

ants

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ants

reference:

- Cannon, et al., Stat2, chapter 07, example 7.16

Import the data.

```
data <- read.csv("SandwichAnts.csv", header=TRUE)
head(data)
```

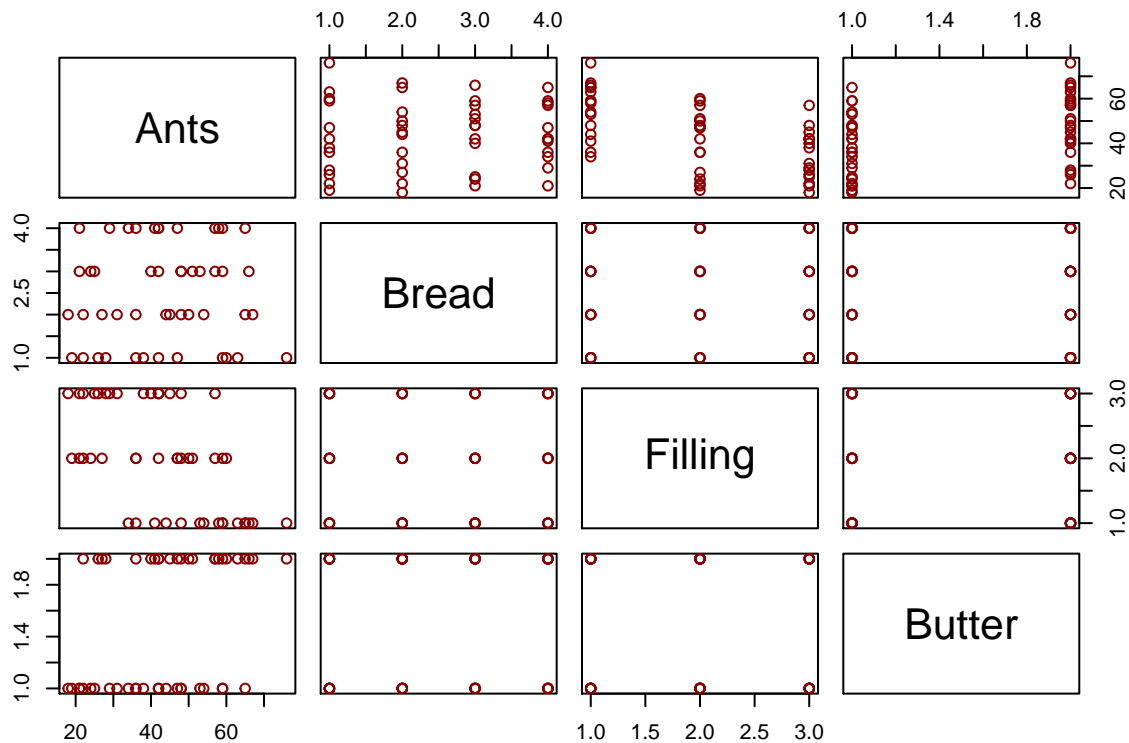
```
##   Trial   Bread   Filling Butter Ants
## 1     1 WholeWheat HamPickles   no   34
## 2     2 MultiGrain PeanutButter yes   47
## 3     3         Rye HamPickles   yes  67
## 4     4 MultiGrain HamPickles   yes  63
## 5     5 WholeWheat HamPickles   no   65
## 6     6 WholeWheat HamPickles   yes  58
```

```
dim(data)
```

```
## [1] 48  5
```

Scatterplot matrix.

```
pairs(~ Ants + Bread + Filling + Butter, data=data, col="darkred")
```



Ant statistics.

