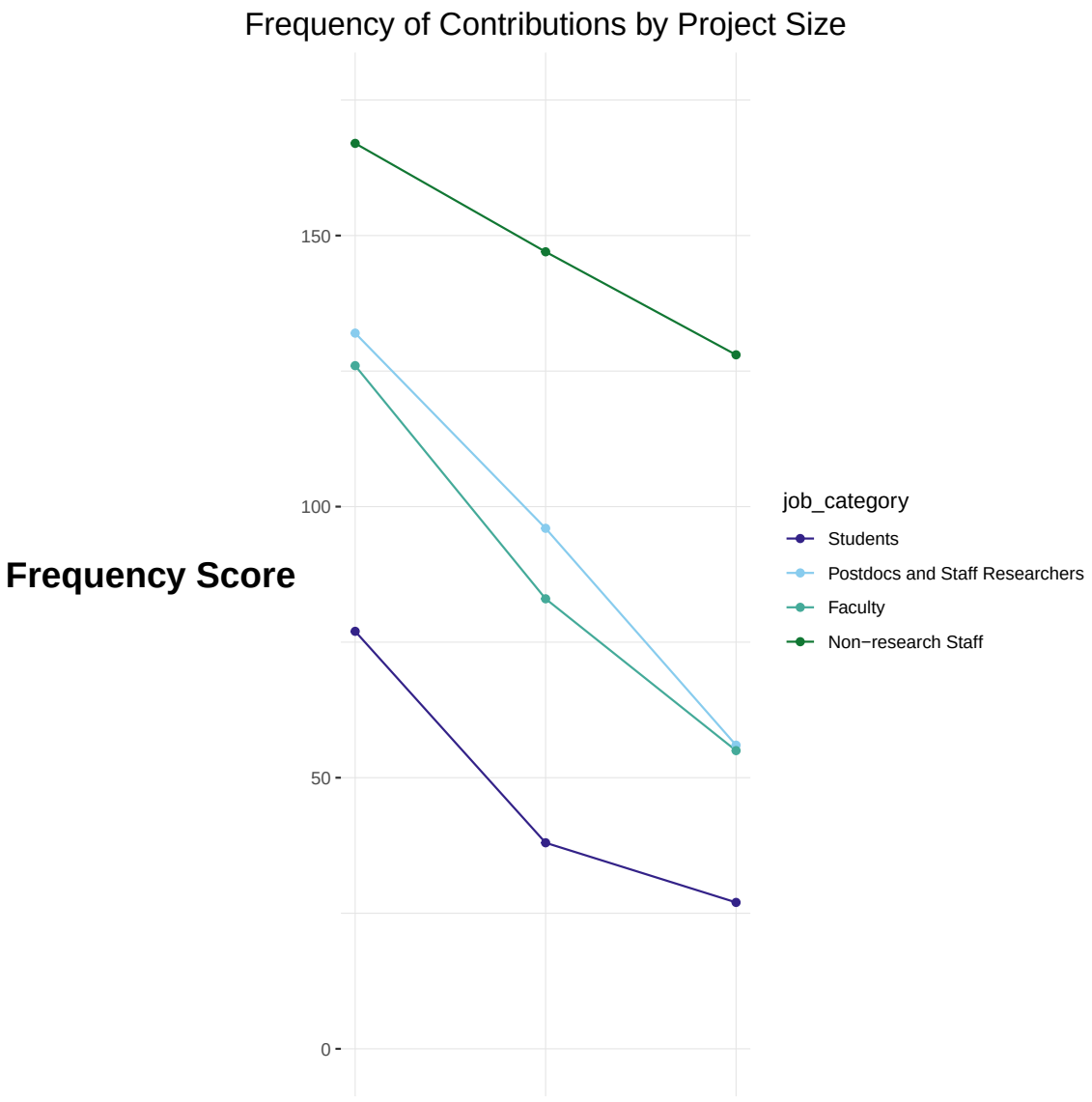
Sum up frequency scores

```
combined_scores <- combined_coded_all %>%
  count(job_category, size, wt = frequency_score, name = "total_score")

# Reorder factor levels
combined_scores$size <- factor(combined_scores$size, levels = ordered_sizes)

combined_scores
```

```
# A tibble: 12 x 3
   job_category                   size   total_score
   <fct>                          <fct>        <int>
 1 Students                       Small           77
 2 Students                       Medium          38
 3 Students                       Large           27
 4 Postdocs and Staff Researchers Small          132
 5 Postdocs and Staff Researchers Medium          96
 6 Postdocs and Staff Researchers Large           56
 7 Faculty                        Small          126
 8 Faculty                        Medium          83
 9 Faculty                        Large           55
10 Non-research Staff             Small          167
11 Non-research Staff             Medium         147
12 Non-research Staff             Large          128
```

```
ggplot(
    combined_scores,
    aes(x = size, y = total_score, group = job_category, color = job_category)
  ) +
    geom_line() +
    geom_point() +
    ylim(0, 175) +
    scale_x_discrete(expand = c(0.025, 0.025)) +
    ylab("Frequency Score") +
    xlab("Project Size") +
```

```
    ggtitle("Frequency of Contributions by Project Size") +
    scale_color_manual(values = COLORS) +

    theme(
          axis.title.y = element_text(
            angle = 0,
            vjust = 0.5,
            size = 18,
            face = "bold"
          ),
          axis.title.x = element_blank(),
          axis.text.x = element_blank(),
          axis.ticks.x = element_blank(),
          panel.background = element_blank(),
          panel.grid.major = element_line(linewidth = 0.25, linetype = "solid", color = "gray
          panel.grid.minor = element_line(linewidth = 0.25, linetype = "solid", color = "gray
          plot.margin = unit(c(0.5, 0.5, 0.5, 0.5), "cm"),
          plot.title = element_text(hjust = 0.5, size = 16),
        )
```



