

Problem Set #4

Experiment Design: Alex & Daniel

```
# load packages
library(foreign)
library(data.table)
library(ggplot2)
library(RColorBrewer)
library(lmtest)
library(sandwich)
library(multiwayvcov)
library(AER)
```

5. Tetris FTW?

A doctoral student conducted an experiment in which she randomly varied whether she ran or walked 40 minutes each morning. In the middle of the afternoon over a period of 26 days she measured the following outcome variables: (1) her weight; (2) her score in Tetris; (3) her mood on a 0-5 scale; (4) her energy; and (5) whether she got a question right on the math GRE.

```
d = data.table(read.dta("./data/Hough_WorkingPaper_2010.dta"))
d = d[!is.na(tetris),]
head(d)
```

##	day	run	weight	tetris	mood	energy	appetite	gre
## 1:	1	1	21	11092	3	3	0	1
## 2:	2	1	21	14745	3	1	2	0
## 3:	3	0	20	11558	3	3	0	1
## 4:	4	0	21	11747	3	1	1	1
## 5:	5	0	21	14319	2	3	3	1
## 6:	6	1	19	7126	3	2	0	1

- a. Suppose you were seeking to estimate the average effect of running on her Tetris score. Explain the assumptions needed to identify this causal effect based on this within-subjects design. Are these assumptions plausible in this case? What special concerns arise due to the fact that the subject was conducting the study, undergoing the treatments, and measuring her own outcomes?

The two assumptions on no-anticipation and no-persistence. The former is very plausible, especially if she assigns whether she runs on a particular day after she plays Tetris on the previous day. The latter is probably satisfied as well. Unless she is going on extremely long runs or gets injured, it is unlikely any effects on her Tetris playing persists to the next day. The fact that that she is performing the study on herself could only be problematic if she is hoping for some specific effect, e.g. if she hopes that running makes her a better Tetris player, she might try harder on days that she runs.

- b. Estimate the effect of running today on Tetris score. What is the ATE?

```
m = d[, lm(tetris ~ run)]
(co = coeftest(m))
```

```
##
## t test of coefficients:
##
##           Estimate Std. Error t value Pr(>|t|)
```

```
## (Intercept) 12806.4      3708.5  3.4532 0.002264 **
## run         13613.1      4855.6  2.8036 0.010351 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

The estimated effect is 13613.1