

# SDM4 in R: Regression Wisdom (Chapter 8)

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June 13, 2018

## Introduction and background

This document is intended to help describe how to undertake analyses introduced as examples in the Fourth Edition of *Stats: Data and Models* (2014) by De Veaux, Velleman, and Bock. More information about the book can be found at [http://wps.aw.com/aw\\_deveaux\\_stats\\_series](http://wps.aw.com/aw_deveaux_stats_series). This file as well as the associated R Markdown reproducible analysis source file used to create it can be found at <http://nhorton.people.amherst.edu/sdm4>.

This work leverages initiatives undertaken by Project MOSAIC (<http://www.mosaic-web.org>), an NSF-funded effort to improve the teaching of statistics, calculus, science and computing in the undergraduate curriculum. In particular, we utilize the `mosaic` package, which was written to simplify the use of R for introductory statistics courses. A short summary of the R needed to teach introductory statistics can be found in the `mosaic` package vignettes (<http://cran.r-project.org/web/packages/mosaic>). A paper describing the `mosaic` approach was published in the *R Journal*: <https://journal.r-project.org/archive/2017/RJ-2017-024>.

## Chapter 8: Regression Wisdom

### Section 8.1: Examining residuals

Figure 8.1 (page 220) displays the scatterplot of heart rate vs duration for the Penguins dataset (along with a superimposed regression line and a smoother).

```
library(mosaic)
library(readr)
options(digits = 3)
Penguins <- read_csv("http://nhorton.people.amherst.edu/sdm4/data/Penguins.csv")
gf_point(DiveHeartRate ~ Duration, ylab = "Dive Heart Rate (bpm)",
         xlab = "Duration (mins)", data = Penguins) %>%
  gf_lm() %>%
  gf_smooth(se = FALSE)
```

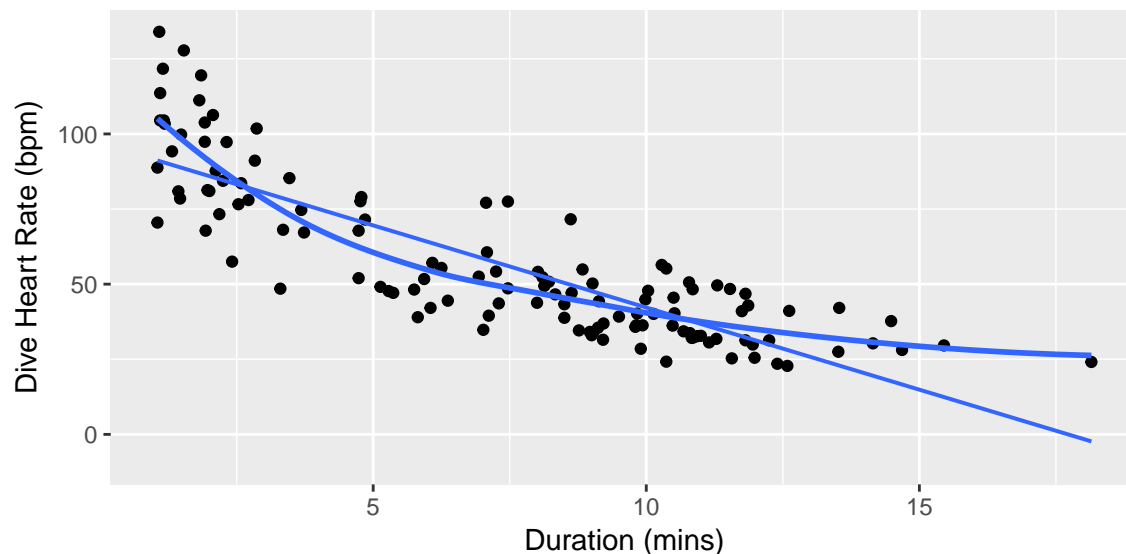


Figure 8.2 (page 220) displays the residuals from a linear regression model as a function of duration.

```
Penguinmod <- lm(DiveHeartRate ~ Duration, data = Penguins)
gf_point(resid(Penguinmod) ~ Duration, data = Penguins) %>%
  gf_lm() %>%
  gf_smooth(se = FALSE)
```

