

Cyber_Perceptions_Survey_Proj

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11/13/2020

Clean Data for Analysis

```
anon_data <- read.csv(here("anon_data.csv"), sep=",")

# Clean Column Names
names(anon_data) <- gsub("\\.", "", names(anon_data))

# Remove Incomplete Data
anon_data <- filter(anon_data, Progress == 100)
names(anon_data)
```

```
## [1] "X" "Progress" "Durationinseconds"
## [4] "Finished" "ResponseId" "DistributionChannel"
## [7] "UserLanguage" "Q1" "X1Q1"
## [10] "X1Q2" "X1Q3" "X1Q4"
## [13] "X2Q1" "X2Q2" "X2Q3"
## [16] "X2Q4" "X3Q1" "X3Q2"
## [19] "X3Q3" "X3Q4" "X4Q1"
## [22] "X4Q2" "X4Q3" "X4Q4"
## [25] "X5Q1" "X5Q2" "X5Q3"
## [28] "X5Q4" "Q11" "Q12"
## [31] "Q14" "Q24" "Q13"
## [34] "Q25" "Q26" "Q29_1"
## [37] "Q30" "Q31" "Q32"
## [40] "Q34" "Q35" "Q36"
## [43] "Q17" "Q19" "Q20"
## [46] "Q6" "Q7" "Q8"
## [49] "Q9" "TimeLag1" "AttributionConfidence1"
## [52] "DamageAssessment1" "Hacktype1" "Persistence1"
## [55] "TimeLag2" "AttributionConfidence2" "DamageAssessment2"
## [58] "Hacktype2" "Persistence2" "TimeLag3"
## [61] "AttributionConfidence3" "DamageAssessment3" "Hacktype3"
## [64] "Persistence3" "TimeLag4" "AttributionConfidence4"
## [67] "DamageAssessment4" "Hacktype4" "Persistence4"
## [70] "TimeLag5" "AttributionConfidence5" "DamageAssessment5"
## [73] "Hacktype5" "Persistence5"
```

```
# Breakout Data
Userdata <- subset(anon_data[,1:which(colnames(anon_data)=="UserLanguage")])
Questions <- subset(anon_data[,which(colnames(anon_data)=="Q1"):which(colnames(anon_data)=="X5Q4")])
Controls <- subset(anon_data[,which(colnames(anon_data)=="Q11"):which(colnames(anon_data)=="Q9")])
Scenario <- subset(anon_data[,which(colnames(anon_data)=="TimeLag1" ):NCOL(anon_data)])
```

```

#Fix Userdata
NewUserData <- rbind(Userdata,Userdata,Userdata,Userdata,Userdata)

#Fix Questions
Questions1 <- Questions[,c("X1Q1","X1Q2","X1Q3","X1Q4")]
Questions2 <- Questions[,c("X2Q1","X2Q2","X2Q3","X2Q4")]
Questions3 <- Questions[,c("X3Q1","X3Q2","X3Q3","X3Q4")]
Questions4 <- Questions[,c("X4Q1","X4Q2","X4Q3","X4Q4")]
Questions5 <- Questions[,c("X5Q1","X5Q2","X5Q3","X5Q4")]

Questions1$ID <- 1
Questions2$ID <- 2
Questions3$ID <- 3
Questions4$ID <- 4
Questions5$ID <- 5

dfs <- c("Questions1", "Questions2", "Questions3", "Questions4", "Questions5")
for(df in dfs)
  assign(df, setNames(get(df), c("AttackDef","AssessConf","Response","Norm", "ID"))))

NewQuestions <- rbind(Questions1,Questions2,Questions3,Questions4,Questions5)

cols <- c("AttackDef","AssessConf","Response","Norm", "ID")
NewQuestions[cols] <- lapply(NewQuestions[cols], factor)

```

Fix Controls

```

Controls$KQ1 <- if_else((Controls$Q11 ==TRUE),0,1)
Controls$KQ2 <- if_else((Controls$Q12 ==TRUE),0,1)
Controls$KQ3 <- if_else((Controls$Q14 ==TRUE),1,0)
Controls$KQ4 <- if_else((Controls$Q24 ==TRUE),0,1)
Controls$KQ5 <- if_else((Controls$Q13 ==TRUE),1,0)
Controls$KQ6 <- if_else((Controls$Q25 == "Secure"),1,0)
Controls$KQ7 <- if_else((Controls$Q26 == "True"),1,0)

Controls$KSUM <- (rowSums(Controls[,c("KQ1","KQ2","KQ3","KQ4","KQ5","KQ6","KQ7"))]/7)

Controls$R1 <- Controls$Q29_1
Controls$R1 <- (Controls$R1 / 7)

prob <- c("Definitely take my winnings "=1,"Probably take my winnings "=2,"Not sure "=3,"Probably continue
Controls$R2 <- prob[Controls$Q30]

likert <- c("Strongly agree "=5,"Somewhat agree "=4,"Neither agree nor disagree "=3,"Somewhat disagree "=2,
Controls$R3 <- likert[Controls$Q31]
Controls$R4 <- likert[Controls$Q32]
Controls$R5 <- likert[Controls$Q34]
Controls$R6 <- likert[Controls$Q35]
easy <- c("Extremely difficult "=1,"Somewhat difficult "=2,"Neither easy nor difficult "=3,"Somewhat easy"
Controls$R7 <- easy[Controls$Q36]

```

```

Controls$RSUM <- (rowSums(Controls[,c("R2","R3","R4","R5","R6","R7")))/30)
Controls$RSUMED <- (rowSums(Controls[,c("R1","RSUM")))/2)

Controls$M1 <- if_else((Controls$Q17 == "Yes"),1,0)
Controls$M2 <- if_else((Controls$Q19 == "Yes"),1,0)
Controls$M3 <- if_else((Controls$Q20 == "Yes"),1,0)

Controls$MSUM <- (rowSums(Controls[,c("M1","M2","M3")))/3)

CleanControls <- subset(Controls[,c("Q6","Q7","Q8","KSUM","RSUMED","MSUM")])

American_list <- c("American (American)","American (Caucasian)","American citizen","USA (Caucasian)","A
                "american","U.S.A.","United states","usa","U.S.")
cut_America<- paste0("\\b(", paste0(American_list, collapse="|"), "\\b)")

CleanControls$Q8 <- gsub(cut_America, "American", CleanControls$Q8)

cols <- c("Q6","Q7","Q8")
CleanControls[cols] <- lapply(CleanControls[cols], factor)

summary(CleanControls)

##      Q6                                     Q7
## No : 7      4 year degree                      :45
## Yes:69      4 year degree,Professional degree    : 4
##              Doctorate                          : 2
##              Professional degree                  :24
##              Some college,4 year degree,Professional degree: 1
##
##
##              Q8              KSUM              RSUMED              MSUM
## American          :51      Min.    :0.2857      Min.    :0.2595      Min.    :0.0000
## Indian            : 4      1st Qu.:0.5714      1st Qu.:0.5357      1st Qu.:0.0000
## American (American) : 1      Median :0.7143      Median :0.6452      Median :0.3333
## American (Caucasian): 1      Mean    :0.6692      Mean    :0.6280      Mean    :0.3772
## Asian              : 1      3rd Qu.:0.7143      3rd Qu.:0.7250      3rd Qu.:0.6667
## (Other)            :16      Max.    :0.8571      Max.    :0.9000      Max.    :1.0000
## NA's               : 2

NewControls <- rbind(CleanControls,CleanControls,CleanControls,CleanControls,CleanControls)

```

Fix Scores

```

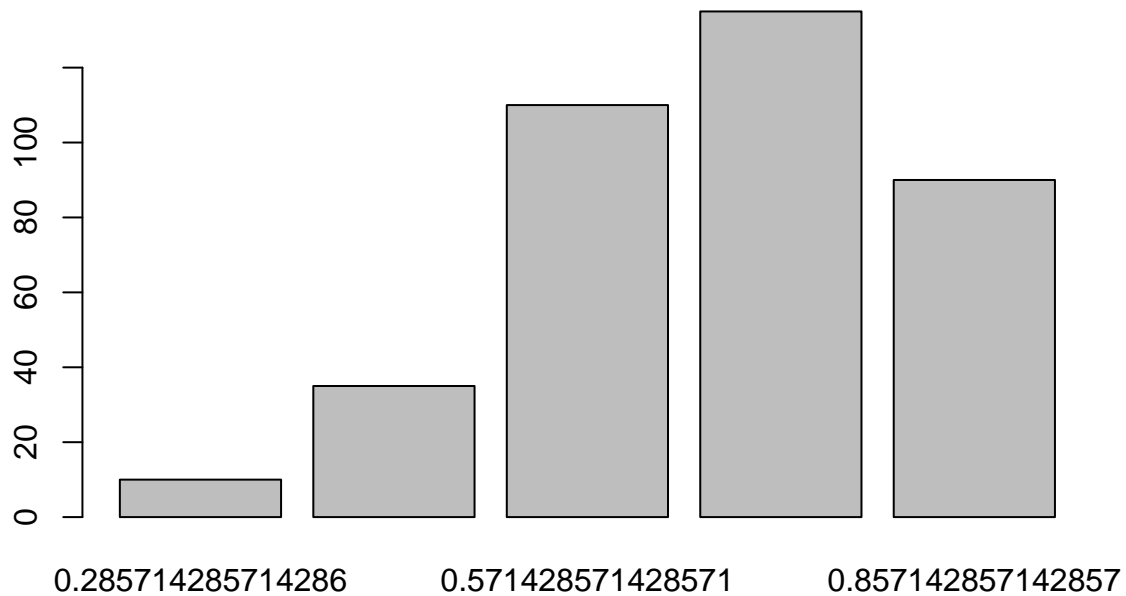
# Score Stacking
Scenario1 <- Scenario[,c("TimeLag1","AttributionConfidence1","DamageAssessment1","Hacktype1","Persistence1")]
Scenario2 <- Scenario[,c("TimeLag2","AttributionConfidence2","DamageAssessment2","Hacktype2","Persistence2")]
Scenario3 <- Scenario[,c("TimeLag3","AttributionConfidence3","DamageAssessment3","Hacktype3","Persistence3")]
Scenario4 <- Scenario[,c("TimeLag4","AttributionConfidence4","DamageAssessment4","Hacktype4","Persistence4")]
Scenario5 <- Scenario[,c("TimeLag5","AttributionConfidence5","DamageAssessment5",
                        "Hacktype5","Persistence5")]

