

# Cyber\_Perceptions\_Survey\_Proj

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## Load Libraries and Create Anon File from Raw Qualtrics Output

### Clean Data for Analysis

```
anon_data <- read.csv(here::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)

# 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")

```

## 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"=4)
Controls$R2 <- prob[Controls$Q30]

likert <- c("Strongly agree"=5, "Somewhat agree"=4, "Neither agree nor disagree"=3, "Somewhat disagree"=2, "Strongly disagree"=1)
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"=4, "Extremely easy"=5)
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)", "American (U.S.)", "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")
summary(CleanControls)
```

```
##           Q6           Q7           Q8           KSUM
## Length:76      Length:76      Length:76      Min.    :0.2857
## Class :character Class :character Class :character 1st Qu.:0.5714
## Mode  :character Mode  :character Mode  :character Median :0.7143
##                                           Mean  :0.6692
##                                           3rd Qu.:0.7143
##                                           Max.   :0.8571
##           RSUMED           MSUM
## Min.    :0.2595  Min.    :0.0000
## 1st Qu.:0.5357  1st Qu.:0.0000
## Median :0.6452  Median :0.3333
## Mean   :0.6280  Mean   :0.3772
## 3rd Qu.:0.7250  3rd Qu.:0.6667
## Max.   :0.9000  Max.   :1.0000
```

```
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")]
```

```
# Set IDs
```

```
Scenario1$ID <- 1
Scenario2$ID <- 2
Scenario3$ID <- 3
Scenario4$ID <- 4
Scenario5$ID <- 5
```

```
dfs <- c("Scenario1", "Scenario2", "Scenario3", "Scenario4", "Scenario5")
for(df in dfs)
```

```
  assign(df, setNames(get(df), c("Time_Lag","Attribution_Confidence","Damage_Assessment","Hack_Type","Persistence")))
```

```
Scenarios <- rbind(Scenario1,Scenario2,Scenario3,Scenario4,Scenario5)
```

```
cols <- c("Time_Lag","Attribution_Confidence","Damage_Assessment","Hack_Type","Persistence", "ID")
summary(Scenarios)
```

```
##      Time_Lag      Attribution_Confidence      Damage_Assessment
## Length:380      Length:380      Length:380
## Class :character Class :character      Class :character
## Mode  :character Mode  :character      Mode  :character
```

```
##
##
##
## Hack_Type Persistence ID
## Length:380 Length:380 Min. :1
## Class :character Class :character 1st Qu.:2
## Mode :character Mode :character Median :3
## Mean :3
## 3rd Qu.:4
## Max. :5

#Combine Components
stacked_data <- cbind(NewUserData,NewControls,Scenarios,NewQuestions)

levels(stacked_data$Response)[match("Escalate",levels(stacked_data$Response))] <- "Escalatory attack" #

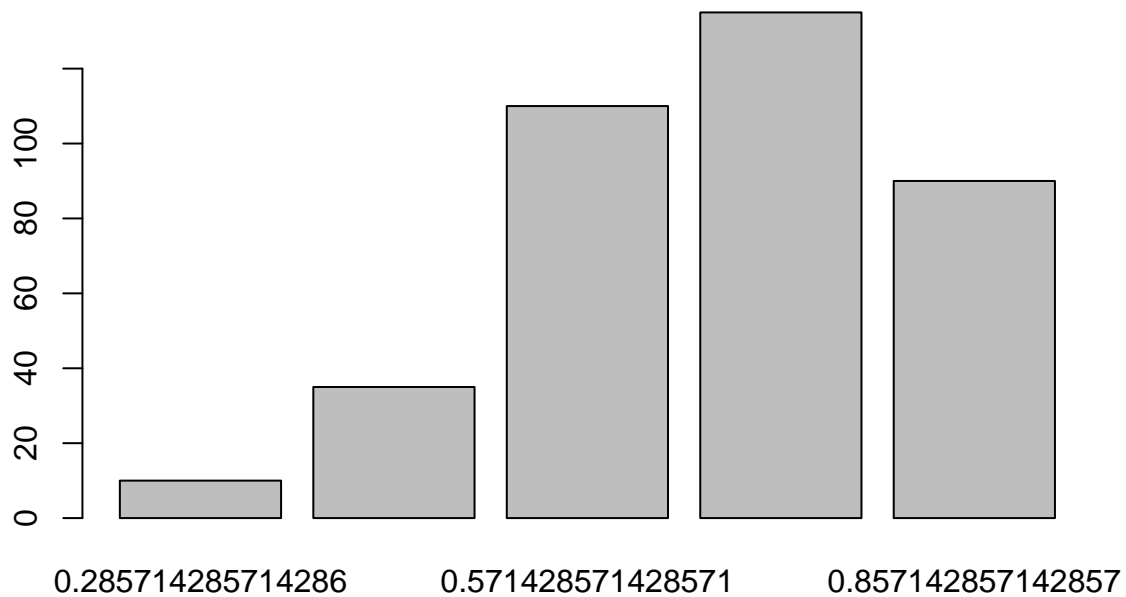
# table(stacked_data$AttackDef, stacked_data$Response)
# table(stacked_data$AttackDef, stacked_data$Response, stacked_data$Norm)
```

## Attention Check Remove Low KSUM Scores

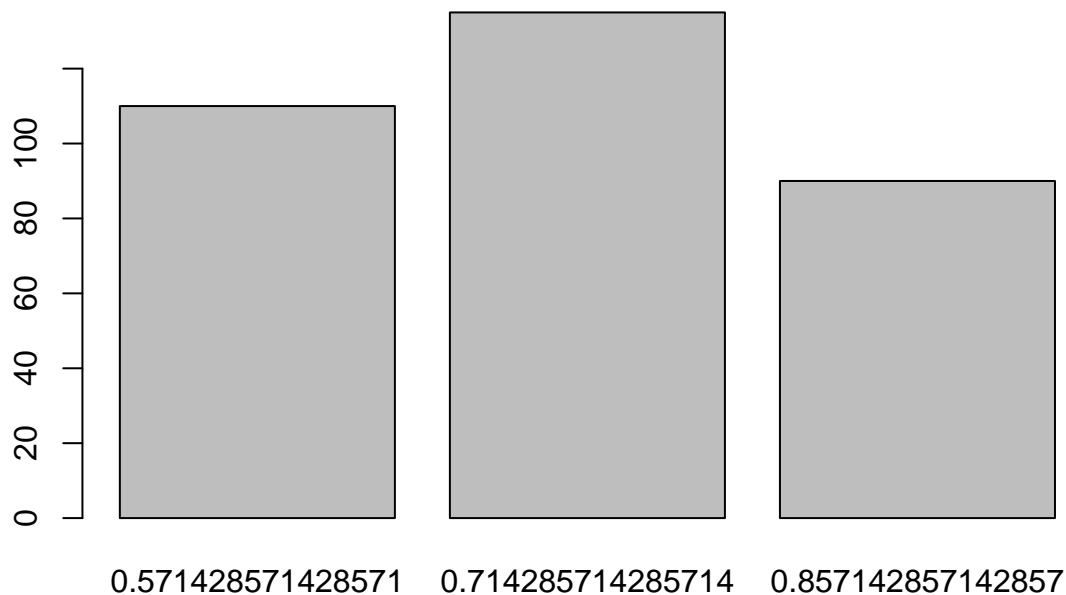
```
table(stacked_data$KSUM)

