srvyr compared to the survey package

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The srvyr package aims to add dplyr like syntax to the survey package. This vignette focuses on how srvyr compares to the survey package, for more information about survey design and analysis, check out the vignettes in the survey package, or Thomas Lumley's book, *Complex Surveys: A Guide to Analysis Using R*.

Everything that srvyr can do, can also be done in survey. In fact, behind the scenes the survey package is doing all of the hard work for srvyr. srvyr strives to make your code simpler and more easily readable to you, especially if you are already used to the dplyr package.

Motivating example

The dplyr package has made it fast and easy to write code to summarize data. For example, if we wanted to check how the year-to-year change in academic progress indicator score varied by school level and percent of parents were high school graduates, we can do this:

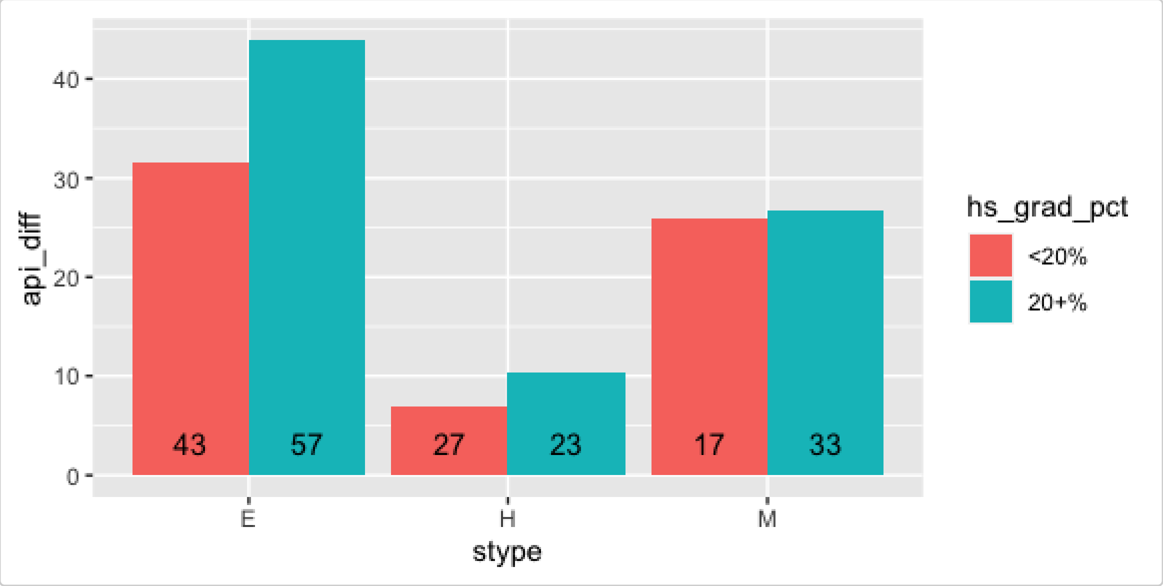
```
library(survey)
library(ggplot2)
library(dplyr)

data(api)

out <- apistrat %>%
  mutate(hs_grad_pct = cut(hsg, c(0, 20, 100), include.lowest = TRUE,
                           labels = c("<20%", "20+%"))) %>%
  group_by(stype, hs_grad_pct) %>%
  summarize(api_diff = weighted.mean(api00 - api99, pw),
            n = n())

ggplot(data = out, aes(x = stype, y = api_diff, group = hs_grad_pct, fill = hs_grad_pct)) +
  geom_col(stat = "identity", position = "dodge") +
  geom_text(aes(y = 0, label = n), position = position_dodge(width = 0.9), vjust = -1)
```

```
## Warning: Ignoring unknown parameters: stat
```



However, if we wanted to add error bars to the graph to capture the uncertainty due to sampling variation, we have to completely rewrite the `dplyr` code for the `survey` package. `srvyr` allows a more direct translation.