```



```
##           10           35           110           135
## 0.857142857142857
##           90
```

```
barplot(table(stacked_data$KSUM))
```



```
nrow(stacked_data[stacked_data$KSUM > .5, ])/385 # drops 11.7% of participants
```

```
## [1] 0.8701299
```

```
nrow(stacked_data[stacked_data$KSUM > .6, ])/385 # drops 41.6% of participants
```

```
## [1] 0.5844156
```

```
# stacked_data <- stacked_data[stacked_data$KSUM > .5714, ]
nrow(stacked_data)
```

```
## [1] 380
```

Creating a communicativity variable

```
summary(stacked_data$communicativity)
```

```
## Length Class Mode
##      0  NULL  NULL
```

```

table(stacked_data$communicativity)

## < table of extent 0 >
stacked_data$AssessConf <- as.character(stacked_data$AssessConf)

stacked_data$AttackDefNeg <- if_else((stacked_data$AttackDef == "Sylvania is signaling their opposition t

class(stacked_data$'AttackDefNo')

## [1] "NULL"
class(stacked_data$'ResponseId')

## [1] "character"
likert2 <- c("extremely unconfident"=1,"not very confident"=2,"somewhat confident"=3,"very confident"=4)
stacked_data$AssessConfNo <- likert2[stacked_data$AssessConf]

stacked_data$AttackDefNo <- if_else((stacked_data$AttackDef == "Sylvania is signaling their opposition t
stacked_data$AttackDefNo <- as.numeric(stacked_data$AttackDefNo)

stacked_data$communicativity <- if_else(stacked_data$AttackDefNo == 2,abs(stacked_data$AssessConfNo-6),
stacked_data$communicativity <- as.numeric(stacked_data$communicativity)

```

Date Reducation to Creat Cross Correlation Matrix

```

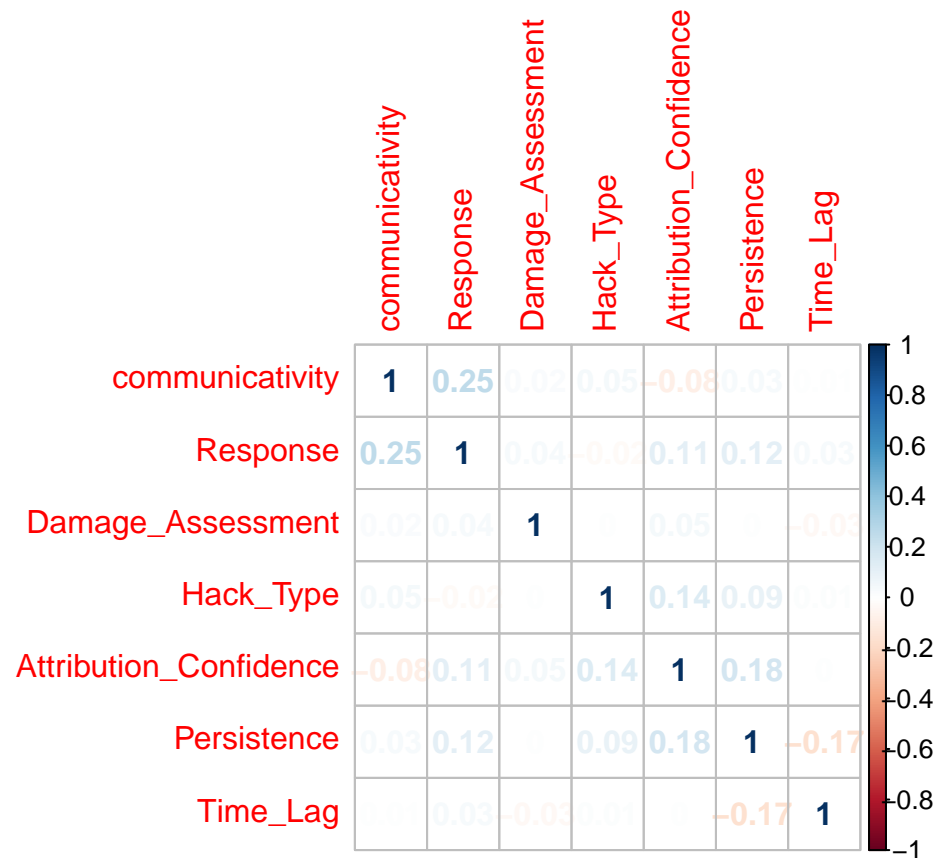
#Removing ID variable

data1 <- subset(stacked_data, select = c("communicativity", "Response", "Damage_Assessment", "Hack_Type", "

data1$Damage_Assessment <- as.numeric(data1$Damage_Assessment)
data1$Hack_Type <- as.numeric(data1$Hack_Type)
data1$Attribution_Confidence <- as.numeric(data1$Attribution_Confidence)
data1$Persistence <- as.numeric(data1$Persistence)
data1$Time_Lag <- as.numeric(data1$Time_Lag)
data1$Response <- as.numeric(data1$Response)

datamatrix<-cor(data1)
corrplot(datamatrix, method="number")

