Graphing For ANOVA

ANOVA is an analysis of means, so on our graphs we should be plotting means. I'm going to demonstrate two kinds of graphs: boxplots and interaction plots.

We will use the Eysenck data. Instructions for downloading these data were on a previous handout.

```r
> boxplot(Recall~Instructions, data=EYS)
```

This is the basic format of the function to draw boxplots. I don't like it for two reasons. First, boxplots don't display means, so we will have to add the means. But it's also just a messy graph, with high scoring groups and low scoring groups all mixed up with each other. Also, the control group is in the midst of all this. It would be good to put the control group either first or last. I'm going to rearrange the boxplots by playing a little trick.

```r
> levels(EYS$Instructions)
[1] "Adjective" "Control" "Counting" "Imagery" "Rhyming"
```

If we don't tell it to do otherwise, R will arrange the levels of a factor in alphabetical order. Recall that we can tell R which group we want as the first level by using the relevel() command. But here we need a finesse. I want the Control group first, BUT I also want the Adjective and Imagery groups to be plotted next to each other and the Counting and Rhyming groups to be plotted next to each other. Why?

We can achieve a reasonable result like this by using the relevel() function twice. First, we'll move the Imagery group into the first position so it is next to Adjective. Then we'll move the Control group into the first position.

```r
> relevel(EYS$Instructions, ref="Imagery")  # output not shown
> EYS$Instructions = relevel(EYS$Instructions, ref="Control")
> levels(EYS$Instructions)
[1] "Control" "Imagery" "Adjective" "Counting" "Rhyming"
```

Excellent! Now we can draw the boxplots, and the groups should be arranged in that order on the horizontal axis.

```r
> boxplot(Recall~Instructions, data=EYS)
```

Progress! But we still haven't plotted the means. First, we need to get the means.

```r
> EYSmeans = tapply(EYS$Recall, EYS$Instructions, mean)
> EYSmeans
   Control Imagery Adjective Counting  Rhyming
     15.65    15.50     12.90      6.75      7.25
```
Now we can redraw the boxplots and plot the means as filled circles (big dots) inside the boxes.

```r
> boxplot(Recall~Instructions, data=EYS)
> points(x=1:5, y=EYSmeans, pch=16)
```

The points function cannot be executed until the boxplots have been drawn and are present in an open graphics window. 1:5 means "one through five." It is the x-coordinates of the points we are plotting. Use 1:(however many boxplots you have to plot means inside of). EYS means are the y-coordinates. Finally, we set point character (pch) equal to 16 to get a filled circle. This option can be set to any value between 1 and 20, in case you want to play a bit. (You will have to start from scratch if you want to change the point character. I.e., redraw the boxplots.) These dots will have to be explained in the caption to your graph, because they are not a standard part of boxplots.

What kind of effect have we just plotted?

The second kind of graph I want to show you is called an interaction plot or profile plot. I'll show you the basic command, and then I'll dress it up a little.

```r
> interaction.plot(x.factor=EYS$Instructions, trace.factor=EYS$Age, +   response=EYS$Recall)
```

Remember! The + sign is a continuation prompt. I broke the line (pressed Enter) after I completed the trace.factor option.

What kind of effect(s) does this show. Now let's make it pretty.

```r
> with(EYS, interaction.plot(Instructions, Age, Recall, legend=T, type="b", +   pch=c(1,16)))
```

Note: Next time you're in the psych dept. hallway, look at the posters that are on display to see various kinds of graphs that can be drawn to display ANOVA results.