##
## 0.285714285714286 0.428571428571429 0.571428571428571 0.714285714285714
## 10 35 110 135
## 0.857142857142857
## 90

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



```
nrow(stacked_data[stacked_data$KSUM <= .5, ]) # 45 rows 9 students
## [1] 45
nrow(stacked_data[stacked_data$KSUM > .5, ]) # 335 rows 67 students
## [1] 335
nrow(stacked_data[stacked_data$KSUM > .5, ])/380 # keeps 88.16% of participants, drops 11.84
## [1] 0.8815789
nrow(stacked_data[stacked_data$KSUM > .6, ])/380 # drops 41.6% of participants
## [1] 0.5921053
stacked_data <- stacked_data[stacked_data$KSUM > .5, ]
table(stacked_data$KSUM)
##
## 0.571428571428571 0.714285714285714 0.857142857142857
##           110           135           90
barplot(table(stacked_data$KSUM))
```



```
summary(stacked_data)
```

```
##           X           Progress  Durationinseconds Finished
##  Min.      : 1.00    Min.      :100    Min.      :   365    Mode:logical
## 1st Qu.:22.00    1st Qu.:100    1st Qu.:   721    TRUE:335
## Median :47.00    Median :100    Median :   975
## Mean   :43.81    Mean   :100    Mean   : 22076
## 3rd Qu.:64.00    3rd Qu.:100    3rd Qu.: 1884
## Max.   :95.00    Max.   :100    Max.   :574328
## ResponseId      DistributionChannel UserLanguage           Q6
## Length:335      Length:335          Length:335      Length:335
## Class :character Class :character    Class :character Class :character
## Mode  :character Mode  :character    Mode  :character Mode  :character
##
##
##           Q7           Q8           KSUM           RSUMED
## Length:335      Length:335      Min.      :0.5714    Min.      :0.2595
## Class :character Class :character    1st Qu.:0.5714    1st Qu.:0.5190
## Mode  :character Mode  :character    Median :0.7143    Median :0.6357
##                                     Mean   :0.7058    Mean   :0.6201
##                                     3rd Qu.:0.8571    3rd Qu.:0.7238
##                                     Max.   :0.8571    Max.   :0.8619
##
##           MSUM           Time_Lag      Attribution_Confidence Damage_Assessment
##  Min.      :0.0000    Length:335      Length:335      Length:335
## 1st Qu.:0.0000    Class :character Class :character Class :character
```

```
## Median :0.3333 Mode :character Mode :character Mode :character
## Mean :0.3483
## 3rd Qu.:0.6667
## Max. :1.0000
## Hack_Type Persistence ID AttackDef
## Length:335 Length:335 Min. :1 Length:335
## Class :character Class :character 1st Qu.:2 Class :character
## Mode :character Mode :character Median :3 Mode :character
## Mean :3
## 3rd Qu.:4
## Max. :5
## AssessConf Response Norm ID
## Length:335 Length:335 Length:335 Min. :1
## Class :character Class :character Class :character 1st Qu.:2
## Mode :character Mode :character Mode :character Median :3
## Mean :3
## 3rd Qu.:4
## Max. :5
```

```
stacked_data[14:18] <- lapply(stacked_data[14:18] , factor)
summary(stacked_data)
```

```
## X Progress Durationinseconds Finished
## Min. : 1.00 Min. :100 Min. : 365 Mode:logical
## 1st Qu.:22.00 1st Qu.:100 1st Qu.: 721 TRUE:335
## Median :47.00 Median :100 Median : 975
## Mean :43.81 Mean :100 Mean : 22076
## 3rd Qu.:64.00 3rd Qu.:100 3rd Qu.: 1884
## Max. :95.00 Max. :100 Max. :574328
## ResponseId DistributionChannel UserLanguage Q6
## Length:335 Length:335 Length:335 Length:335
## Class :character Class :character Class :character Class :character
## Mode :character Mode :character Mode :character Mode :character
##
##
## Q7 Q8 KSUM RSUMED
## Length:335 Length:335 Min. :0.5714 Min. :0.2595
## Class :character Class :character 1st Qu.:0.5714 1st Qu.:0.5190
## Mode :character Mode :character Median :0.7143 Median :0.6357
## Mean :0.7058 Mean :0.6201
## 3rd Qu.:0.8571 3rd Qu.:0.7238
## Max. :0.8571 Max. :0.8619
## MSUM Time_Lag Attribution_Confidence Damage_Assessment
## Min. :0.0000 1 month :162 60%:163 10 Million :162
## 1st Qu.:0.0000 6 months:173 90%:172 500 Million:173
## Median :0.3333
## Mean :0.3483
## 3rd Qu.:0.6667
## Max. :1.0000
## Hack_Type
## that temporarily disables a critical service :168
## where valuable confidential information is stolen:167
##
##
```

```
##
##
##
## Both nations have been engaging in ongoing low-impact tactical cyber operations against each other.
## Sylvania has been engaging in ongoing low-impact tactical cyber operations against Freedonia.
##
##
##
##      ID      AttackDef      AssessConf      Response
## Min.   :1      Length:335      Length:335      Length:335
## 1st Qu.:2      Class :character  Class :character  Class :character
## Median :3      Mode  :character  Mode  :character  Mode  :character
## Mean   :3
## 3rd Qu.:4
## Max.   :5
##      Norm      ID
## Length:335      Min.   :1
## Class :character 1st Qu.:2
## Mode  :character Median :3
##                  Mean   :3
##                  3rd Qu.:4
##                  Max.   :5
```