```



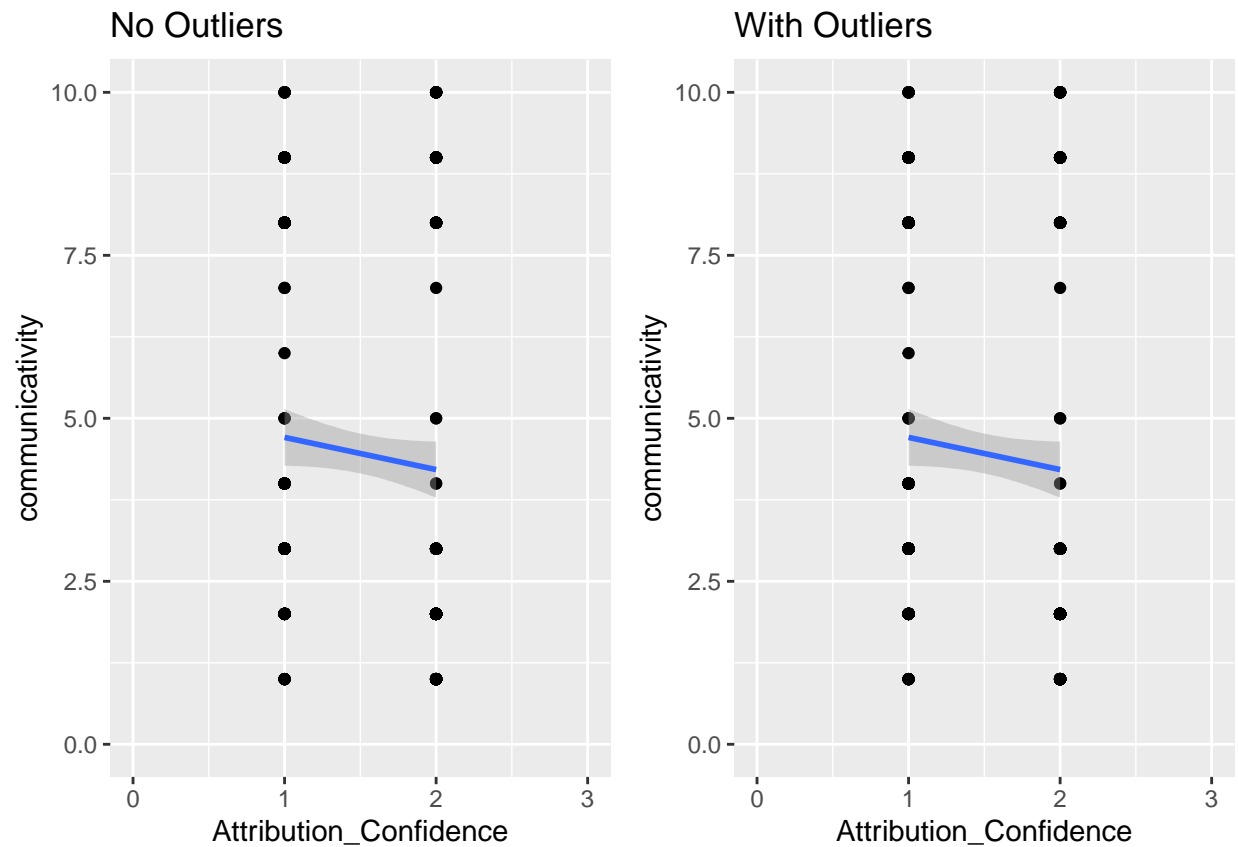
Plotting Outliers

```
# Plot of data with outliers.

plot1 <- ggplot(data = data1, aes(x = Attribution_Confidence, y = communicativity)) +
  geom_point() +
  geom_smooth(method = lm) +
  xlim(0, 3) + ylim(0, 10) +
  ggtitle("No Outliers")
plot2 <- ggplot(data = data1, aes(x = Attribution_Confidence, y = communicativity)) +
  geom_point() +
  geom_smooth(method = lm) +
  xlim(0, 3) + ylim(0, 10) +
  ggtitle("With Outliers")

gridExtra::grid.arrange(plot1, plot2, ncol=2)

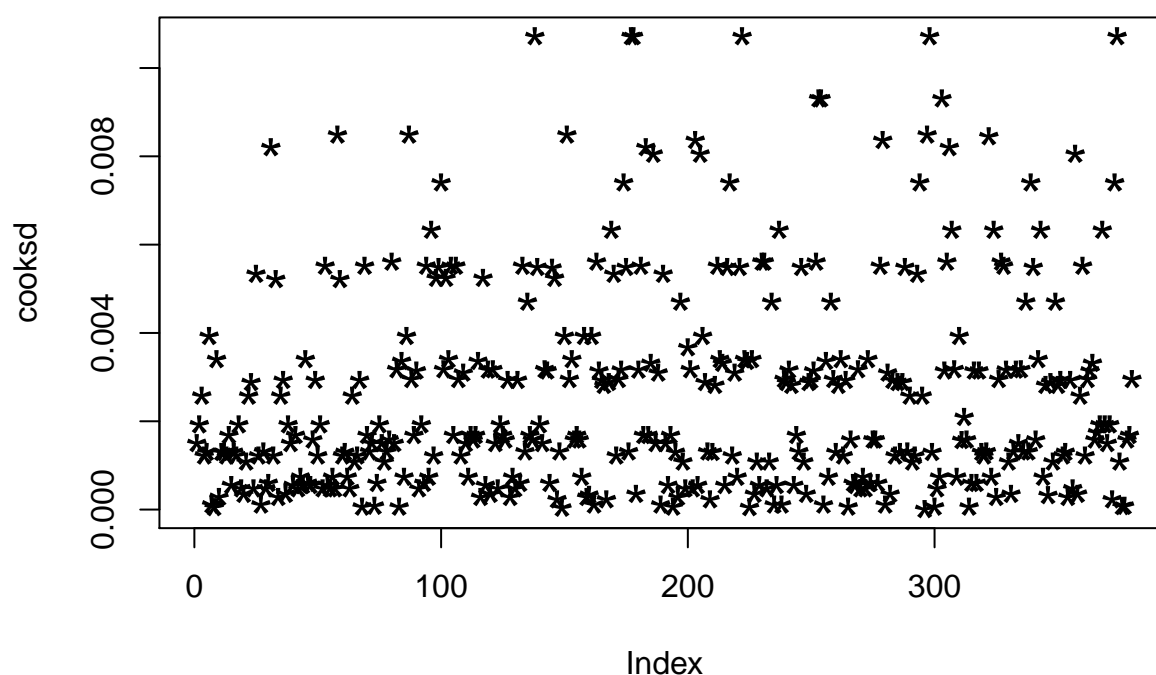
## `geom_smooth()` using formula 'y ~ x'
## `geom_smooth()` using formula 'y ~ x'
```



```
mod <- lm(communicativity ~ Damage_Assessment + Hack_Type + Attribution_Confidence, data=stacked_data)
cooks_d <- cooks.distance(mod)

sample_size <- nrow(stacked_data)
plot(cooks_d, pch="*", cex=2, main="Influential Obs by Cooks distance") # plot cook's distance
```


Influential Obs by Cooks distance



Hypothesis 1: Without interaction effects

Hypothesis

```
logitregH1 <- glm(formula = communicativity ~ Damage_Assessment + Hack_Type + Attribution_Confidence, data = stacked_data)
summary(logitregH1)
```

```
##
## Call:
## glm(formula = communicativity ~ Damage_Assessment + Hack_Type +
##      Attribution_Confidence, data = stacked_data)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -3.995  -2.292  -1.442   3.410   5.926
##
## Coefficients:
##              Estimate Std. Error
## (Intercept)         4.4779     0.2994
## Damage_Assessment500 Million         0.1494     0.3105
## Hack_Typewhere valuable confidential information is stolen         0.3677     0.3132
## Attribution_Confidence90%        -0.5532     0.3135
##
## t value Pr(>|t|)
## (Intercept)        14.954  <2e-16 ***
```

```

## Damage_Assessment500 Million                0.481    0.6307
## Hack_Typewhere valuable confidential information is stolen    1.174    0.2412
## Attribution_Confidence90%                -1.764    0.0785 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 9.129062)
##
##      Null deviance: 3470.3  on 379  degrees of freedom
## Residual deviance: 3432.5  on 376  degrees of freedom
## AIC: 1924.7
##
## Number of Fisher Scoring iterations: 2
#Type a message

logitregH1b <- glm(formula = communicativity ~ Damage_Assessment * Hack_Type * Attribution_Confidence,
summary(logitregH1b)

##
## Call:
## glm(formula = communicativity ~ Damage_Assessment * Hack_Type *
##      Attribution_Confidence, data = stacked_data)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -4.000  -2.456  -1.456   3.346   6.027
##
## Coefficients:
##
## (Intercept)
## Damage_Assessment500 Million
## Hack_Typewhere valuable confidential information is stolen
## Attribution_Confidence90%
## Damage_Assessment500 Million:Hack_Typewhere valuable confidential information is stolen
## Damage_Assessment500 Million:Attribution_Confidence90%
## Hack_Typewhere valuable confidential information is stolen:Attribution_Confidence90%
## Damage_Assessment500 Million:Hack_Typewhere valuable confidential information is stolen:Attribution_
##
## (Intercept)
## Damage_Assessment500 Million
## Hack_Typewhere valuable confidential information is stolen
## Attribution_Confidence90%
## Damage_Assessment500 Million:Hack_Typewhere valuable confidential information is stolen
## Damage_Assessment500 Million:Attribution_Confidence90%
## Hack_Typewhere valuable confidential information is stolen:Attribution_Confidence90%
## Damage_Assessment500 Million:Hack_Typewhere valuable confidential information is stolen:Attribution_
##
## (Intercept)
## Damage_Assessment500 Million
## Hack_Typewhere valuable confidential information is stolen
## Attribution_Confidence90%
## Damage_Assessment500 Million:Hack_Typewhere valuable confidential information is stolen
## Damage_Assessment500 Million:Attribution_Confidence90%
## Hack_Typewhere valuable confidential information is stolen:Attribution_Confidence90%

```

```

## Damage_Assessment500 Million:Hack_Typewhere valuable confidential information is stolen:Attribution_
##
## (Intercept)
## Damage_Assessment500 Million
## Hack_Typewhere valuable confidential information is stolen
## Attribution_Confidence90%
## Damage_Assessment500 Million:Hack_Typewhere valuable confidential information is stolen
## Damage_Assessment500 Million:Attribution_Confidence90%
## Hack_Typewhere valuable confidential information is stolen:Attribution_Confidence90%
## Damage_Assessment500 Million:Hack_Typewhere valuable confidential information is stolen:Attribution_
##
## (Intercept)
## Damage_Assessment500 Million
## Hack_Typewhere valuable confidential information is stolen
## Attribution_Confidence90%
## Damage_Assessment500 Million:Hack_Typewhere valuable confidential information is stolen
## Damage_Assessment500 Million:Attribution_Confidence90%
## Hack_Typewhere valuable confidential information is stolen:Attribution_Confidence90%
## Damage_Assessment500 Million:Hack_Typewhere valuable confidential information is stolen:Attribution_
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 9.059024)
##
##      Null deviance: 3470.3  on 379  degrees of freedom
## Residual deviance: 3370.0  on 372  degrees of freedom
## AIC: 1925.7
##
## Number of Fisher Scoring iterations: 2
logitregH1c <- glm(formula = communicativity ~ Damage_Assessment + Hack_Type + Attribution_Confidence +
summary(logitregH1c)

##
## Call:
## glm(formula = communicativity ~ Damage_Assessment + Hack_Type +
##      Attribution_Confidence + Persistence, data = stacked_data)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -4.141  -2.281  -1.391   3.360   6.068
##
## Coefficients:
##
## (Intercept)
## Damage_Assessment500 Million
## Hack_Typewhere valuable confidential information is stolen
## Attribution_Confidence90%
## PersistenceSylvania has been engaging in ongoing low-impact tactical cyber operations against Freedom
##
## (Intercept)
## Damage_Assessment500 Million
## Hack_Typewhere valuable confidential information is stolen
## Attribution_Confidence90%
## PersistenceSylvania has been engaging in ongoing low-impact tactical cyber operations against Freedom