Nah, still needs work. How about we just plot the trend for large projects?

Large projects

```
large <- subset(combined, size == "Large")
large_counts <- large %>%
  count(job_category, frequency, name = "n")
```

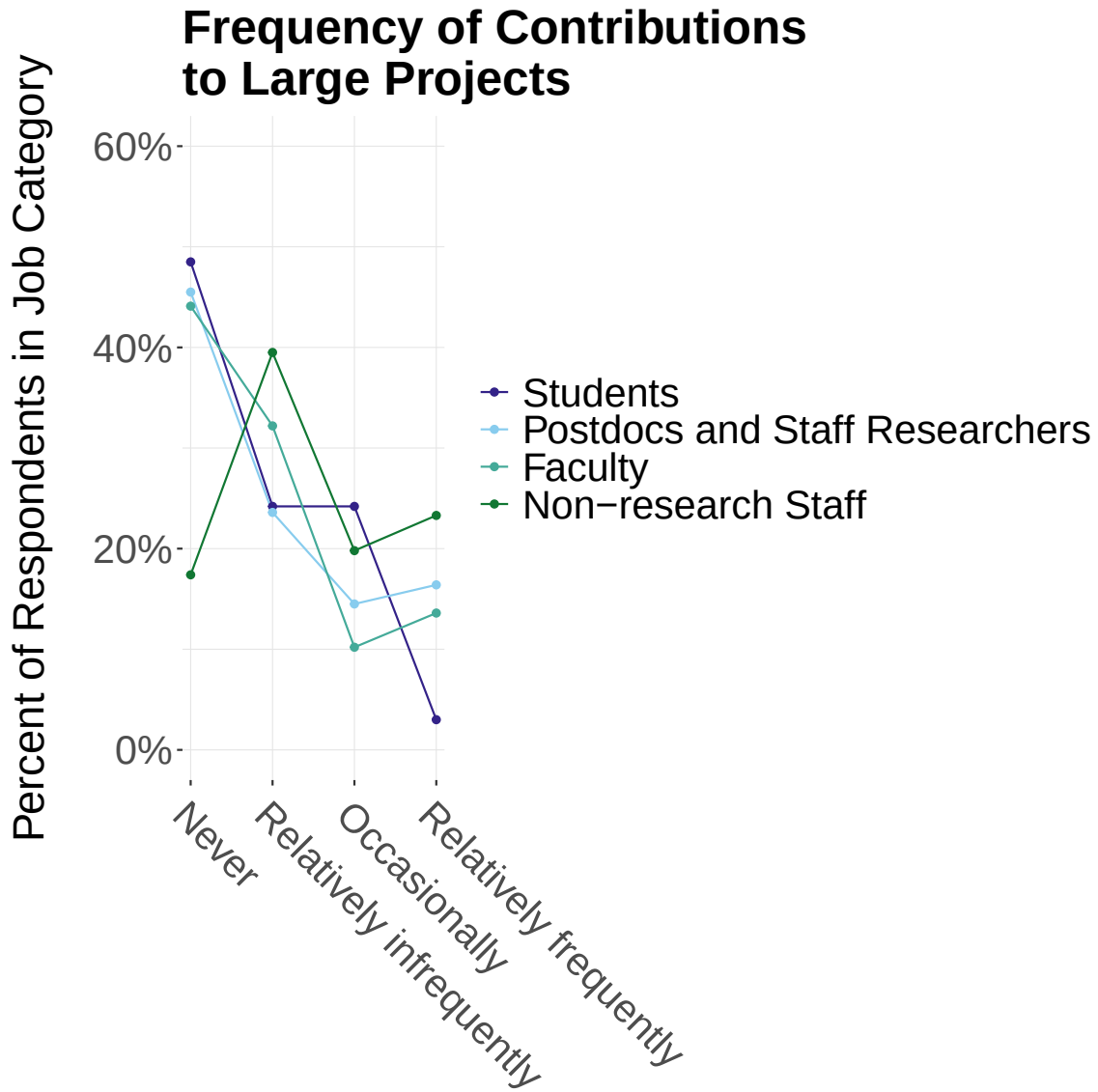
```r
large_counts <- large_counts %>%
  group_by(job_category) %>%
  mutate(perc_total = round(100 * n / sum(n), 1)) %>%
  ungroup()
```

```r
large_line <- ggplot(
    large_counts,
    aes(x = frequency, y = perc_total, group = job_category, color = job_category)
  ) +
    geom_line() +
    geom_point() +
    ylim(0, 50) +

    scale_x_discrete(expand = c(0.025, 0.025)) +
    scale_y_continuous(labels = scales::percent_format(accuracy = 1, scale = 1), limits = c(0
    scale_color_manual(values = COLORS) +

    ylab("Percent of Respondents in Job Category") +
    xlab("Project Size") +
    ggtitle("Frequency of Contributions\nto Large Projects") +


    theme(
          axis.title.y = element_text(
            size = 22,
            margin = margin(r = 20)
          ),
          axis.text.y = element_text(size = 20),
          axis.title.x = element_blank(),
          axis.text.x = element_text(
            angle = -45,
            hjust = 0,
            vjust = 1,
            size = 20,
            margin = margin(t = 6)),
          #axis.ticks.x = element_blank(),
          legend.text = element_text(size = 20),
          legend.title = element_blank(),
          panel.background = element_blank(),
          panel.grid.major = element_line(linewidth = 0.25, linetype = "solid", color = "gray
          panel.grid.minor = element_line(linewidth = 0.25, linetype = "solid", color = "gray
```

```
          plot.margin = unit(c(0.5, 0.5, 0.5, 0.5), "cm"),
          plot.title = element_text(hjust = 0, size = 24, face = "bold"),
        )
```

```
Scale for y is already present.
Adding another scale for y, which will replace the existing scale.
```

```
large_line
```



Hard to discern a clear trend. Let's save the plot anyway.

Save the plot

```
save_plot("proj_sizes_large_line.tiff", 10, 6, p=large_line)
```

Medium projects

What about Medium projects? Do the same trends hold?