## Creating a communicativity variable

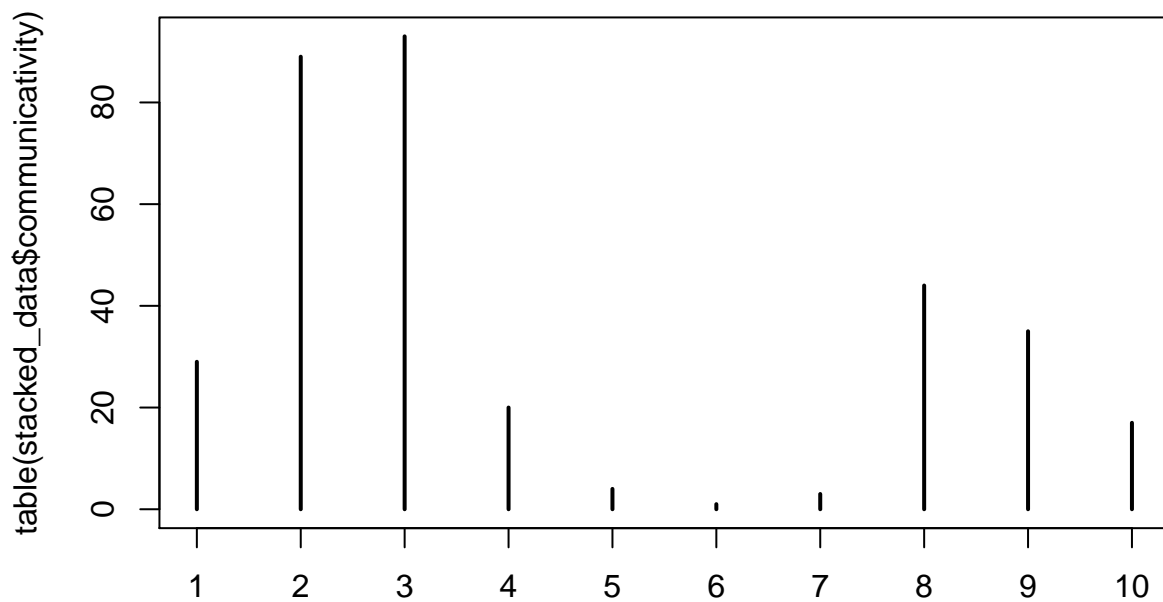
```
likert2 <- c("extremely unconfident"=1,"not very confident"=2,"somewhat confident"=3,"very confident"=4)
stacked_data$AssessConfNo <- likert2[stacked_data$AssessConf]

stacked_data$AttackDefNo <- if_else((stacked_data$AttackDef == "Sylvania is signaling their opposition to"),
stacked_data$communicativity <- if_else(stacked_data$AttackDefNo == 2,abs(stacked_data$AssessConfNo-6),
summary(stacked_data$communicativity)

##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##    1.000  2.000   3.000  4.328  8.000 10.000
table(stacked_data$communicativity)

##
##  1  2  3  4  5  6  7  8  9 10
## 29 89 93 20  4  1  3 44 35 17
plot(table(stacked_data$communicativity))
```





```
table(stacked_data$AssessConf,stacked_data$Response)
```

```
##
##               Deescalate Employ a proportional response Escalate
## extremely confident             5                23          1
## extremely unconfident          4                 1          0
## not very confident             17                 6          0
## somewhat confident             72                59          0
## very confident                 54                59          2
##
##               Escalatory attack
## extremely confident             17
## extremely unconfident           0
## not very confident              0
## somewhat confident              6
## very confident                  9
```

```
# dataH4 <- lapply(dataH4, as.numeric)
# cor(stacked_data$AssessConf,stacked_data$Response)
```

```
Assessed <- as.factor(stacked_data$AssessConf)
Assessed <- as.numeric(Assessed)
```

```
Responded <- as.factor(stacked_data$Response)
Responded <- as.numeric(Responded)
```

```
table(stacked_data$Q6)
```

```
##
## No Yes
## 30 305
```

```
# 30 No
# 305 Yes
```

```
table(stacked_data$Q7)
```

```
##
## 4 year degree
## 200
## 4 year degree,Professional degree
## 20
## Doctorate
## 5
## Professional degree
## 105
## Some college,4 year degree,Professional degree
## 5
```

```
# 40 college graduates
# 26 professional degree
# 1 doctorate
```

```
table(stacked_data$Q8)
```

```
##
## American
## 2
## American (American
##
## Asi
##
## Croatian, Italian, Irish, German
##
## Dutch (but not living in the EU, hence still complying with with first question of this questionnaire)
##
## Filipin
##
## German (No worries, I reside in the American and will not invoke GDP
##
## Ind
##
## India
##
## Jord
##
## Kenya
##
## korea
##
## Latin
##
## Romania
```

```
##
##
##
##
##
##
##
##
```