```

```

##
## (Intercept)
## Damage_Assessment500 Million
## Hack_Typewhere valuable confidential information is stolen
## Attribution_Confidence90%
## PersistenceSylvania has been engaging in ongoing low-impact tactical cyber operations against Freedom
##
## (Intercept)
## Damage_Assessment500 Million
## Hack_Typewhere valuable confidential information is stolen
## Attribution_Confidence90%
## PersistenceSylvania has been engaging in ongoing low-impact tactical cyber operations against Freedom
##
## (Intercept)
## Damage_Assessment500 Million
## Hack_Typewhere valuable confidential information is stolen
## Attribution_Confidence90%
## PersistenceSylvania has been engaging in ongoing low-impact tactical cyber operations against Freedom
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 9.136819)
##
##      Null deviance: 3470.3  on 379  degrees of freedom
## Residual deviance: 3426.3  on 375  degrees of freedom
## AIC: 1926
##
## Number of Fisher Scoring iterations: 2
logitregH1d <- glm(formula = communicativity ~ Damage_Assessment + Hack_Type + Attribution_Confidence +
summary(logitregH1d)

##
## Call:
## glm(formula = communicativity ~ Damage_Assessment + Hack_Type +
##      Attribution_Confidence + Persistence + KSUM + RSUMED + MSUM,
##      data = stacked_data)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -4.078  -2.284  -1.425   3.393   6.087
##
## Coefficients:
##
## (Intercept)
## Damage_Assessment500 Million
## Hack_Typewhere valuable confidential information is stolen
## Attribution_Confidence90%
## PersistenceSylvania has been engaging in ongoing low-impact tactical cyber operations against Freedom
## KSUM
## RSUMED
## MSUM
##
## (Intercept)
## Damage_Assessment500 Million

```

```

## Hack_Typewhere valuable confidential information is stolen
## Attribution_Confidence90%
## PersistenceSylvania has been engaging in ongoing low-impact tactical cyber operations against Freedom
## KSUM
## RSUMED
## MSUM
##
## (Intercept)
## Damage_Assessment500 Million
## Hack_Typewhere valuable confidential information is stolen
## Attribution_Confidence90%
## PersistenceSylvania has been engaging in ongoing low-impact tactical cyber operations against Freedom
## KSUM
## RSUMED
## MSUM
##
## (Intercept)
## Damage_Assessment500 Million
## Hack_Typewhere valuable confidential information is stolen
## Attribution_Confidence90%
## PersistenceSylvania has been engaging in ongoing low-impact tactical cyber operations against Freedom
## KSUM
## RSUMED
## MSUM
##
## (Intercept)
## Damage_Assessment500 Million
## Hack_Typewhere valuable confidential information is stolen
## Attribution_Confidence90%
## PersistenceSylvania has been engaging in ongoing low-impact tactical cyber operations against Freedom
## KSUM
## RSUMED
## MSUM
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 9.207142)
##
##      Null deviance: 3470.3  on 379  degrees of freedom
## Residual deviance: 3425.1  on 372  degrees of freedom
## AIC: 1931.9
##
## Number of Fisher Scoring iterations: 2

```

Hypothesis 2: With interaction effects

```

# Hypothesis includes all possible interactions (coercive signal)
logitregH2a <- glm(formula = communicativity ~ Damage_Assessment * Hack_Type * Attribution_Confidence *
                  Time_Lag, data = data1)
summary(logitregH2a)

##

```

```
## Call:
## glm(formula = communicativity ~ Damage_Assessment * Hack_Type *
##       Attribution_Confidence * Persistence * Time_Lag, data = data1)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -4.300  -2.286  -1.182   2.832   6.417
##
## Coefficients:
##                                     Estimate
## (Intercept)                        26.9560
## Damage_Assessment                   -0.8174
## Hack_Type                           0.5089
## Attribution_Confidence               -6.8412
## Persistence                         -25.2213
## Time_Lag                           -6.7494
## Damage_Assessment:Hack_Type         -7.2915
## Damage_Assessment:Attribution_Confidence -0.9500
## Hack_Type:Attribution_Confidence   -8.6849
## Damage_Assessment:Persistence        9.3056
## Hack_Type:Persistence                6.9255
## Attribution_Confidence:Persistence  11.3845
## Damage_Assessment:Time_Lag          -3.0710
## Hack_Type:Time_Lag                  -4.7304
## Attribution_Confidence:Time_Lag      -1.7345
## Persistence:Time_Lag                13.3481
## Damage_Assessment:Hack_Type:Attribution_Confidence 7.7033
## Damage_Assessment:Hack_Type:Persistence -0.9769
## Damage_Assessment:Attribution_Confidence:Persistence -4.3953
## Hack_Type:Attribution_Confidence:Persistence 0.1403
## Damage_Assessment:Hack_Type:Time_Lag 6.3198
## Damage_Assessment:Attribution_Confidence:Time_Lag 3.5824
## Hack_Type:Attribution_Confidence:Time_Lag 8.5492
## Damage_Assessment:Persistence:Time_Lag -4.5005
## Hack_Type:Persistence:Time_Lag -2.1206
## Attribution_Confidence:Persistence:Time_Lag -5.6006
## Damage_Assessment:Hack_Type:Attribution_Confidence:Persistence -1.3429
## Damage_Assessment:Hack_Type:Attribution_Confidence:Time_Lag -6.1245
## Damage_Assessment:Hack_Type:Persistence:Time_Lag -0.2598
## Damage_Assessment:Attribution_Confidence:Persistence:Time_Lag 1.9295
## Hack_Type:Attribution_Confidence:Persistence:Time_Lag -1.1713
## Damage_Assessment:Hack_Type:Attribution_Confidence:Persistence:Time_Lag 1.2433
##                                     Std. Error
## (Intercept)                        50.4471
## Damage_Assessment                   32.0985
## Hack_Type                           33.5384
## Attribution_Confidence               34.9008
## Persistence                         32.4228
## Time_Lag                           31.1427
## Damage_Assessment:Hack_Type         21.1505
## Damage_Assessment:Attribution_Confidence 21.5859
## Hack_Type:Attribution_Confidence   22.6797
## Damage_Assessment:Persistence        20.7534
## Hack_Type:Persistence                21.2489
```