Preparing a survey dataset

`as_survey_design()`, `as_survey_rep()` and `as_survey_twophase()` are analogous to `survey::svydesign()`, `survey::svrepdesign()` and `survey::twophase()` respectively. Because they are designed to match `dplyr`'s style of non-standard evaluation, they accept bare column names instead of formulas (~). They also move the data argument first, so that it is easier to use `magrittr` pipes (%>%).

```
library(srvyr)

# simple random sample
srs_design_srvyr <- apisrs %>% as_survey_design(ids = 1, fpc = fpc)

srs_design_survey <- svydesign(ids = ~1, fpc = ~fpc, data = apisrs)
```

The `srvyr` functions also accept `dplyr::select()`'s special selection functions (such as `starts_with()`, `one_of()`, etc.), so these functions are analogous:

```
# selecting variables to keep in the survey object (stratified example)
strat_design_srvyr <- apistrat %>%
  as_survey_design(1, strata = stype, fpc = fpc, weight = pw,
                variables = c(stype, starts_with("api")))

strat_design_survey <- svydesign(~1, strata = ~stype, fpc = ~fpc,
                                 variables = ~stype + api99 + api00 + api.stu,
                                 weight = ~pw, data = apistrat)
```

The function `as_survey()` will automatically choose between the three `as_survey_*` functions based on the arguments, so you can save a few keystrokes.

```
# simple random sample (again)
srs_design_srvyr2 <- apisrs %>% as_survey(ids = 1, fpc = fpc)
```

Data manipulation

Once you’ve set up your survey data, you can use `dplyr` verbs such as `mutate()`, `select()`, `filter()` and `rename()`.

```
strat_design_srvyr <- strat_design_srvyr %>%
  mutate(api_diff = api00 - api99) %>%
  rename(api_students = api.stu)

strat_design_survey$variables$api_diff <- strat_design_survey$variables$api00 -
  strat_design_survey$variables$api99
names(strat_design_survey$variables)[names(strat_design_survey$variables) == "api.stu"] <-
        "api_students"
```

Note that `arrange()` is not available, because the `srvyr` object expects to stay in the same order. Nor are two-table verbs such as `full_join()`, `bind_rows()`, etc. available to `srvyr` objects either because they may have implications on the survey design. If you need to use these functions, you should use them earlier in your analysis pipeline, when the objects are still stored as `data.frame`s.

Summary statistics

Of the entire population

`srvyr` also provides `summarize()` and several survey-specific functions that calculate summary statistics on numeric variables: `survey_mean()`, `survey_total()`, `survey_quantile()` and `survey_ratio()`. These functions differ from their counterparts in `survey` because they always return a data.frame in a consistent format. As such, they do not return the variance-covariance matrix, and so are not as flexible.

```
# Using srvyr
out <- strat_design_srvyr %>%
  summarize(api_diff = survey_mean(api_diff, vartype = "ci"))

out
```

```
##   api_diff api_diff_low api_diff_upp
## 1 32.89252     28.84756     36.93747
```

```
# Using survey
out <- svymean(~api_diff, strat_design_survey)

out
```

```
##            mean     SE
## api_diff 32.893 2.0511
```

```
confint(out)
```

```
##             2.5 %   97.5 %
## api_diff 28.87241 36.91262
```

By group

srvyr also allows you to calculate statistics on numeric variables by group, using group_by().

```
# Using srvyr
strat_design_srvyr %>%
  group_by(stype) %>%
  summarize(api_increase = survey_total(api_diff >= 0),
            api_decrease = survey_total(api_diff < 0))
```

```
## # A tibble: 3 x 5
##   stype api_increase api_increase_se api_decrease api_decrease_se
##   <fct>        <dbl>           <dbl>        <dbl>           <dbl>
## 1 E            4067.           119.         354.            119.
## 2 H             498.            49.4        257.             49.4
## 3 M             998.            19.9         20.4            19.9
```

```
# Using survey
svyby(~api_diff >= 0, ~stype, strat_design_survey, svytotal)
```

```
##   stype api_diff >= 0FALSE api_diff >= 0TRUE se.api_diff >= 0FALSE
## E     E             353.68           4067.32             119.17185
## H     H             256.70            498.30              49.37208
## M     M              20.36            997.64              19.85371
##   se.api_diff >= 0TRUE
## E            119.17185
## H             49.37208
## M             19.85371
```