Singapore  
Suriname  
U  
Whi

```
# 49 Americans
# 4 Indian
# 9 Unique nationality
# 4 ethnicities
# 4 blank
```

## Date Redefined to Create Cross Correlation Matrix

```
unique(stacked_data$AttackDef)
```

```
## [1] "Sylvania is signaling their opposition to our prior high intensity attack. They want to strateg
## [2] "Sylvania is simply advancing its immediate interest fulfilling a tactical objective. Our prior l
stacked_data$AttackDefNeg <- if_else((stacked_data$AttackDef == "Sylvania is signaling their opposition
```

```
#Removing ID variable
data1 <- stacked_data %>%
  dplyr::select(communicativity,AttackDef,Response,Norm,Time_Lag:Persistence,RSUMED) %>%
  mutate(AttackDef = recode(AttackDef, "Sylvania is signaling their opposition to our prior high intens
  mutate(Response = recode(Response, "Deescalate" = 1, "Employ a proportional response" = 2, "Escalate"
  mutate(Norm = recode(Norm, "Yes" = 2, "No" = 1)) %>%
  mutate(Damage_Assessment = recode(Damage_Assessment, "500 Million" = 2, "10 Million" = 1)) %>%
  mutate(Attribution_Confidence = recode(Attribution_Confidence, "90%" = 2, "60%" = 1)) %>%
  mutate(Time_Lag = recode(Time_Lag, "6 months" = 1, "1 month" = 2)) %>%
  mutate(Hack_Type = recode(Hack_Type, "that temporarily disables a critical service" = 2, "where valual
  mutate(Persistence = recode(Persistence, "Sylvania has been engaging in ongoing low-impact tactical cy
    "Both nations have been engaging in ongoing low-impact tactical cyber oper
```

```
table(data1$communicativity,data1$Norm)
```

```
##
##      1  2
##  1   3  1
##  2  22 26
##  3  27 32
##  4   6  8
##  5   0  3
##  6   1  0
##  7   0  3
##  8   3 10
##  9   4  2
## 10   0  1
```

```
# Time_Lag coded so that 1 month has higher "intensity" than 6 months based on hypothesis that this wou
```

```

dataH4 <- data1 %>%
  filter(!is.na(Norm))

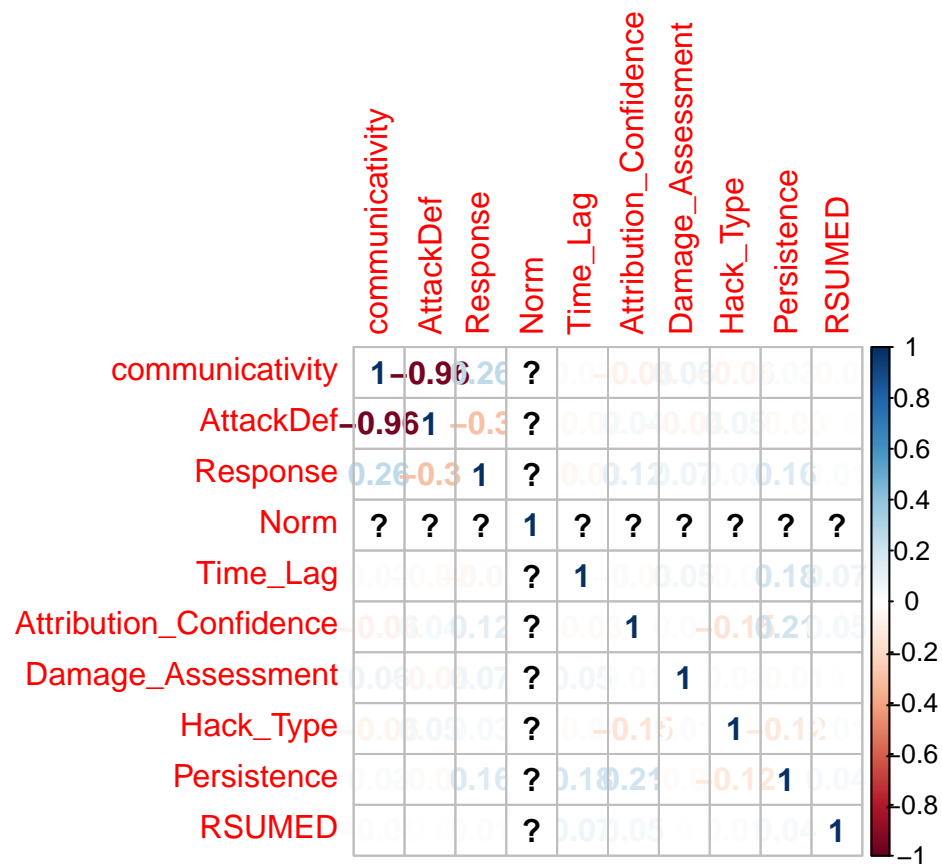
dataH4 <- lapply(dataH4, as.numeric)
dataH4 <- as.data.frame(dataH4)

# cor(data1)
# data1 <- subset (data1, select = -Norm)
# data1 <- subset (data1, select = -Response)
# data1

# data1 <- data1[,-c(Norm)]

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