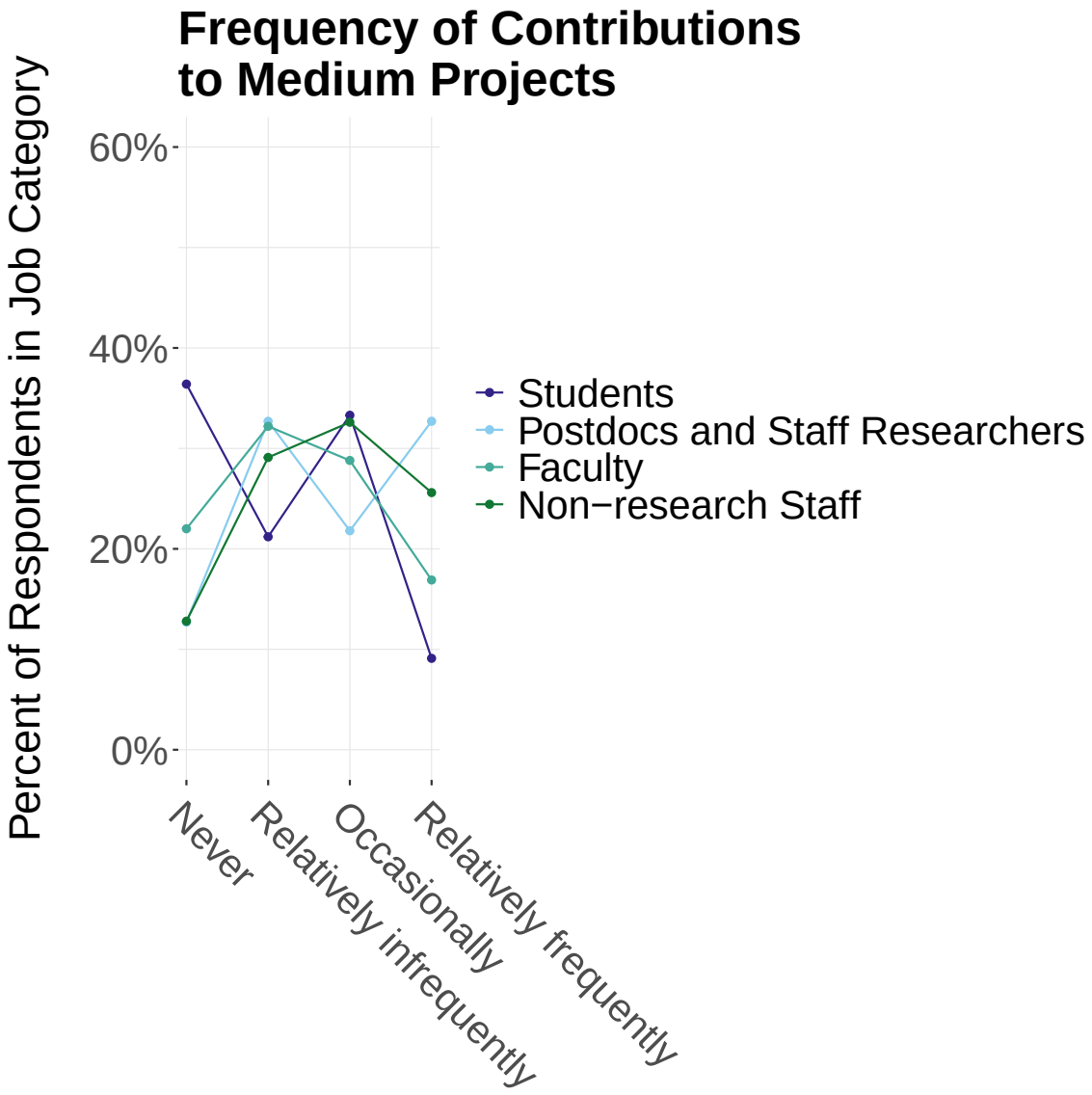
```
med <- subset(combined, size == "Medium")
med_counts <- med %>%
  count(job_category, frequency, name = "n")

med_counts <- med_counts %>%
  group_by(job_category) %>%
  mutate(perc_total = round(100 * n / sum(n), 1)) %>%
  ungroup()
```

```
med_line <- ggplot(
    med_counts,
    aes(x = frequency, y = perc_total, group = job_category, color = job_category)
  ) +
    geom_line() +
    geom_point() +
    ylim(0, 50) +

    scale_x_discrete(expand = c(0.025, 0.025)) +
    scale_y_continuous(labels = scales::percent_format(accuracy = 1, scale = 1), limits = c(0
    scale_color_manual(values = COLORS) +

    ylab("Percent of Respondents in Job Category") +
    xlab("Project Size") +
    ggtitle("Frequency of Contributions\nto Medium Projects") +


    theme(
          axis.title.y = element_text(
            size = 22,
            margin = margin(r = 20)
          ),
```

```
          axis.text.y = element_text(size = 20),
          axis.title.x = element_blank(),
          axis.text.x = element_text(
            angle = -45,
            hjust = 0,
            vjust = 1,
            size = 20,
            margin = margin(t = 6)),
          #axis.ticks.x = element_blank(),
          legend.text = element_text(size = 20),
          legend.title = element_blank(),
          panel.background = element_blank(),
          panel.grid.major = element_line(linewidth = 0.25, linetype = "solid", color = "gray
          panel.grid.minor = element_line(linewidth = 0.25, linetype = "solid", color = "gray
          plot.margin = unit(c(0.5, 0.5, 0.5, 0.5), "cm"),
          plot.title = element_text(hjust = 0, size = 24, face = "bold"),
        )
```

```
Scale for y is already present.
Adding another scale for y, which will replace the existing scale.
```

```
med_line
```



