Generating 3d Graphs in SPSS and R

Three-dimensional graphs are rarely used in practice except for didactic purposes. They are kind of cool though and especially helpful for visualizing the idea of the regression plane in a two-predictor multiple regression. Good luck visualizing a four-dimensional graph for three predictors, however! The 3d orientation of the plots for the various plotting methods below seems to vary considerably. I like the orientation used on the R `scatterplot3d` package the best.

**SPSS**

This plot was created in SPSS Version 24.

The **GGRAPH** command is used and there are a number of options for appearances that I did not employ. The order of the dimensions under the **GUIDE** statements is dimension 1 (x-width), dimension 2 (y-depth), and dimension 3 (z-height). The dependent variables is typically put on the vertical axis (z dimension). The name "graphdataset" appearing on the **NAME** keyword is an arbitrary name and it can be any name you choose. It names the data set read out and used in the later **SOURCE** command, so these two names must match exactly. Note that the Years Since PhD axis values are descending rather than ascending.

```plaintext
GGRAPH
/GRAPHDATASET NAME="graphdataset" VARIABLES=pubs time salary MISSING=LISTWISE REPORTMISSING=NO
/GRAPHSPEC SOURCE=INLINE.
BEGIN GPL
SOURCE: s=userSource(id("graphdataset"))
DATA: pubs=col(source(s), name("pubs"))
DATA: time=col(source(s), name("time"))
DATA: salary=col(source(s), name("salary"))
COORD: rect(dim(1,2,3))
GUIDE: axis(dim(1), label("Pubs"))
GUIDE: axis(dim(2), label("Years Since PhD"))
GUIDE: axis(dim(3), label("Salary"))
ELEMENT: point(position(pubs*time*salary))
ELEMENT: line(position(smooth.linear(pubs*time*salary)))
END GPL.
```

![3D Graph Example](image-url)
R

I found two ways to generate 3d scatterplots in R. The first uses the `scatterplot3d` package and is a more traditional looking 3-dimensional scatter plot with a regression plane. You can change colors and make other appearance modifications, including use of `type = "h"` that draws vertical lines under each point (which can help with visualizing the position of the points). A scatterplot is requested first and then the plane is added using values from the regression model using the `lm` function.

```r
library(scatterplot3d)

# order of variables in scatterplot3d function are x1 (width), x2 (depth), and y (height)
s3d <- scatterplot3d(mydata$PUBS, mydata$TIME, mydata$SALARY, type = "p", highlight.3d = TRUE, pch = 20)

# Add regression plane
mod <- lm(SALARY ~ PUBS + TIME, data=mydata)
s3d$plane3d(mod, draw_polygon = TRUE, draw_lines = TRUE)
```

The second method is available within the `car` package using the `scatter3d` function. You do not need to run a separate regression model using the `lm` function first. `id.n=3` labels the ID for three most extreme points and is not necessary.

```r
library(car)
library(rgl)
scatter3d(SALARY ~ PUBS + TIME, id.n=3, data=mydata)
```