## Attribution_Confidence:Persistence	21.7056
## Damage_Assessment:Time_Lag	20.1238
## Hack_Type:Time_Lag	20.4273
## Attribution_Confidence:Time_Lag	21.0604
## Persistence:Time_Lag	20.8061
## Damage_Assessment:Hack_Type:Attribution_Confidence	13.9119
## Damage_Assessment:Hack_Type:Persistence	13.4299
## Damage_Assessment:Attribution_Confidence:Persistence	13.4864
## Hack_Type:Attribution_Confidence:Persistence	13.8688
## Damage_Assessment:Hack_Type:Time_Lag	13.0505
## Damage_Assessment:Attribution_Confidence:Time_Lag	13.3003
## Hack_Type:Attribution_Confidence:Time_Lag	13.5586
## Damage_Assessment:Persistence:Time_Lag	13.8026
## Hack_Type:Persistence:Time_Lag	13.3632
## Attribution_Confidence:Persistence:Time_Lag	13.5180
## Damage_Assessment:Hack_Type:Attribution_Confidence:Persistence	8.5641
## Damage_Assessment:Hack_Type:Attribution_Confidence:Time_Lag	8.4767
## Damage_Assessment:Hack_Type:Persistence:Time_Lag	8.6906
## Damage_Assessment:Attribution_Confidence:Persistence:Time_Lag	8.6792
## Hack_Type:Attribution_Confidence:Persistence:Time_Lag	8.5536
## Damage_Assessment:Hack_Type:Attribution_Confidence:Persistence:Time_Lag	5.4218
##	t value
## (Intercept)	0.534
## Damage_Assessment	-0.025
## Hack_Type	0.015
## Attribution_Confidence	-0.196
## Persistence	-0.778
## Time_Lag	-0.217
## Damage_Assessment:Hack_Type	-0.345
## Damage_Assessment:Attribution_Confidence	-0.044
## Hack_Type:Attribution_Confidence	-0.383
## Damage_Assessment:Persistence	0.448
## Hack_Type:Persistence	0.326
## Attribution_Confidence:Persistence	0.524
## Damage_Assessment:Time_Lag	-0.153
## Hack_Type:Time_Lag	-0.232
## Attribution_Confidence:Time_Lag	-0.082
## Persistence:Time_Lag	0.642
## Damage_Assessment:Hack_Type:Attribution_Confidence	0.554
## Damage_Assessment:Hack_Type:Persistence	-0.073
## Damage_Assessment:Attribution_Confidence:Persistence	-0.326
## Hack_Type:Attribution_Confidence:Persistence	0.010
## Damage_Assessment:Hack_Type:Time_Lag	0.484
## Damage_Assessment:Attribution_Confidence:Time_Lag	0.269
## Hack_Type:Attribution_Confidence:Time_Lag	0.631
## Damage_Assessment:Persistence:Time_Lag	-0.326
## Hack_Type:Persistence:Time_Lag	-0.159
## Attribution_Confidence:Persistence:Time_Lag	-0.414
## Damage_Assessment:Hack_Type:Attribution_Confidence:Persistence	-0.157
## Damage_Assessment:Hack_Type:Attribution_Confidence:Time_Lag	-0.723
## Damage_Assessment:Hack_Type:Persistence:Time_Lag	-0.030
## Damage_Assessment:Attribution_Confidence:Persistence:Time_Lag	0.222
## Hack_Type:Attribution_Confidence:Persistence:Time_Lag	-0.137
## Damage_Assessment:Hack_Type:Attribution_Confidence:Persistence:Time_Lag	0.229

```
##                                                    Pr(>|t|)
## (Intercept)                                0.593
## Damage_Assessment                        0.980
## Hack_Type                                0.988
## Attribution_Confidence                    0.845
## Persistence                              0.437
## Time_Lag                                 0.829
## Damage_Assessment:Hack_Type              0.730
## Damage_Assessment:Attribution_Confidence 0.965
## Hack_Type:Attribution_Confidence         0.702
## Damage_Assessment:Persistence            0.654
## Hack_Type:Persistence                    0.745
## Attribution_Confidence:Persistence        0.600
## Damage_Assessment:Time_Lag               0.879
## Hack_Type:Time_Lag                       0.817
## Attribution_Confidence:Time_Lag           0.934
## Persistence:Time_Lag                     0.522
## Damage_Assessment:Hack_Type:Attribution_Confidence 0.580
## Damage_Assessment:Hack_Type:Persistence 0.942
## Damage_Assessment:Attribution_Confidence:Persistence 0.745
## Hack_Type:Attribution_Confidence:Persistence 0.992
## Damage_Assessment:Hack_Type:Time_Lag     0.629
## Damage_Assessment:Attribution_Confidence:Time_Lag 0.788
## Hack_Type:Attribution_Confidence:Time_Lag 0.529
## Damage_Assessment:Persistence:Time_Lag   0.745
## Hack_Type:Persistence:Time_Lag           0.874
## Attribution_Confidence:Persistence:Time_Lag 0.679
## Damage_Assessment:Hack_Type:Attribution_Confidence:Persistence 0.875
## Damage_Assessment:Hack_Type:Attribution_Confidence:Time_Lag 0.470
## Damage_Assessment:Hack_Type:Persistence:Time_Lag 0.976
## Damage_Assessment:Attribution_Confidence:Persistence:Time_Lag 0.824
## Hack_Type:Attribution_Confidence:Persistence:Time_Lag 0.891
## Damage_Assessment:Hack_Type:Attribution_Confidence:Persistence:Time_Lag 0.819
##
## (Dispersion parameter for gaussian family taken to be 9.159319)
##
##      Null deviance: 3470.3  on 379  degrees of freedom
## Residual deviance: 3187.4  on 348  degrees of freedom
## AIC: 1952.6
##
## Number of Fisher Scoring iterations: 2
summary(logitregH2a)$coeff[-1,4]<0.05
```

```
##                                Damage_Assessment
##                                FALSE
##                                Hack_Type
##                                FALSE
##                                Attribution_Confidence
##                                FALSE
##                                Persistence
##                                FALSE
##                                Time_Lag
##                                FALSE
##                                Damage_Assessment:Hack_Type
```



```

##                                     FALSE
##                               Damage_Assessment:Attribution_Confidence
##                                     FALSE
##                               Hack_Type:Attribution_Confidence
##                                     FALSE
##                               Damage_Assessment:Persistence
##                                     FALSE
##                               Hack_Type:Persistence
##                                     FALSE
##                               Attribution_Confidence:Persistence
##                                     FALSE
##                               Damage_Assessment:Time_Lag
##                                     FALSE
##                               Hack_Type:Time_Lag
##                                     FALSE
##                               Attribution_Confidence:Time_Lag
##                                     FALSE
##                               Persistence:Time_Lag
##                                     FALSE
##                               Damage_Assessment:Hack_Type:Attribution_Confidence
##                                     FALSE
##                               Damage_Assessment:Hack_Type:Persistence
##                                     FALSE
##                               Damage_Assessment:Attribution_Confidence:Persistence
##                                     FALSE
##                               Hack_Type:Attribution_Confidence:Persistence
##                                     FALSE
##                               Damage_Assessment:Hack_Type:Time_Lag
##                                     FALSE
##                               Damage_Assessment:Attribution_Confidence:Time_Lag
##                                     FALSE
##                               Hack_Type:Attribution_Confidence:Time_Lag
##                                     FALSE
##                               Damage_Assessment:Persistence:Time_Lag
##                                     FALSE
##                               Hack_Type:Persistence:Time_Lag
##                                     FALSE
##                               Attribution_Confidence:Persistence:Time_Lag
##                                     FALSE
##                               Damage_Assessment:Hack_Type:Attribution_Confidence:Persistence
##                                     FALSE
##                               Damage_Assessment:Hack_Type:Attribution_Confidence:Time_Lag
##                                     FALSE
##                               Damage_Assessment:Hack_Type:Persistence:Time_Lag
##                                     FALSE
##                               Damage_Assessment:Attribution_Confidence:Persistence:Time_Lag
##                                     FALSE
##                               Hack_Type:Attribution_Confidence:Persistence:Time_Lag
##                                     FALSE
##                               Damage_Assessment:Hack_Type:Attribution_Confidence:Persistence:Time_Lag
##                                     FALSE

```

```

# Only includes interactions of the Message variables with other message variables and Context with oth
logitregH2b <- glm(formula = communicativity ~ Damage_Assessment + Hack_Type + Attribution_Confidence +

```

```

Attribution_Confidence + Attribution_Confidence * Hack_Type
+ Persistence + Time_Lag + Persistence * Time_Lag, data = data1)
summary(logitregH2b)

```

```

##
## Call:
## glm(formula = communicativity ~ Damage_Assessment + Hack_Type +
##      Attribution_Confidence + Damage_Assessment * Hack_Type +
##      Damage_Assessment * Attribution_Confidence + Attribution_Confidence *
##      Hack_Type + Persistence + Time_Lag + Persistence * Time_Lag,
##      data = data1)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -4.166  -2.296  -1.341   3.339   6.095
##
## Coefficients:
##                                Estimate Std. Error t value Pr(>|t|)
## (Intercept)                   7.0030     2.7851   2.514  0.0123 *
## Damage_Assessment              0.4433     1.2807   0.346  0.7294
## Hack_Type                     0.8546     1.3433   0.636  0.5250
## Attribution_Confidence        -3.2195     1.3820  -2.330  0.0204 *
## Persistence                   -0.8185     1.0101  -0.810  0.4183
## Time_Lag                     -0.9580     1.0036  -0.955  0.3404
## Damage_Assessment:Hack_Type   -1.1158     0.6278  -1.777  0.0763 .
## Damage_Assessment:Attribution_Confidence  0.9274     0.6305   1.471  0.1422
## Hack_Type:Attribution_Confidence  0.7909     0.6272   1.261  0.2081
## Persistence:Time_Lag         0.7285     0.6355   1.146  0.2525
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 9.076855)
##
##      Null deviance: 3470.3  on 379  degrees of freedom
## Residual deviance: 3358.4  on 370  degrees of freedom
## AIC: 1928.4
##
## Number of Fisher Scoring iterations: 2

```

```

# Running a regression with all interaction effects between two variables (excludes interaction effect.
logitregH2c <- glm(formula = communicativity ~ Damage_Assessment + Hack_Type + Attribution_Confidence +
+ Damage_Assessment * Attribution_Confidence + Attribution_Confidence * Hack_Type +
+ Hack_Type * Persistence + Attribution_Confidence * Persistence + Damage_Assessment
+ Time_Lag, data = data1)
summary(logitregH2c)

```

```

##
## Call:
## glm(formula = communicativity ~ Damage_Assessment + Hack_Type +
##      Attribution_Confidence + Persistence + Time_Lag + Damage_Assessment *
##      Hack_Type + Damage_Assessment * Attribution_Confidence +
##      Attribution_Confidence * Hack_Type + Persistence * Time_Lag +
##      Damage_Assessment * Persistence + Hack_Type * Persistence +
##      Attribution_Confidence * Persistence + Damage_Assessment *