Save the plot

```
save_plot("proj_sizes_med_line.tiff", 10, 6, p=med_line)
```

Small projects

We've made it this far. We might as well look at small projects, too.

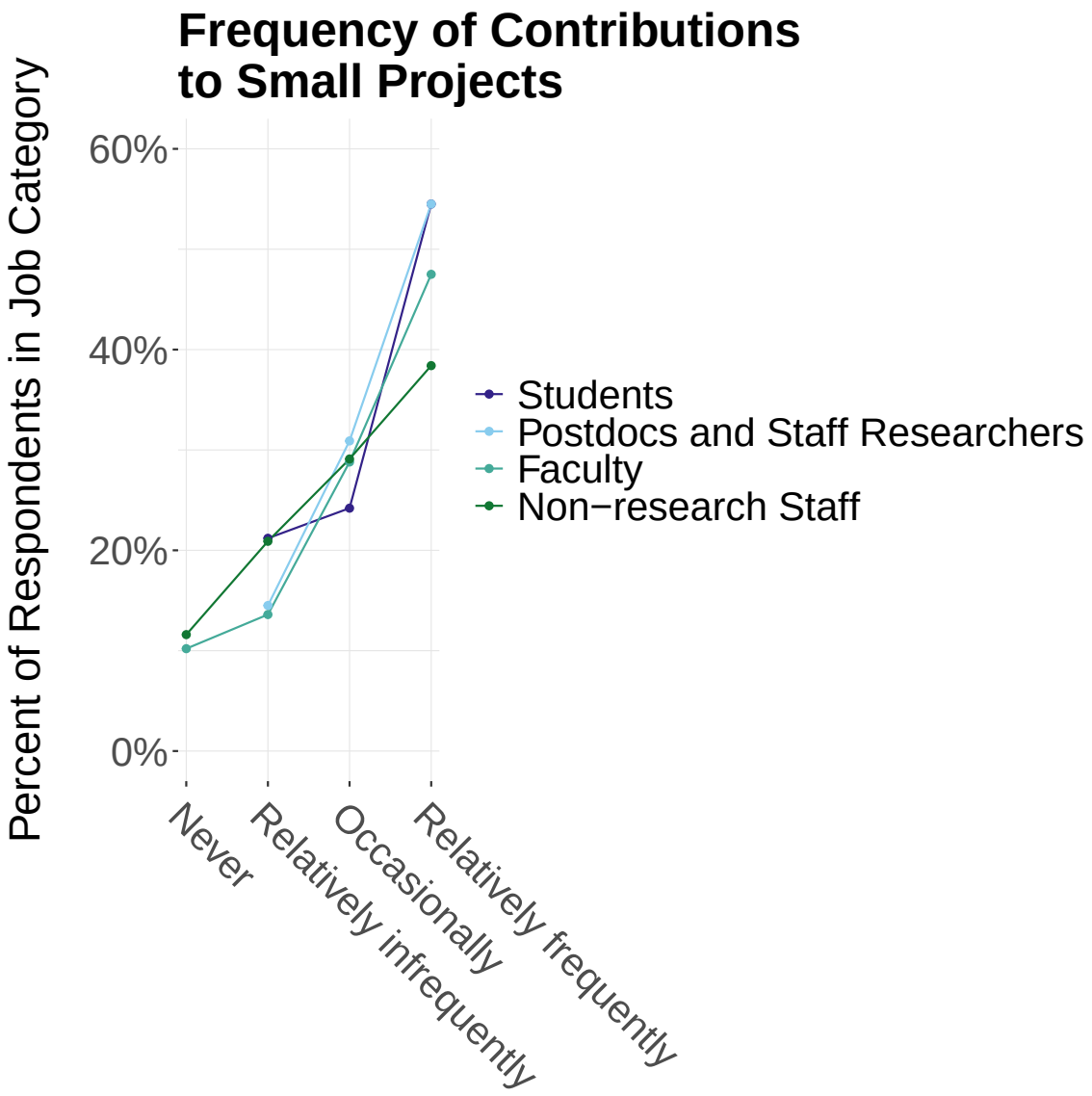
```r
small <- subset(combined, size == "Small")
small_counts <- small %>%
  count(job_category, frequency, name = "n")

small_counts <- small_counts %>%
  group_by(job_category) %>%
  mutate(perc_total = round(100 * n / sum(n), 1)) %>%
  ungroup()
```

```r
small_line <- ggplot(
    small_counts,
    aes(x = frequency, y = perc_total, group = job_category, color = job_category)
  ) +
    geom_line() +
    geom_point() +
    ylim(0, 50) +

    scale_x_discrete(expand = c(0.025, 0.025)) +
    scale_y_continuous(labels = scales::percent_format(accuracy = 1, scale = 1), limits = c(0
    scale_color_manual(values = COLORS) +

    ylab("Percent of Respondents in Job Category") +
    xlab("Project Size") +
    ggtitle("Frequency of Contributions\nto Small Projects") +


    theme(
          axis.title.y = element_text(
            size = 22,
            margin = margin(r = 20)
          ),
          axis.text.y = element_text(size = 20),
          axis.title.x = element_blank(),
          axis.text.x = element_text(
            angle = -45,
            hjust = 0,
            vjust = 1,
            size = 20,
            margin = margin(t = 6)),
          #axis.ticks.x = element_blank(),
          legend.text = element_text(size = 20),
          legend.title = element_blank(),
```

```
          panel.background = element_blank(),
          panel.grid.major = element_line(linewidth = 0.25, linetype = "solid", color = "gray
          panel.grid.minor = element_line(linewidth = 0.25, linetype = "solid", color = "gray
          plot.margin = unit(c(0.5, 0.5, 0.5, 0.5), "cm"),
          plot.title = element_text(hjust = 0, size = 24, face = "bold"),
        )
```

```
Scale for y is already present.
Adding another scale for y, which will replace the existing scale.
```

```
small_line
```