Proportions by group

You can also calculate the proportion or count in each group of a factor or character variable by leaving x empty in survey_mean() or survey_total().

```
# Using srvyr
srs_design_srvyr %>%
  group_by(awards) %>%
  summarize(proportion = survey_mean(),
            total = survey_total())
```

```
## # A tibble: 2 x 5
##   awards proportion proportion_se total total_se
##   <fct>       <dbl>         <dbl> <dbl>    <dbl>
## 1 No           0.38       0.0338 2354.     210.
## 2 Yes          0.62       0.0338 3840.     210.
```

```
# Using survey
svymean(~awards, srs_design_survey)
```

```
##           mean     SE
## awardsNo  0.38 0.0338
## awardsYes 0.62 0.0338
```

```
svytotal(~awards, srs_design_survey)
```

```
##            total     SE
## awardsNo  2353.7 209.65
## awardsYes 3840.3 209.65
```

Unweighted calculations

Finally, the `unweighted()` function can act as an escape hatch to calculate unweighted calculations on the dataset.

```
# Using srvyr
strat_design_srvyr %>%
  group_by(stype) %>%
  summarize(n = unweighted(n()))
```

```
## # A tibble: 3 x 2
##   stype     n
##   <fct> <int>
## 1 E       100
## 2 H        50
## 3 M        50
```

```
# Using survey
svyby(~api99, ~stype, strat_design_survey, unwtd.count)
```

```
##   stype counts se
## E     E    100  0
## H     H     50  0
## M     M     50  0
```

Back to the example

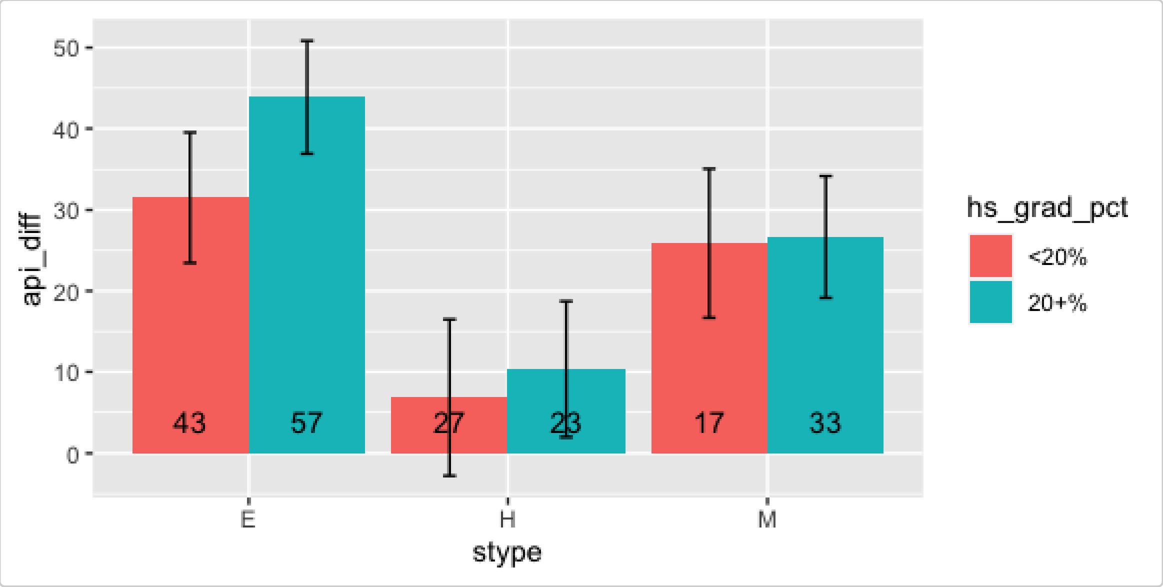
So now, we have all the tools needed to create the first graph and add error bounds. Notice that the data manipulation code is nearly identical to the `dplyr` code, with a little extra set up, and replacing `weighted.mean()` with `survey_mean`.

```
strat_design <- apistrat %>%
  as_survey_design(strata = stype, fpc = fpc, weight  = pw)

out <- strat_design %>%
  mutate(hs_grad_pct = cut(hsg, c(0, 20, 100), include.lowest = TRUE,
                           labels = c("<20%", "20+%"))) %>%
  group_by(stype, hs_grad_pct) %>%
  summarize(api_diff = survey_mean(api00 - api99, vartype = "ci"),
            n = unweighted(n()))

ggplot(data = out, aes(x = stype, y = api_diff, group = hs_grad_pct, fill = hs_grad_pct,
                       ymax = api_diff_upp, ymin = api_diff_low)) +
  geom_col(stat = "identity", position = "dodge") +
  geom_errorbar(position = position_dodge(width = 0.9), width = 0.1) +
  geom_text(aes(y = 0, label = n), position = position_dodge(width = 0.9), vjust = -1)
```

```
## Warning: Ignoring unknown parameters: stat
```