```

```

##      Time_Lag + Hack_Type * Time_Lag + Attribution_Confidence *
##      Time_Lag, data = data1)
##
## Deviance Residuals:
##      Min        1Q    Median        3Q        Max
## -4.348  -2.143  -1.128    3.040    6.145
##
## Coefficients:
##                                Estimate Std. Error t value Pr(>|t|)
## (Intercept)                   7.2655     4.0827   1.780   0.0760 .
## Damage_Assessment              1.9513     1.8182   1.073   0.2839
## Hack_Type                     -1.9978     1.9390  -1.030   0.3035
## Attribution_Confidence         -2.4219     2.0838  -1.162   0.2459
## Persistence                    0.4082     1.8446   0.221   0.8250
## Time_Lag                      -2.0062     1.7281  -1.161   0.2464
## Damage_Assessment:Hack_Type    -1.0588     0.6314  -1.677   0.0944 .
## Damage_Assessment:Attribution_Confidence  0.9269     0.6453   1.436   0.1517
## Hack_Type:Attribution_Confidence  0.7944     0.6398   1.242   0.2151
## Persistence:Time_Lag          0.5491     0.6551   0.838   0.4024
## Damage_Assessment:Persistence  -0.3400     0.6555  -0.519   0.6043
## Hack_Type:Persistence          0.3403     0.6475   0.526   0.5995
## Attribution_Confidence:Persistence -0.6423     0.6566  -0.978   0.3287
## Damage_Assessment:Time_Lag     -0.7233     0.6398  -1.131   0.2590
## Hack_Type:Time_Lag             1.4849     0.6395   2.322   0.0208 *
## Attribution_Confidence:Time_Lag  0.1301     0.6586   0.198   0.8435
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 9.015955)
##
##      Null deviance: 3470.3  on 379  degrees of freedom
## Residual deviance: 3281.8  on 364  degrees of freedom
## AIC: 1931.7
##
## Number of Fisher Scoring iterations: 2
## high correlations are Hack_Type:Attribution_Confidence & Attribution_Confidence:Persistence & Time_L
# Regression to evaluate whether interaction effects that showed high correlation in a cor table signif
logitregH2d <- glm(formula = communicativity ~ Damage_Assessment + Hack_Type + Attribution_Confidence +
summary(logitregH2d) # no effect or significane

##
## Call:
## glm(formula = communicativity ~ Damage_Assessment + Hack_Type +
##      Attribution_Confidence + Persistence + Time_Lag + Hack_Type *
##      Time_Lag, data = data1)
##
## Deviance Residuals:
##      Min        1Q    Median        3Q        Max
## -4.292  -2.258  -1.380    3.265    6.410
##
## Coefficients:
##                                Estimate Std. Error t value Pr(>|t|)

```

```
## (Intercept)          7.7226      1.7308   4.462 1.08e-05 ***
## Damage_Assessment    0.1323      0.3089   0.428 0.66864
## Hack_Type            -2.1058      0.9858  -2.136 0.03332 *
## Attribution_Confidence -0.5692      0.3169  -1.796 0.07324 .
## Persistence          0.2624      0.3192   0.822 0.41148
## Time_Lag             -2.3265      0.9769  -2.382 0.01774 *
## Hack_Type:Time_Lag    1.6190      0.6172   2.623 0.00907 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 9.016951)
##
## Null deviance: 3470.3  on 379  degrees of freedom
## Residual deviance: 3363.3  on 373  degrees of freedom
## AIC: 1923
##
## Number of Fisher Scoring iterations: 2
```

```
summary(logitregH2d)$coeff[-1,4]<0.05
```

```
##      Damage_Assessment      Hack_Type Attribution_Confidence
##              FALSE              TRUE              FALSE
##      Persistence      Time_Lag      Hack_Type:Time_Lag
##              FALSE              TRUE              TRUE
```

Hypothesis 3 on Escalation

```
# this subsetting data to only communicative attacks
```

```
dataH3 <- subset(data1, communicativity>5)
dataH3$Response <- factor(dataH3$Response)
```

```
# run with multinom
```

```
logitregH3a <- multinom(Response ~ Damage_Assessment + Hack_Type + Attribution_Confidence + Persistence
```

```
## # weights:  21 (12 variable)
## initial value 134.030699
## iter  10 value 120.291482
## final value 120.258330
## converged
```

```
summary(logitregH3a) # nothing is statistically significant
```

```
## Call:
```

```
## multinom(formula = Response ~ Damage_Assessment + Hack_Type +
## Attribution_Confidence + Persistence + Time_Lag, data = dataH3)
##
```

```
## Coefficients:
```

```
## (Intercept) Damage_Assessment Hack_Type Attribution_Confidence Persistence
## 2 1.200801 0.1482408 -0.1616370 0.3702777 -0.45158920
## 3 -1.415269 0.6864495 -0.5678412 0.7950521 -0.03699283
## Time_Lag
## 2 -0.1731860
## 3 -0.0531534
```

```
##
## Std. Errors:
## (Intercept) Damage_Assessment Hack_Type Attribution_Confidence Persistence
## 2 1.429103 0.4468632 0.4642469 0.4623796 0.4506020
## 3 1.803849 0.5614863 0.5679266 0.5663810 0.5580563
## Time_Lag
## 2 0.4538058
## 3 0.5578350
##
## Residual Deviance: 240.5167
## AIC: 264.5167

# run with ordinal
logitregH3a2 <- polr(Response ~ Damage_Assessment + Hack_Type + Attribution_Confidence + Persistence + Time_Lag, data = dataH3)
summary(logitregH3a2) # nothing is statistically significant

##
## Re-fitting to get Hessian

## Call:
## polr(formula = Response ~ Damage_Assessment + Hack_Type + Attribution_Confidence + Persistence + Time_Lag, data = dataH3)
##
## Coefficients:
## Value Std. Error t value
## Damage_Assessment 0.43354 0.3556 1.2191
## Hack_Type -0.36501 0.3689 -0.9896
## Attribution_Confidence 0.53143 0.3621 1.4675
## Persistence -0.06162 0.3546 -0.1738
## Time_Lag -0.04319 0.3600 -0.1200
##
## Intercepts:
## Value Std. Error t value
## 1|2 -0.3972 1.1159 -0.3560
## 2|3 2.0667 1.1354 1.8202
##
## Residual Deviance: 242.179
## AIC: 256.179

logitregH3b <- multinom(Response ~ Damage_Assessment * Hack_Type * Attribution_Confidence * Persistence + Time_Lag, data = dataH3)

## # weights: 99 (64 variable)
## initial value 134.030699
## iter 10 value 113.631080
## iter 20 value 107.484194
## iter 30 value 101.182945
## iter 40 value 97.825949
## iter 50 value 95.870185
## iter 60 value 95.272786
## iter 70 value 95.243850
## iter 80 value 95.237247
## iter 90 value 95.233713
## final value 95.233582
## converged
```

```
summary(logitregH3b) # nothing is statistically significant
```

```
## Call:
## multinom(formula = Response ~ Damage_Assessment * Hack_Type *
## Attribution_Confidence * Persistence * Time_Lag, data = dataH3)
##
## Coefficients:
## (Intercept) Damage_Assessment Hack_Type Attribution_Confidence Persistence
## 2 181.30820 -49.52857 57.18818 154.59447 30.21714
## 3 93.27626 -76.61056 196.33077 47.54654 71.29151
## Time_Lag Damage_Assessment:Hack_Type
## 2 -134.08909 19.48916
## 3 -23.81424 -123.08075
## Damage_Assessment:Attribution_Confidence Hack_Type:Attribution_Confidence
## 2 -43.36211 -26.50812
## 3 62.52553 124.30268
## Damage_Assessment:Persistence Hack_Type:Persistence
## 2 -40.69971 -24.13159
## 3 106.73566 -139.06002
## Attribution_Confidence:Persistence Damage_Assessment:Time_Lag
## 2 -122.9899 -138.99762
## 3 -125.4602 -25.12274
## Hack_Type:Time_Lag Attribution_Confidence:Time_Lag Persistence:Time_Lag
## 2 -9.754101 41.72209 43.22773
## 3 -40.358567 -39.25765 -48.26148
## Damage_Assessment:Hack_Type:Attribution_Confidence
## 2 -73.08202
## 3 -127.73370
## Damage_Assessment:Hack_Type:Persistence
## 2 -43.611299
## 3 -9.676498
## Damage_Assessment:Attribution_Confidence:Persistence
## 2 13.26793
## 3 -78.66378
## Hack_Type:Attribution_Confidence:Persistence
## 2 -29.86685
## 3 -54.88984
## Damage_Assessment:Hack_Type:Time_Lag
## 2 73.91519
## 3 65.13868
## Damage_Assessment:Attribution_Confidence:Time_Lag
## 2 110.46693
## 3 57.64606
## Hack_Type:Attribution_Confidence:Time_Lag
## 2 -43.9569
## 3 -146.0742
## Damage_Assessment:Persistence:Time_Lag Hack_Type:Persistence:Time_Lag
## 2 121.3864 -15.49681
## 3 -50.2892 47.20230
## Attribution_Confidence:Persistence:Time_Lag
## 2 -72.56939
## 3 83.00600
## Damage_Assessment:Hack_Type:Attribution_Confidence:Persistence
## 2 107.9675
```

```

## 3 140.5284
## Damage_Assessment:Hack_Type:Attribution_Confidence:Time_Lag
## 2 -9.153325
## 3 61.954813
## Damage_Assessment:Hack_Type:Persistence:Time_Lag
## 2 -29.66742
## 3 11.12305
## Damage_Assessment:Attribution_Confidence:Persistence:Time_Lag
## 2 -32.550698
## 3 3.272584
## Hack_Type:Attribution_Confidence:Persistence:Time_Lag
## 2 80.66419
## 3 60.19593
## Damage_Assessment:Hack_Type:Attribution_Confidence:Persistence:Time_Lag
## 2 -40.27330
## 3 -70.38888
##
## Std. Errors:
## (Intercept) Damage_Assessment Hack_Type Attribution_Confidence Persistence
## 2 1.721478 2.606933 2.383263 1.480658 2.648551
## 3 2.334477 1.932756 1.532580 2.229678 1.287073
## Time_Lag Damage_Assessment:Hack_Type Damage_Assessment:Attribution_Confidence
## 2 2.176608 3.202394 2.688237
## 3 1.010989 1.333661 1.059952
## Hack_Type:Attribution_Confidence Damage_Assessment:Persistence
## 2 1.096449 2.145449
## 3 1.021424 1.627199
## Hack_Type:Persistence Attribution_Confidence:Persistence
## 2 2.924563 3.2503580
## 3 1.652970 0.8425496
## Damage_Assessment:Time_Lag Hack_Type:Time_Lag Attribution_Confidence:Time_Lag
## 2 1.856051 2.590526 2.634397
## 3 2.074395 1.285449 1.220189
## Persistence:Time_Lag Damage_Assessment:Hack_Type:Attribution_Confidence
## 2 1.557196 1.698593
## 3 1.338120 1.453883
## Damage_Assessment:Hack_Type:Persistence
## 2 1.5385766
## 3 0.8933407
## Damage_Assessment:Attribution_Confidence:Persistence
## 2 2.207367
## 3 1.394336
## Hack_Type:Attribution_Confidence:Persistence
## 2 1.531165
## 3 1.719305
## Damage_Assessment:Hack_Type:Time_Lag
## 2 2.5095883
## 3 0.9570933
## Damage_Assessment:Attribution_Confidence:Time_Lag
## 2 1.983135
## 3 1.138337
## Hack_Type:Attribution_Confidence:Time_Lag
## 2 1.5076289
## 3 0.8418951