Wow, that's much prettier.

Save the plot

```
save_plot("proj_sizes_small_line.tiff", 10, 6, p=small_line)
```

```
p_combined <- patchwork::wrap_plots(large_line, plot_spacer(), small_line) +
  plot_layout(widths = c(1, 0.05, 1))
```

```
p_combined <- p_combined +
  plot_annotation(tag_levels = "A") &
  theme(plot.tag = element_text(size = 26))

svglite::svglite(
  file.path(FIGURE_PATH, "figureS3.svg"),
  width = 26,
  height = 10
)
print(p_combined)
dev.off()
```

```
pdf
  2
```

I'd like to know whether the proportion of academics who contribute to large projects with some frequency is significantly lower than the proportion of non-research staff who contribute to large projects with some frequency.

```
combined_counts <- combined %>%
  count(job_category, size, frequency, name = "n")

res <- combined_counts %>%
  filter(size == "Large") %>%
  mutate(
    group = if_else(job_category == "Non-research Staff",
                    "Non-research Staff", "Academics"),
    freq2 = if_else(frequency == "Never", "Never", "Other")
  ) %>%
  group_by(group, freq2) %>%
  summarise(n = sum(n), .groups = "drop_last") %>%
  mutate(prop = n / sum(n)) %>%
  ungroup()

# 2×2 table: proportions for each group
res_wide <- res %>%
  select(group, freq2, prop) %>%
  pivot_wider(names_from = freq2, values_from = prop) %>%
  arrange(match(group, c("Non-research Staff", "Academics")))

res_wide
```

```
# A tibble: 2 x 3
  group              Never Other
  <chr>              <dbl> <dbl>
1 Non-research Staff 0.174 0.826
2 Academics          0.456 0.544
```

Hmm. Seems promising. We should probably do a regression…