```



```
data1[2:9] <- lapply(data1[2:9] , factor)
```

```
table(data1$Hack_Type,data1$Time_Lag)
```

```
##
##      1  2
##  1 85 82
##  2 88 80
```

```
table(data1$Response,data1$communicativity)
```

```
##
##      1  2  3  4  5  6  7  8  9 10
##    1  4 48 59 14  3  1  3 13  6  1
##    2 17 35 32  6  1  0  0 27 24  6
##    3  8  6  2  0  0  0  0  4  5 10
```

```
summary(data1$Norm)
```

```
##      1      2 NA's
##    66    86   183
```

```
# class(stacked_data$Hack_Type)
```

```
# levels(stacked_data$Hack_Type)
```

```
# stacked_data$Hack_Type <- relevel(stacked_data$Hack_Type, ref = "where valuable confidential informat
```

## Plotting Outliers

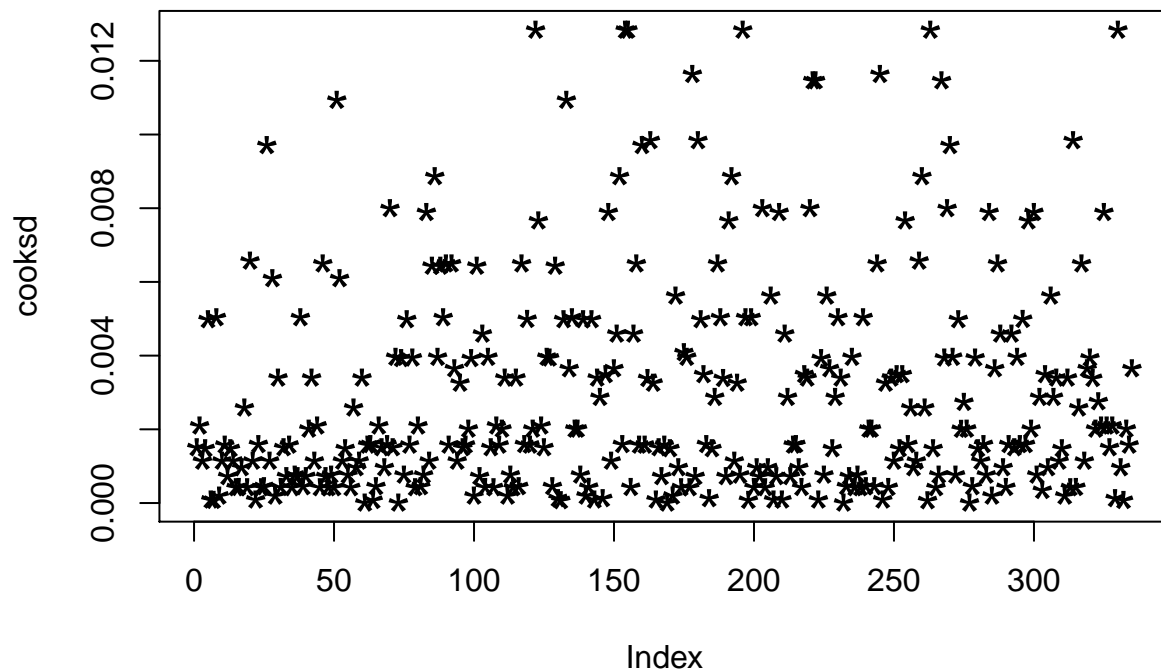
```
# Plot of data with outliers.
```

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

```
sample_size <- nrow(stacked_data)
```

```
plot(cooksds, pch="*", cex=2, main="Influential Obs by Cooks distance") # plot cook's distance
```