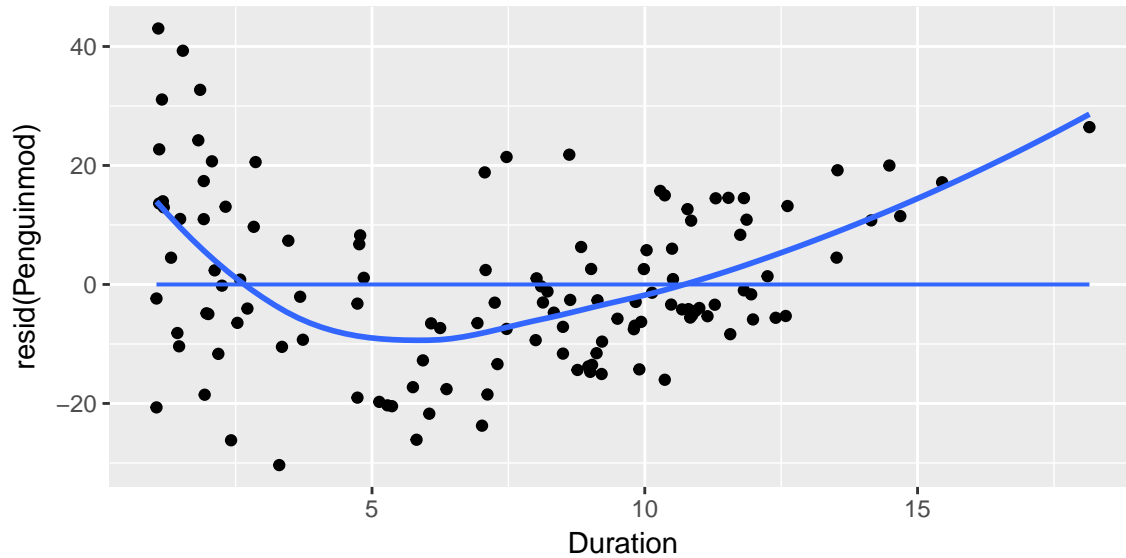


Figure 8.3 (page 221) displays the histogram of residuals for the cereal data from Chapter 7.

```
Cereals <- read_csv("http://nhorton.people.amherst.edu/sdm4/data/Cereals.csv")
Cerealmod <- lm(calories ~ sugars, data = Cereals)
gf_histogram(~ resid(Cerealmod), binwidth = 7.5)
```