There is an R package called `plyr` written by [Hadley Wickham](#) for doing this sort of thing much more elegantly. The basic idea is to break up a data structure into pieces, apply a function to the pieces, and then reassemble the results. Hadley calls this the *split-apply-combine strategy*.

```
ants.vegemite <- with(data, data[Filling=="Vegemite", c(2, 5)])
ants.peanutbutter <- with(data, data[Filling=="PeanutButter", c(2, 5)])
ants.hampickles <- with(data, data[Filling=="HamPickles", c(2, 5)])
ants.vegemite <- with(ants.vegemite, tapply(Ants, Bread, mean))
ants.peanutbutter <- with(ants.peanutbutter, tapply(Ants, Bread, mean))
ants.hampickles <- with(ants.hampickles, tapply(Ants, Bread, mean))
ants.statistics <- rbind(ants.vegemite, ants.peanutbutter, ants.hampickles)
ants.statistics <- ants.statistics[, c(2, 4, 1, 3)]
rownames(ants.statistics) <- c("Vegemite", "PeanutButter", "HamPickles")
ants.statistics
```

```
##           Rye WholeWheat MultiGrain White
## Vegemite  29.00      37.25      33.5 38.75
## PeanutButter 40.25      46.00      37.0 38.25
## HamPickles  57.50      49.50      58.5 56.50
```

Add margins to ant statistics.

Compare with Table 7.2, p.365.

```
row.means <- apply(ants.statistics, 1, mean)
col.means <- apply(ants.statistics, 2, mean)
ants.table <- rbind(cbind(ants.statistics, row.means),
                  c(col.means, mean(row.means)))
colnames(ants.table)[5] <- "Row Mean"
rownames(ants.table)[4] <- "Column Mean"
ants.table
```

```
##           Rye WholeWheat MultiGrain White Row Mean
## Vegemite  29.00      37.25      33.5 38.75  34.625
## PeanutButter 40.25      46.00      37.0 38.25  40.375
## HamPickles  57.50      49.50      58.5 56.50  55.500
## Column Mean 42.25      44.25      43.0 44.50  43.500
```

Two-way ANOVA with interaction.

```
ants.aov <- aov(Ants ~ Filling*Bread, data=data)
options(show.signif.stars=FALSE)
summary(ants.aov)
```

```
##           Df Sum Sq Mean Sq F value  Pr(>F)
## Filling      2   3721  1860.3  10.386 0.000275
## Bread        3     40    13.5   0.075 0.972862
## Filling:Bread 6     577    96.2   0.537 0.776545
## Residuals   36   6448   179.1
```

Multiple regression with interaction.

```
ants.lm <- lm(Ants ~ Filling*Bread, data=data)
summary(ants.lm)
```

```
##
## Call:
## lm(formula = Ants ~ Filling * Bread, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -22.500  -8.875   1.125   9.312  23.000
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)         58.500     6.692   8.742 1.98e-10
## FillingPeanutButter -21.500     9.463  -2.272  0.0292
## FillingVegemite     -25.000     9.463  -2.642  0.0121
## BreadRye            -1.000     9.463  -0.106  0.9164
## BreadWhite          -2.000     9.463  -0.211  0.8338
## BreadWholeWheat    -9.000     9.463  -0.951  0.3479
## FillingPeanutButter:BreadRye  4.250    13.383   0.318  0.7527
## FillingVegemite:BreadRye    -3.500    13.383  -0.262  0.7952
## FillingPeanutButter:BreadWhite  3.250    13.383   0.243  0.8095
## FillingVegemite:BreadWhite    7.250    13.383   0.542  0.5913
## FillingPeanutButter:BreadWholeWheat 18.000    13.383   1.345  0.1870
## FillingVegemite:BreadWholeWheat 12.750    13.383   0.953  0.3471
##
## Residual standard error: 13.38 on 36 degrees of freedom
## Multiple R-squared:  0.4022, Adjusted R-squared:  0.2195
## F-statistic: 2.202 on 11 and 36 DF,  p-value: 0.0369
```

```
anova(ants.lm)
```

```
## Analysis of Variance Table
##
## Response: Ants
##           Df Sum Sq Mean Sq F value    Pr(>F)
## Filling      2 3720.5  1860.25  10.3860 0.0002748
## Bread        3   40.5    13.50   0.0754 0.9728619
## Filling:Bread  6   577.0    96.17   0.5369 0.7765447
## Residuals   36 6448.0   179.11
```

Main effects.

Which sandwiches attract the most ants? ... the least?

Have you ever tried vegemite on rye?

```
library(alr4)
plot(allEffects(ants.lm))
```

Filling*Bread effect plot