### Influential Obs by Cooks distance



```
# Hypothesis 1: Attack Def rather than Communicativity
```

```

# Hypothesis with Attack Def rather than Communicativity
logitregH1a <- glm(formula = AttackDef ~ Damage_Assessment + Hack_Type + Attribution_Confidence + Persi
summary(logitregH1a)

##
## Call:
## glm(formula = AttackDef ~ Damage_Assessment + Hack_Type + Attribution_Confidence +
##     Persistence + Time_Lag, family = "binomial", data = data1)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -1.7002  -1.4647   0.7887   0.8585   1.0106
##
## Coefficients:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)      0.79455    0.29052   2.735  0.00624 **
## Damage_Assessment2 -0.20021    0.24096  -0.831  0.40603
## Hack_Type2        0.26196    0.24386   1.074  0.28273
## Attribution_Confidence2 0.26053    0.24794   1.051  0.29337
## Persistence2      -0.14051    0.25102  -0.560  0.57565
## Time_Lag2        -0.04804    0.24489  -0.196  0.84449
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##      Null deviance: 408.43  on 334  degrees of freedom
## Residual deviance: 405.43  on 329  degrees of freedom
## AIC: 417.43
##
## Number of Fisher Scoring iterations: 4
logitregH1b <- glm(formula = AttackDef ~ Damage_Assessment * Hack_Type * Attribution_Confidence + Persi
summary(logitregH1b)

##
## Call:
## glm(formula = AttackDef ~ Damage_Assessment * Hack_Type * Attribution_Confidence +
##     Persistence * Time_Lag, family = "binomial", data = data1)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -2.3925  -1.4313   0.8288   0.8933   1.0076
##
## Coefficients:
##              Estimate Std. Error
## (Intercept)      0.9994    0.4207
## Damage_Assessment2 -0.1386    0.5204
## Hack_Type2        -0.1724    0.4897
## Attribution_Confidence2 -0.2088    0.4895
## Persistence2      -0.3770    0.3565
## Time_Lag2        -0.2474    0.3539
## Damage_Assessment2:Hack_Type2  0.2870    0.6851
## Damage_Assessment2:Attribution_Confidence2  0.3812    0.6821

```

```
## Hack_Type2:Attribution_Confidence2      2.3261      0.9324
## Persistence2:Time_Lag2                  0.4833      0.5013
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2 -2.6200      1.1429
##                                           z value Pr(>|z|)
## (Intercept)                             2.376    0.0175 *
## Damage_Assessment2                     -0.266    0.7899
## Hack_Type2                             -0.352    0.7248
## Attribution_Confidence2                 -0.427    0.6697
## Persistence2                           -1.057    0.2903
## Time_Lag2                             -0.699    0.4845
## Damage_Assessment2:Hack_Type2           0.419    0.6753
## Damage_Assessment2:Attribution_Confidence2 0.559    0.5762
## Hack_Type2:Attribution_Confidence2      2.495    0.0126 *
## Persistence2:Time_Lag2                  0.964    0.3350
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2 -2.292    0.0219 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
## Null deviance: 408.43 on 334 degrees of freedom
## Residual deviance: 393.98 on 324 degrees of freedom
## AIC: 415.98
##
## Number of Fisher Scoring iterations: 5
```

## Hypothesis 2: Communitivity, Divided Bimodal

```
communicative <- data1 %>%
  filter(AttackDef == 1)

instrumental <- data1 %>%
  filter(AttackDef == 2)

logitreg_2I1 <- glm(formula = communicativity ~ Damage_Assessment + Hack_Type + Attribution_Confidence,
summary(logitreg_2I1)

##
## Call:
## glm(formula = communicativity ~ Damage_Assessment + Hack_Type +
## Attribution_Confidence, data = instrumental)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -1.8321  -0.6126  -0.1843   0.6304   2.5962
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      2.76369    0.11943  23.141 < 2e-16 ***
## Damage_Assessment2  0.06845    0.11169   0.613  0.54054
## Hack_Type2       -0.15112    0.11241  -1.344  0.18014
## Attribution_Confidence2 -0.42829    0.11250  -3.807  0.00018 ***
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 0.7320629)
##
##      Null deviance: 180.74  on 234  degrees of freedom
## Residual deviance: 169.11  on 231  degrees of freedom
## AIC: 599.57
##
## Number of Fisher Scoring iterations: 2

logitreg_2I2 <- glm(formula = communicativity ~ Damage_Assessment * Hack_Type * Attribution_Confidence,
summary(logitreg_2I2)

##
## Call:
## glm(formula = communicativity ~ Damage_Assessment * Hack_Type *
##      Attribution_Confidence, data = instrumental)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -1.96970  -0.52941  -0.06452   0.56250   2.47059
##
## Coefficients:
##
##                                Estimate Std. Error
## (Intercept)                   2.86957    0.17504
## Damage_Assessment2            -0.45290    0.24496
## Hack_Type2                    -0.32118    0.23103
## Attribution_Confidence2        -0.43207    0.22948
## Damage_Assessment2:Hack_Type2   0.87421    0.32263
## Damage_Assessment2:Attribution_Confidence2 0.54481    0.32055
## Hack_Type2:Attribution_Confidence2 -0.05181    0.31326
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2 -0.91953    0.44235
##
##                                t value Pr(>|t|)
## (Intercept)                   16.393 < 2e-16 ***
## Damage_Assessment2            -1.849  0.06577 .
## Hack_Type2                    -1.390  0.16582
## Attribution_Confidence2        -1.883  0.06101 .
## Damage_Assessment2:Hack_Type2   2.710  0.00725 **
## Damage_Assessment2:Attribution_Confidence2 1.700  0.09058 .
## Hack_Type2:Attribution_Confidence2 -0.165  0.86879
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2 -2.079  0.03877 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 0.7047241)
##
##      Null deviance: 180.74  on 234  degrees of freedom
## Residual deviance: 159.97  on 227  degrees of freedom
## AIC: 594.52
##
## Number of Fisher Scoring iterations: 2
```