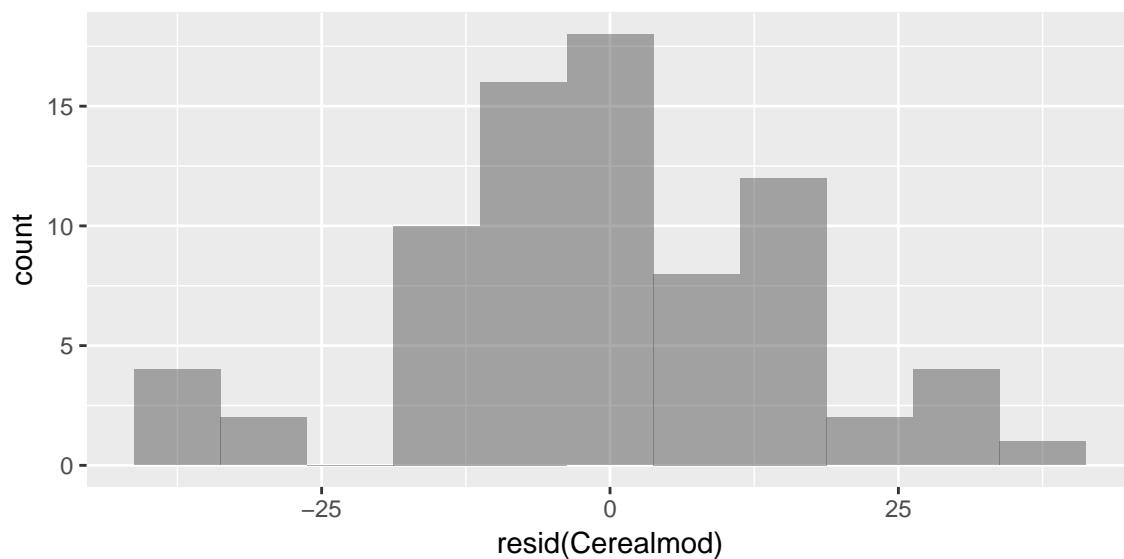
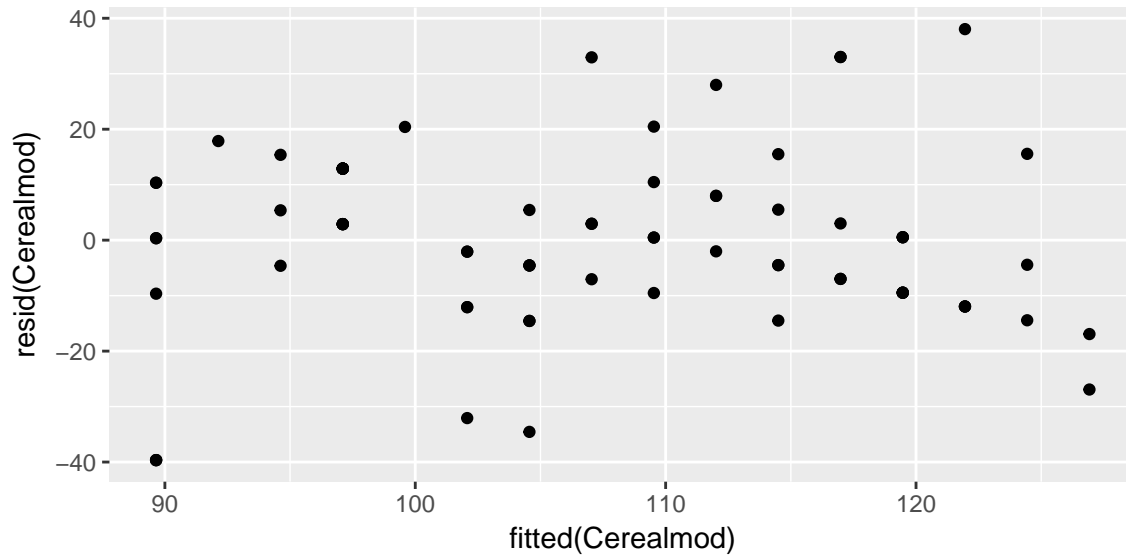


Figure 8.4 (page 221) displays a scatterplot of the residuals vs predicted values. Without jittering, the display has an odd pattern.

```
gf_point(resid(Cerealmod) ~ fitted(Cerealmod))
```



By adding some random noise we can more easily observe values that are shared by more than one cereal.

```
gf_point(jitter(resid(Cerealmod)) ~ jitter(fitted(Cerealmod)))
```