```

```
## Damage_Assessment:Persistence:Time_Lag Hack_Type:Persistence:Time_Lag
## 2 2.001390 2.313381
## 3 1.398746 1.076889
## Attribution_Confidence:Persistence:Time_Lag
## 2 1.8827248
## 3 0.9912258
## Damage_Assessment:Hack_Type:Attribution_Confidence:Persistence
## 2 1.343573
## 3 1.065996
## Damage_Assessment:Hack_Type:Attribution_Confidence:Time_Lag
## 2 1.3791448
## 3 0.9720173
## Damage_Assessment:Hack_Type:Persistence:Time_Lag
## 2 1.151909
## 3 1.624711
## Damage_Assessment:Attribution_Confidence:Persistence:Time_Lag
## 2 1.4198399
## 3 0.8910422
## Hack_Type:Attribution_Confidence:Persistence:Time_Lag
## 2 1.287763
## 3 1.020409
## Damage_Assessment:Hack_Type:Attribution_Confidence:Persistence:Time_Lag
## 2 0.8287632
## 3 1.1181023
##
## Residual Deviance: 190.4672
## AIC: 314.4672
```

```
# Removing the constraint of perceiving communicative attacks
```

```
logitregH3c <- multinom(Response ~ Damage_Assessment + Hack_Type + Attribution_Confidence + Persistence
```

```
## # weights: 21 (12 variable)
## initial value 417.472670
## iter 10 value 366.093477
## final value 363.546604
## converged
```

```
summary(logitregH3c) # nothing is statistically significant
```

```
## Call:
## multinom(formula = Response ~ Damage_Assessment + Hack_Type +
## Attribution_Confidence + Persistence + Time_Lag, data = data1)
##
## Coefficients:
## (Intercept) Damage_Assessment Hack_Type Attribution_Confidence Persistence
## 2 -0.8393234 -0.1062786 -0.02523744 0.1786237 0.3268747
## 3 -3.9968760 0.4352963 -0.38612143 0.6699391 0.7071959
## Time_Lag
## 2 0.1860802
## 3 0.2929004
##
## Std. Errors:
## (Intercept) Damage_Assessment Hack_Type Attribution_Confidence Persistence
## 2 0.7217152 0.2199877 0.2229229 0.2253918 0.2277274
```



```

## 3 1.1791546 0.3490525 0.3467476 0.3592676 0.3592864
## Time_Lag
## 2 0.2236547
## 3 0.3472930
##
## Residual Deviance: 727.0932
## AIC: 751.0932
# nothing is statistically significant
logitregH3d <- multinom(Response ~ Damage_Assessment * Hack_Type * Attribution_Confidence * Persistence

## # weights: 99 (64 variable)
## initial value 417.472670
## iter 10 value 367.439074
## iter 20 value 347.665836
## iter 30 value 339.468802
## iter 40 value 337.238141
## iter 50 value 334.083336
## iter 60 value 333.195892
## iter 70 value 331.803840
## iter 80 value 331.387117
## iter 90 value 330.871742
## iter 100 value 330.724218
## final value 330.724218
## stopped after 100 iterations
summary(logitregH3d) # nothing is statistically significant

## Call:
## multinom(formula = Response ~ Damage_Assessment * Hack_Type *
## Attribution_Confidence * Persistence * Time_Lag, data = data1)
##
## Coefficients:
## (Intercept) Damage_Assessment Hack_Type Attribution_Confidence Persistence
## 2 4.333780 3.427824 14.85301 0.2176254 -2.97137
## 3 1.835384 18.438014 17.09062 -77.3743983 39.55338
## Time_Lag Damage_Assessment:Hack_Type
## 2 -9.145029 -11.51257
## 3 2.619629 -25.48096
## Damage_Assessment:Attribution_Confidence Hack_Type:Attribution_Confidence
## 2 -4.056216 -7.381417
## 3 37.583194 47.717051
## Damage_Assessment:Persistence Hack_Type:Persistence
## 2 -3.090963 -7.22355
## 3 -35.717507 -38.43588
## Attribution_Confidence:Persistence Damage_Assessment:Time_Lag
## 2 -3.06236 -1.196035
## 3 16.51781 -19.224206
## Hack_Type:Time_Lag Attribution_Confidence:Time_Lag Persistence:Time_Lag
## 2 -2.481698 3.438708 3.12071
## 3 -3.983720 45.942957 -38.92001
## Damage_Assessment:Hack_Type:Attribution_Confidence
## 2 5.361978
## 3 -23.698421
## Damage_Assessment:Hack_Type:Persistence

```

```

## 2          6.240523
## 3          31.668950
## Damage_Assessment:Attribution_Confidence:Persistence
## 2          4.746126
## 3         -4.676913
## Hack_Type:Attribution_Confidence:Persistence
## 2          5.377126
## 3         -8.470216
## Damage_Assessment:Hack_Type:Time_Lag
## 2          4.372474
## 3         15.692165
## Damage_Assessment:Attribution_Confidence:Time_Lag
## 2          2.140433
## 3        -18.151827
## Hack_Type:Attribution_Confidence:Time_Lag
## 2          1.51068
## 3        -35.18857
## Damage_Assessment:Persistence:Time_Lag Hack_Type:Persistence:Time_Lag
## 2          2.905279          2.087057
## 3          34.816030          26.847727
## Attribution_Confidence:Persistence:Time_Lag
## 2          0.9556118
## 3         -2.8270158
## Damage_Assessment:Hack_Type:Attribution_Confidence:Persistence
## 2          -3.912068
## 3          2.235799
## Damage_Assessment:Hack_Type:Attribution_Confidence:Time_Lag
## 2          -2.345459
## 3          14.621145
## Damage_Assessment:Hack_Type:Persistence:Time_Lag
## 2          -3.12058
## 3         -24.72506
## Damage_Assessment:Attribution_Confidence:Persistence:Time_Lag
## 2          -3.308873
## 3         -4.205660
## Hack_Type:Attribution_Confidence:Persistence:Time_Lag
## 2          -2.283319
## 3          4.644181
## Damage_Assessment:Hack_Type:Attribution_Confidence:Persistence:Time_Lag
## 2          2.202088
## 3          1.373438
##
## Std. Errors:
## (Intercept) Damage_Assessment Hack_Type Attribution_Confidence Persistence
## 2    8.525930    7.358779 10.225223    9.405058    7.314508
## 3    4.489219    3.632879  3.296517    11.967066    7.269871
## Time_Lag Damage_Assessment:Hack_Type Damage_Assessment:Attribution_Confidence
## 2  6.631369    6.652004    6.105287
## 3  8.319345    5.376259    4.025178
## Hack_Type:Attribution_Confidence Damage_Assessment:Persistence
## 2    7.385302    7.199450
## 3    4.365973    4.618509
## Hack_Type:Persistence Attribution_Confidence:Persistence
## 2    5.615759    5.984008