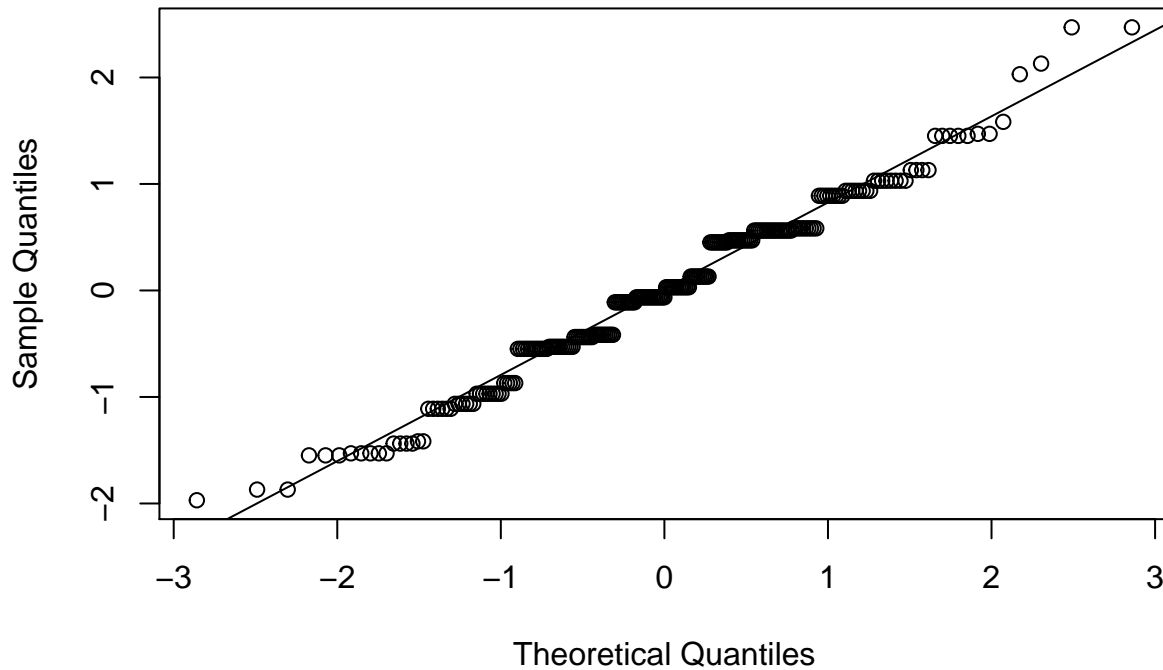


```
hist(logitreg_2I2$residuals)
```



```
qqnorm(logitreg_2I2$residuals);qqline(logitreg_2I2$residuals)
```

## Normal Q-Q Plot



```
logitreg_2I3 <- glm(formula = communicativity ~ Damage_Assessment * Hack_Type * Attribution_Confidence +
summary(logitreg_2I3)
```

```
##
## Call:
## glm(formula = communicativity ~ Damage_Assessment * Hack_Type *
##      Attribution_Confidence + Time_Lag * Persistence, data = instrumental)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -1.97201  -0.48088   0.01225   0.57932   2.52941
##
## Coefficients:
##                                     Estimate Std. Error
## (Intercept)                        2.84857    0.19028
## Damage_Assessment2                  -0.45465    0.24581
## Hack_Type2                          -0.31779    0.23133
## Attribution_Confidence2              -0.43567    0.23301
## Time_Lag2                           0.01574    0.15955
## Persistence2                        0.21263    0.16198
## Damage_Assessment2:Hack_Type2        0.89588    0.32442
## Damage_Assessment2:Attribution_Confidence2 0.51233    0.32315
## Hack_Type2:Attribution_Confidence2  -0.09207    0.31592
## Time_Lag2:Persistence2              -0.27827    0.22868
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2 -0.89662    0.44634
##
##                                     t value Pr(>|t|)
```

```
## (Intercept) 14.971 < 2e-16 ***
## Damage_Assessment2 -1.850 0.06570 .
## Hack_Type2 -1.374 0.17089
## Attribution_Confidence2 -1.870 0.06282 .
## Time_Lag2 0.099 0.92152
## Persistence2 1.313 0.19062
## Damage_Assessment2:Hack_Type2 2.761 0.00623 **
## Damage_Assessment2:Attribution_Confidence2 1.585 0.11429
## Hack_Type2:Attribution_Confidence2 -0.291 0.77100
## Time_Lag2:Persistence2 -1.217 0.22493
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2 -2.009 0.04576 *
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 0.7052733)
##
## Null deviance: 180.74 on 234 degrees of freedom
## Residual deviance: 157.98 on 224 degrees of freedom
## AIC: 597.58
##
## Number of Fisher Scoring iterations: 2
```

```
logitreg_2I4 <- glm(formula = communicativity ~ Damage_Assessment + Hack_Type + Attribution_Confidence +
summary(logitreg_2I4)
```

```
##
## Call:
## glm(formula = communicativity ~ Damage_Assessment + Hack_Type +
## Attribution_Confidence + Time_Lag + Persistence, data = communicative)
##
## Deviance Residuals:
## Min 1Q Median 3Q Max
## -2.2911 -0.4533 -0.1055 0.6094 1.5836
##
## Coefficients:
## Estimate Std. Error t value Pr(>|t|)
## (Intercept) 8.10546 0.18770 43.183 < 2e-16 ***
## Damage_Assessment2 0.10456 0.16341 0.640 0.52381
## Hack_Type2 0.22989 0.16904 1.360 0.17709
## Attribution_Confidence2 0.56132 0.16781 3.345 0.00118 **
## Time_Lag2 0.08106 0.16384 0.495 0.62190
## Persistence2 0.11791 0.16402 0.719 0.47400
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 0.6350583)
##
## Null deviance: 69.040 on 99 degrees of freedom
## Residual deviance: 59.695 on 94 degrees of freedom
## AIC: 246.2
##
## Number of Fisher Scoring iterations: 2
```

```
logitreg_2C1 <- glm(formula = communicativity ~ Damage_Assessment * Hack_Type * Attribution_Confidence,
summary(logitreg_2C1)
```

```
##
## Call:
## glm(formula = communicativity ~ Damage_Assessment * Hack_Type *
##      Attribution_Confidence, data = communicative)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -2.1667  -0.5000  -0.1429   0.5719   1.5625
##
## Coefficients:
##                                     Estimate Std. Error
## (Intercept)                        8.4000     0.2535
## Damage_Assessment2                 -0.2333     0.3432
## Hack_Type2                         0.0375     0.3231
## Attribution_Confidence2             0.2471     0.3194
## Damage_Assessment2:Hack_Type2       0.2958     0.4515
## Damage_Assessment2:Attribution_Confidence2 0.5863     0.4454
## Hack_Type2:Attribution_Confidence2 0.3154     0.6807
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2 -0.5059     0.8072
##                                     t value Pr(>|t|)
## (Intercept)                      33.142  <2e-16 ***
## Damage_Assessment2                -0.680    0.498
## Hack_Type2                        0.116    0.908
## Attribution_Confidence2            0.773    0.441
## Damage_Assessment2:Hack_Type2      0.655    0.514
## Damage_Assessment2:Attribution_Confidence2 1.316    0.191
## Hack_Type2:Attribution_Confidence2 0.463    0.644
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2 -0.627    0.532
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 0.6424001)
##
##      Null deviance: 69.040  on 99  degrees of freedom
## Residual deviance: 59.101  on 92  degrees of freedom
## AIC: 249.2
##
## Number of Fisher Scoring iterations: 2
```

