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BACS HW (Week 7)

1.

i. Would this scenario create systematic or random error (or both or neither)?
ii. Which part of the t-statistic (diff, sd, n, alpha) would be affected?
iii. Will it increase or decrease our *power* to reject the null hypothesis?
iv. Which kind of error (Type I or Type II) becomes more likely because of this scenario?

a) You discover that your colleague wanted to target the general population of Taiwanese users of the product. However, he only collected data from a pool of young consumers, and missed many older customers who you suspect might use the product much less every day.

i. Systematic error, the error (bias) from sampling is predictable in some level.
ii. Difference, the observed mean usage time x_i will expected to be higher.
iii. Increase.
iv. Type I error since it's more likely to mistakenly reject H_{null}.

b) You find that 20 of the respondents are reporting data from the wrong wearable device, so they should be removed from the data. These 20 people are just like the others in every other respect.

i. Systematic error, the error from sampling is predictable in some level.
ii. The number of sample.
iii. Decrease.
iv. Type II error since it's more likely to mistakenly accept H_{null}.

c) A very annoying professor visiting your company has criticized your colleague's "95% confidence" criteria, and has suggested relaxing it to just 90%.

i. Neither, setting of confidence criteria is not error.
ii. Alpha.
iii. Increase.
iv. Type I error since it's more likely to mistakenly reject H_{null}.

d) Your colleague has measured usage times between on five weekdays and taken a daily average. But you feel this will underreport usage for younger people who are very active on weekends, whereas it over-reports usage of older users.

i. Systematic error, the error (bias) from sampling is predictable in some level.
ii. Standard deviation, as the younger is underreported, and elder is over-reported.
iii. Decrease.
iv. Type II error since it's more likely to mistakenly accept H_{null}.

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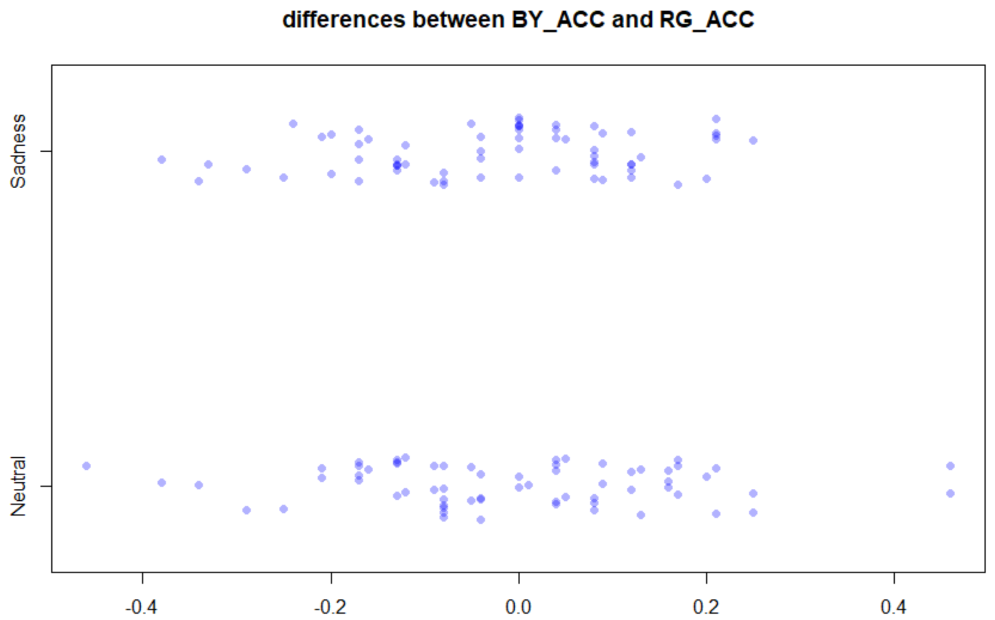
2.

```
> experiment <- read.csv('study2Data.csv', header=TRUE)
> BY_data <- with(experiment, data.frame(Subject, Axis='BY', Emotion_Condition, 
ACC=BY_ACC, SAD_ESRI))
> RG_data <- with(experiment, data.frame(Subject, Axis='RG', Emotion_Condition, 
ACC=RG_ACC, SAD_ESRI))
> RG<-RG_data$ACC
> BY<-BY_data$ACC
```

a) Visualize the differences between blue-yellow accuracy (BY_ACC) and red-green accuracy (RG_ACC) for both the sad and neutral viewers (Emotion_Condition)

```
> stripchart((BY-RG)~factor(experiment$Emotion_Condition), vertical=FALSE, metho
d="jitter", pch=16, col=rgb(0,0,1,0.3), main='differences between BY_ACC and RG_
ACC')
```



b) Run a t-test (*traditional*) to check if there is a significant difference in blue-yellow accuracy between sad and neutral participants at 95% confidence.

```
> t.test(BY_data$ACC~factor(BY_data$Emotion_Condition))
        Welch Two Sample t-test

data:  BY_data$ACC by factor(BY_data$Emotion_Condition)
t = 2.0435, df = 125.606, p-value = 0.04309
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.001384159 0.086308149
sample estimates:
mean in group Neutral mean in group Sadness 
            0.6129231             0.5690769 
```

c) Run a t-test (*traditional*) to check if there is a significant difference in red-green accuracy between sad and neutral participants at 95% confidence.

```
> t.test(RG_data$ACC~factor(RG_data$Emotion_Condition))
       Welch Two Sample t-test

data:  RG_data$ACC by factor(RG_data$Emotion_Condition)
t = 0.8749, df = 121.976, p-value = 0.3833
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.03263405  0.08432635
sample estimates:
mean in group Neutral mean in group Sadness
            0.6203077             0.5944615
```

d) Since the result of t-test of red-green accuracy is not significant, we cannot claim that there is an interaction between emotion and color axis

e) Run a factorial design ANOVA where color perception accuracy is determined by emotion (sad vs. neutral), color-axis (RG vs. BY), and the interaction of emotion and color-axis.

```
> all_data <- rbind(BY_data, RG_data)[2:4]
> summary(aov(formula = ACC ~ Axis + Emotion_Condition + Axis:Emotion_Conditi
on, data=all_data))
                        Df Sum Sq Mean Sq F value Pr(>F)
Axis                     1  0.017 0.01745   0.806 0.3703
Emotion_Condition        1  0.079 0.07893   3.644 0.0574 .
Axis:Emotion_Condition   1  0.005 0.00526   0.243 0.6224
Residuals              256  5.545 0.02166
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```