Tooth Growth Analysis: Correlation with diet and Vitamin C

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Get the data and take a quick look at it

```
data(ToothGrowth)
```

```
## 'data.frame':    60 obs. of  3 variables:
##  $ len : num  4.2 11.5 7.3 5.8 6.4 10 11.2 11.2 5.2 7 ...
##  $ supp: Factor w/ 2 levels "OJ","VC": 2 2 2 2 2 2 2 2 2 2 ...
##  $ dose: num  0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 ...
```

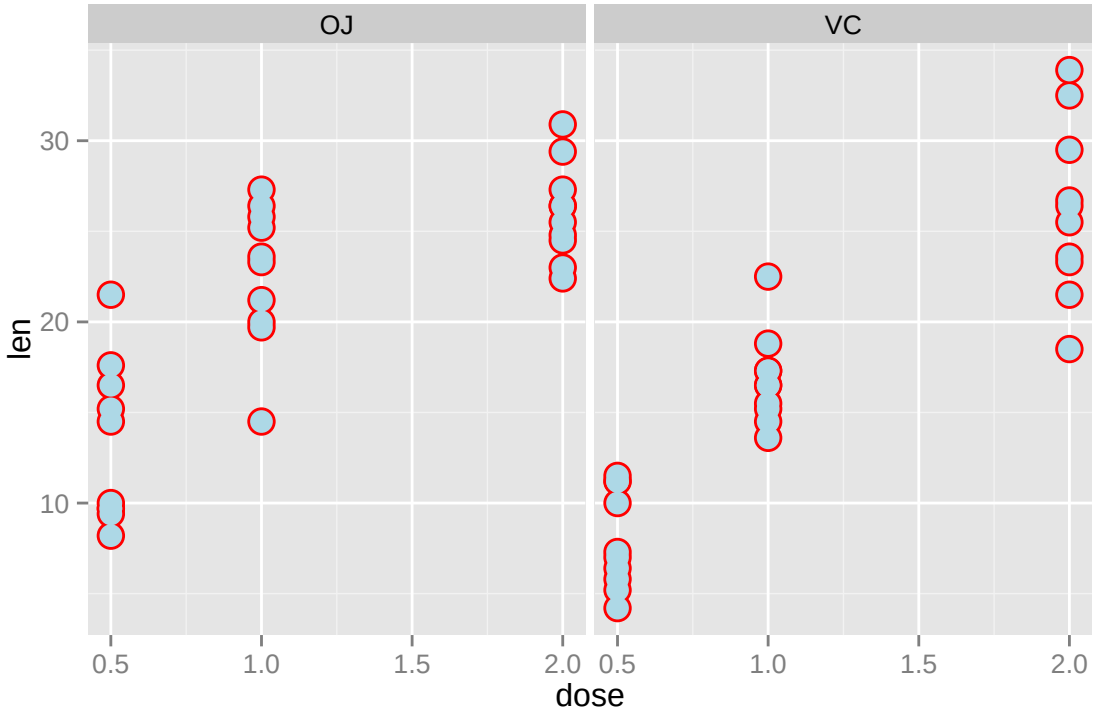
Exploratory Analysis

Here is a plot of the data showing behavior trends in tooth growth factored by supplement.

```
require(ggplot2)
```

```
## Loading required package: ggplot2
```

```
ggplot(ToothGrowth, aes(x=dose, y = len))+geom_point(size = 5, colour="red")+geom_point(size = 4, colou
```



A summary of the data:

```
##       len       supp         dose
##  Min.   : 4.2   OJ:30   Min.   :0.50
##  1st Qu.:13.1   VC:30   1st Qu.:0.50
##  Median :19.2           Median :1.00
##  Mean   :18.8           Mean   :1.17
##  3rd Qu.:25.3           3rd Qu.:2.00
##  Max.   :33.9           Max.   :2.00
```

shows the data appear to be well behaved (10 unpaired observations at each condition) and do not require cleaning for this anlaysis.

```
##    len supp dose
## 1  4.2   VC  0.5
## 2 11.5   VC  0.5
## 3  7.3   VC  0.5
## 4  5.8   VC  0.5
## 5  6.4   VC  0.5
```

Confidence Intervals

The first step is to look at the statistical significance of the shift in the data. I just pick some random pairs to test below.

To keep the analysis part clean, first split up the data by Supplement and Dose

```
##Group the data into individual sets with somewhat descriptive names (Supplement and Dose)
        ##Vitamin C set
        VC05<-ToothGrowth[1:10,]
        VC10<-ToothGrowth[11:20,]
        VC20<-ToothGrowth[21:30,]
        ##Ornage Juice Set
        OJ05<-ToothGrowth[31:40,]
        OJ10<-ToothGrowth[41:50,]
        OJ20<-ToothGrowth[51:60,]
```

Confidence Interval Analysis

Within Vitamin C Data

```
a<- t.test(VC10$len, VC05$len, paried=FALSE)
lcb<-a$conf.int[1]
ucb<-a$conf.int[2]
```

Dose0.5 to Dose1.0 The confidence interval differents between tooth length at these doses is 6.3143 to 11.2657 which does not contain 0.

Dose1.0 to Dose2.0 The confidence interval difference between tooth length at these doses is 5.6857 to 13.0543 which does not contain 0.

Within Orange Juice

```
a<- t.test(OJ10$len, OJ05$len, paried=FALSE)
lcb<-a$conf.int[1]
ucb<-a$conf.int[2]
```

Dose0.5 to Dose1.0 The confidence interval difference between tooth length at these doses is 5.5244 to 13.4156 which does not contain 0.

Orange Juice to Vitamin C

```
a<- t.test(OJ10$len, VC10$len, paried=FALSE)
lcb<-a$conf.int[1]
ucb<-a$conf.int[2]
```

Dose1.0 to Dose1.0 The confidence interval difference between tooth length from the Orange Juice and Vitamin C at doses of 1.0 is 2.8021 to 9.0579 which does not contain 0.

Conclusion In all the cases above the shifts in the mean, both with increasing dose and the comparison of Vitamin C to Orange Juice are significant.

Hypothesis Testing

Hypothesis to be tested.

Orange Juice at a dose of 1.0 is more effective (produces more tooth growth) than Vitamin C.

```
b<-t.test(OJ10$len, VC10$len, paired=FALSE)
```

Test at dose of 1.0. The anlaysis shows that forOJ10 and VC10 using the Welch Two Sample t-test the t-statistic is 15.3577 and the confidence interval is 2.8021 and 9.0579.

```
b<-t.test(OJ20$len, VC20$len, paired=FALSE)
```

Test at dose of 2.0 The anlaysis shows that forOJ20 and VC20 using the Welch Two Sample t-test the t-statistic is 14.0398 and the confidence interval is -3.7981 and 3.6381.

Conclusion

Assumptions