```

```

## 3          4.289680          4.037877
## Damage_Assessment:Time_Lag Hack_Type:Time_Lag Attribution_Confidence:Time_Lag
## 2          7.111943          5.500458          5.784325
## 3          3.455313          2.619818          3.438255
## Persistence:Time_Lag Damage_Assessment:Hack_Type:Attribution_Confidence
## 2          7.680889          4.522702
## 3          11.863999          11.366510
## Damage_Assessment:Hack_Type:Persistence
## 2          4.197815
## 3          7.566832
## Damage_Assessment:Attribution_Confidence:Persistence
## 2          4.266693
## 3          1.933546
## Hack_Type:Attribution_Confidence:Persistence
## 2          3.963322
## 3          1.765785
## Damage_Assessment:Hack_Type:Time_Lag
## 2          4.219486
## 3          7.266836
## Damage_Assessment:Attribution_Confidence:Time_Lag
## 2          4.383557
## 3          2.569887
## Hack_Type:Attribution_Confidence:Time_Lag
## 2          4.030751
## 3          3.647542
## Damage_Assessment:Persistence:Time_Lag Hack_Type:Persistence:Time_Lag
## 2          8.308502          4.253116
## 3          5.149491          4.997464
## Attribution_Confidence:Persistence:Time_Lag
## 2          4.562603
## 3          4.237358
## Damage_Assessment:Hack_Type:Attribution_Confidence:Persistence
## 2          2.554049
## 3          2.042293
## Damage_Assessment:Hack_Type:Attribution_Confidence:Time_Lag
## 2          2.661583
## 3          2.230824
## Damage_Assessment:Hack_Type:Persistence:Time_Lag
## 2          4.130108
## 3          12.699377
## Damage_Assessment:Attribution_Confidence:Persistence:Time_Lag
## 2          4.195274
## 3          2.157018
## Hack_Type:Attribution_Confidence:Persistence:Time_Lag
## 2          2.630551
## 3          2.170615
## Damage_Assessment:Hack_Type:Attribution_Confidence:Persistence:Time_Lag
## 2          2.148609
## 3          4.137745
##
## Residual Deviance: 661.4484
## AIC: 789.4484

```

Hypothesis 4 on Norm Adoption — Future research could focus on!

```
dataH4 <- na.omit(dataH3)

nrow(dataH4) # 31 results not sufficient for statistical tests

## [1] 122

summary(dataH4)

##   communicativity  Response Damage_Assessment  Hack_Type
##   Min.    : 6.000   1:31      Min.    :1.000      Min.    :1.000
##   1st Qu.: 8.000   2:65      1st Qu.:1.000      1st Qu.:1.000
##   Median : 9.000   3:26      Median :2.000      Median :2.000
##   Mean   : 8.672                Mean   :1.525      Mean   :1.533
##   3rd Qu.: 9.000                3rd Qu.:2.000      3rd Qu.:2.000
##   Max.   :10.000                Max.    :2.000      Max.    :2.000
##   Attribution_Confidence Persistence      Time_Lag
##   Min.    :1.000      Min.    :1.000      Min.    :1.000
##   1st Qu.:1.000      1st Qu.:1.000      1st Qu.:1.000
##   Median :1.000      Median :2.000      Median :2.000
##   Mean   :1.467      Mean   :1.525      Mean   :1.516
##   3rd Qu.:2.000      3rd Qu.:2.000      3rd Qu.:2.000
##   Max.   :2.000      Max.    :2.000      Max.    :2.000

# logitregH4a <- glm(Norm ~ Damage_Assessment + Hack_Type + Attribution_Confidence + Persistence + Time_Lag, data = dataH4)
# summary(logitregH4a)

# assumptions:
# 1) identify if attack is communicative
# 2) assign confidence level to communicative assessment
# 3) choose response (escalate, proportional, deescalate) for short term response
# 4) in the long-term either abide or reject the proposed communicated norm
```

Hypothesis 5 on Effect of Supplementary Variables on Confidence

```
logitregH5a <- glm(formula = AssessConfNo ~ Damage_Assessment + Hack_Type + Attribution_Confidence + Persistence + Time_Lag + KSUM + RSUMED + MSUM, data = stacked_data)
summary(logitregH5a)

##
## Call:
## glm(formula = AssessConfNo ~ Damage_Assessment + Hack_Type + Attribution_Confidence + Persistence + Time_Lag + KSUM + RSUMED + MSUM, data = stacked_data)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -2.67480  -0.52214   0.04569   0.56252   1.74860
##
## Coefficients:
##
```

```

## (Intercept)
## Damage_Assessment500 Million
## Hack_Typewhere valuable confidential information is stolen
## Attribution_Confidence90%
## PersistenceSylvania has been engaging in ongoing low-impact tactical cyber operations against Freedom
## Time_Lag6 months
## KSUM
## RSUMED
## MSUM
##
## (Intercept)
## Damage_Assessment500 Million
## Hack_Typewhere valuable confidential information is stolen
## Attribution_Confidence90%
## PersistenceSylvania has been engaging in ongoing low-impact tactical cyber operations against Freedom
## Time_Lag6 months
## KSUM
## RSUMED
## MSUM
##
## (Intercept)
## Damage_Assessment500 Million
## Hack_Typewhere valuable confidential information is stolen
## Attribution_Confidence90%
## PersistenceSylvania has been engaging in ongoing low-impact tactical cyber operations against Freedom
## Time_Lag6 months
## KSUM
## RSUMED
## MSUM
##
## (Intercept)
## Damage_Assessment500 Million
## Hack_Typewhere valuable confidential information is stolen
## Attribution_Confidence90%
## PersistenceSylvania has been engaging in ongoing low-impact tactical cyber operations against Freedom
## Time_Lag6 months
## KSUM
## RSUMED
## MSUM
##
## (Intercept)
## Damage_Assessment500 Million
## Hack_Typewhere valuable confidential information is stolen
## Attribution_Confidence90%
## PersistenceSylvania has been engaging in ongoing low-impact tactical cyber operations against Freedom
## Time_Lag6 months
## KSUM
## RSUMED
## MSUM
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 0.6821793)
##

```

```
## Null deviance: 280.63 on 379 degrees of freedom
## Residual deviance: 253.09 on 371 degrees of freedom
## AIC: 943.95
##
## Number of Fisher Scoring iterations: 2
```

```
summary(stacked_data$KSUM)
```

```
## Min. 1st Qu. Median Mean 3rd Qu. Max.
## 0.2857 0.5714 0.7143 0.6692 0.7143 0.8571
```

Hypothesis 6 Employing a logit on instrumentality vs communicativity

```
stacked_data$AttackDefNo <- (stacked_data$AttackDefNo - 1)
logitregH6a <- glm(formula = AttackDefNo ~ Damage_Assessment + Hack_Type + Attribution_Confidence + Persistence + Time_Lag + KSUM + RSUMED + MSUM, family = "binomial",
                  data = stacked_data)
summary(logitregH6a)
```

```
##
## Call:
## glm(formula = AttackDefNo ~ Damage_Assessment + Hack_Type + Attribution_Confidence + Persistence + Time_Lag + KSUM + RSUMED + MSUM, family = "binomial",
## data = stacked_data)
##
## Deviance Residuals:
## Min 1Q Median 3Q Max
## -1.7217 -1.4136 0.8295 0.8980 1.0695
##
## Coefficients:
## (Intercept)
## Damage_Assessment500 Million
## Hack_Typewhere valuable confidential information is stolen
## Attribution_Confidence90%
## PersistenceSylvania has been engaging in ongoing low-impact tactical cyber operations against Freedom
## Time_Lag6 months
## KSUM
## RSUMED
## MSUM
##
## (Intercept)
## Damage_Assessment500 Million
## Hack_Typewhere valuable confidential information is stolen
## Attribution_Confidence90%
## PersistenceSylvania has been engaging in ongoing low-impact tactical cyber operations against Freedom
## Time_Lag6 months
## KSUM
## RSUMED
## MSUM
##
## (Intercept)
```

```

## Damage_Assessment500 Million
## Hack_Typewhere valuable confidential information is stolen
## Attribution_Confidence90%
## PersistenceSylvania has been engaging in ongoing low-impact tactical cyber operations against Freedom
## Time_Lag6 months
## KSUM
## RSUMED
## MSUM
##
## (Intercept)
## Damage_Assessment500 Million
## Hack_Typewhere valuable confidential information is stolen
## Attribution_Confidence90%
## PersistenceSylvania has been engaging in ongoing low-impact tactical cyber operations against Freedom
## Time_Lag6 months
## KSUM
## RSUMED
## MSUM
##
## (Dispersion parameter for binomial family taken to be 1)
##
##      Null deviance: 477.02  on 379  degrees of freedom
## Residual deviance: 473.40  on 371  degrees of freedom
## AIC: 491.4
##
## Number of Fisher Scoring iterations: 4

```