Grab Bag

Using `survey` functions on `srvyr` objects

Because `srvyr` objects are just `survey` objects with some extra structure, all of the functions from `survey` will still work with them. If you need to calculate something beyond simple summary statistics, you can use `survey` functions.

```
glm <- svyglm(api00 ~ ell + meals + mobility, design = strat_design)
summary(glm)
```

```
##
## Call:
## svyglm(formula = api00 ~ ell + meals + mobility, design = strat_design)
##
## Survey design:
## Called via srvyr
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 820.8873    10.0777  81.456   <2e-16 ***
## ell          -0.4806     0.3920  -1.226    0.222
## meals        -3.1415     0.2839 -11.064   <2e-16 ***
## mobility      0.2257     0.3932   0.574    0.567
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 5171.966)
##
## Number of Fisher Scoring iterations: 2
```

Standard evaluation

Srvyr now supports the standard evaluation conventions introduced in dplyr version 0.7 and rlang. If you'd like to use a function programmatically, you can use the functions from rlang like `rlang::quo()` or `rlang::sym()` to capture the expression and `rlang::!!` to unquote it. All of these functions are re-exported by srvyr, so you don't need to load the rlang library to use them.

Here's a quick example, but please see the dplyr vignette `vignette("programming", package = "dplyr")` for more details.

```
fpc_var <- sym("fpc")
srs_design_srvyr <- apisrs %>% as_survey_design(fpc = !!fpc_var)

grouping_var <- sym("stype")
api_diff <- quo(api00 - api99)

srs_design_srvyr %>%
  group_by(!!grouping_var) %>%
  summarize(
    api_increase = survey_total((!!api_diff) >= 0),
    api_decrease = survey_total((!!api_diff) < 0)
  )
```

```
## # A tibble: 3 x 5
##   stype api_increase api_increase_se api_decrease api_decrease_se
##   <fct>        <dbl>           <dbl>        <dbl>           <dbl>
## 1 E            4057.            205.         341.            98.5
## 2 H             557.            124.         217.            79.4
## 3 M             898.            152.         124.            60.5
```

Srvyr will also follow dplyr’s lead on deprecating the old method of NSE, the so-called “underscore functions” (like `summarize_`). Currently, they have been soft-deprecated, but I expect them to be removed altogether in some future version of srvyr.

Scoped functions

Srvyr has also been able to take advantage of the new-ish dplyr “scoped” variants of the main manipulation functions like `summarize_at()`. These functions allow you to quickly calculate summary statistics for multiple variables. For example:

```r
# Calculate survey mean for all variables that have names starting with "api"
strat_design %>%
  summarize_at(vars(starts_with("api")), survey_mean)
```

```
##      api00 api00_se    api99 api99_se  api.stu api.stu_se
## 1 662.2874 9.408941 629.3948 9.963947 498.2255   16.06028
```

The dplyr documentation `dplyr::scoped` provides more details.