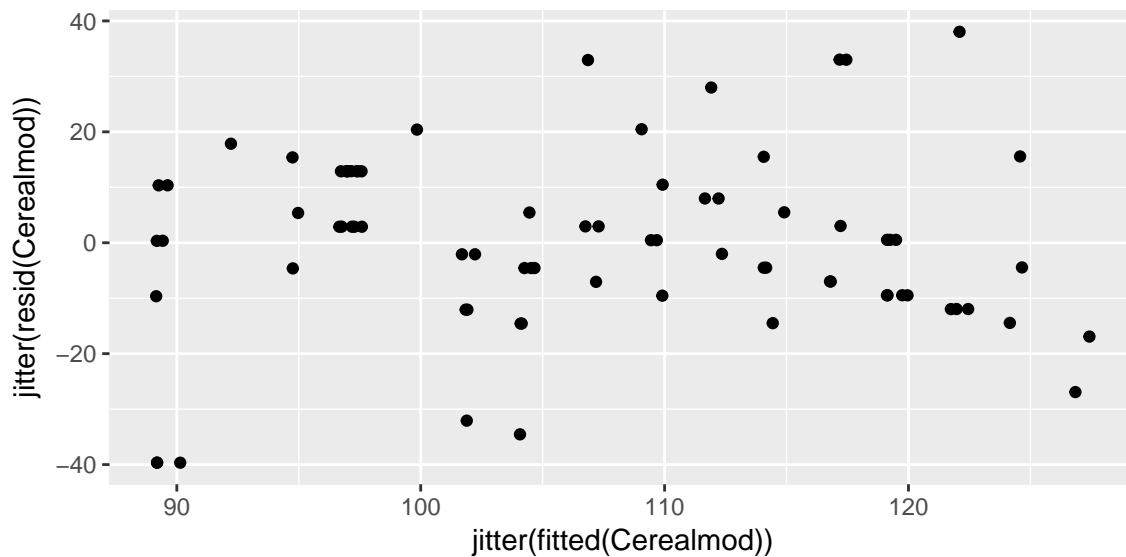


Figure 8.5 (page 222) displays the scatterplot stratified by what shelf it is displayed on at the store.

```
tally(~ shelf, data = Cereals)
```

```
## shelf
## 1 2 3
## 20 21 36
```

```
Cereals <- mutate(Cereals, shelfgrp =
  recode(shelf,
```

```

`1` = "bottomshelf",
`2` = "middleshelf",
`3` = "topshelf")
)
tally(~ shelfgrp, data = Cereals)

```

```

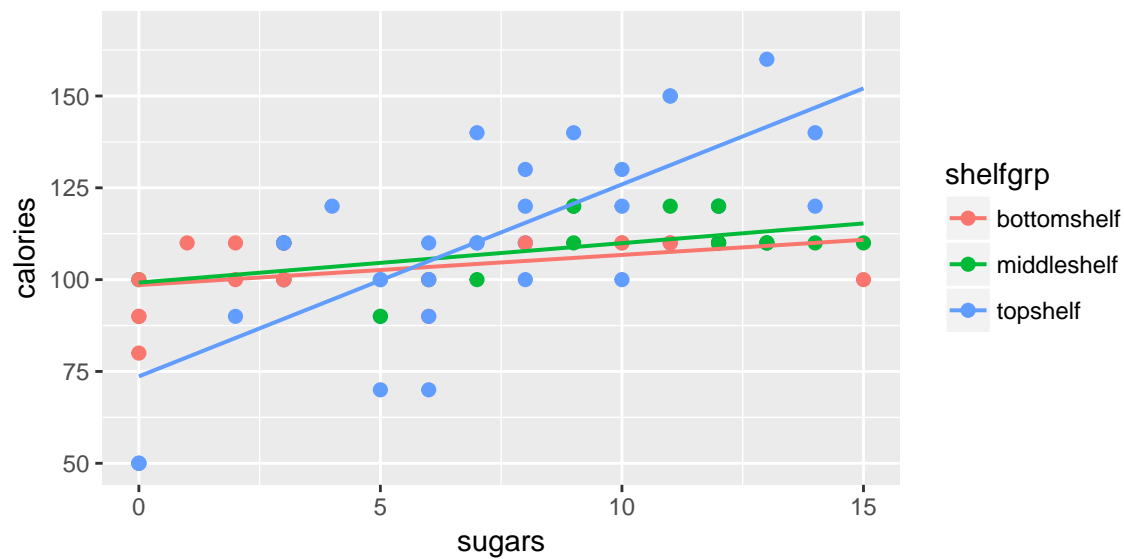
## shelfgrp
## bottomshelf middleshelf topshelf
##          20          21          36

```

```

gf_point(calories ~ sugars, color = ~ shelfgrp,
  lwd = 2, data = Cereals) %>%
  gf_lm()

```



Section 8.2: Extrapolation and reaching beyond the data

Section 8.3: Outliers, leverage, and influence

Section 8.4: Lurking variables and causation

Section 8.5: Working with summary values