## Hypothesis 3: Without interaction effects

```
levels(stacked_data$Hack_Type)
```

```
## [1] "that temporarily disables a critical service"
## [2] "where valuable confidential information is stolen"
```

```
levels(data1$Hack_Type)
```

```
## [1] "1" "2"
```

```
# Hypothesis
```

```
logitregH3a <- glm(formula = communicativity ~ Damage_Assessment + Hack_Type + Attribution_Confidence,
summary(logitregH3a)
```

```
##
## Call:
## glm(formula = communicativity ~ Damage_Assessment + Hack_Type +
##      Attribution_Confidence, data = data1)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -3.946  -2.130  -1.154   3.427   5.915
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      4.5727     0.3375  13.548  <2e-16 ***
## Damage_Assessment2  0.3734     0.3216   1.161    0.246
## Hack_Type2       -0.4186     0.3249  -1.288    0.199
## Attribution_Confidence2 -0.4427     0.3250  -1.362    0.174
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 8.647936)
##
##      Null deviance: 2899.9  on 334  degrees of freedom
## Residual deviance: 2862.5  on 331  degrees of freedom
## AIC: 1679.4
##
## Number of Fisher Scoring iterations: 2
```

*#Type a message*

```
logitregH3b <- glm(formula = communicativity ~ Damage_Assessment * Hack_Type * Attribution_Confidence,
summary(logitregH3b)
```

```
##
## Call:
## glm(formula = communicativity ~ Damage_Assessment * Hack_Type *
##      Attribution_Confidence, data = data1)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -3.617  -2.422  -1.510   3.408   6.515
##
## Coefficients:
##              Estimate Std. Error
## (Intercept)      4.545455     0.506969
## Damage_Assessment2 -0.212121     0.701866
## Hack_Type2         0.007737     0.661420
## Attribution_Confidence2 0.046382     0.655828
## Damage_Assessment2:Hack_Type2 0.275951     0.923869
## Damage_Assessment2:Attribution_Confidence2 0.130489     0.915862
## Hack_Type2:Attribution_Confidence2 -2.114725     0.931443
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2 1.833028     1.289808
##              t value Pr(>|t|)
## (Intercept)      8.966  <2e-16 ***
## Damage_Assessment2 -0.302    0.7627
## Hack_Type2         0.012    0.9907
## Attribution_Confidence2 0.071    0.9437
## Damage_Assessment2:Hack_Type2 0.299    0.7654
```

```

## Damage_Assessment2:Attribution_Confidence2          0.142    0.8868
## Hack_Type2:Attribution_Confidence2                  -2.270    0.0238 *
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2  1.421    0.1562
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 8.481569)
##
## Null deviance: 2899.9 on 334 degrees of freedom
## Residual deviance: 2773.5 on 327 degrees of freedom
## AIC: 1676.8
##
## Number of Fisher Scoring iterations: 2
print(xtable::xtable(logitregH1b, digits = 2, caption='Communicativity: Message Variables with Interact.',
  file = "logitregH3b.tex",
  caption.placement = 'top', include.colnames = TRUE)

logitregH3c <- glm(formula = communicativity ~ Damage_Assessment + Hack_Type + Attribution_Confidence +
summary(logitregH3c)

##
## Call:
## glm(formula = communicativity ~ Damage_Assessment + Hack_Type +
## Attribution_Confidence + Persistence, data = data1)
##
## Deviance Residuals:
## Min      1Q  Median      3Q      Max
## -4.075 -2.190 -1.300  3.323  6.039
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      4.4695     0.3692  12.106 <2e-16 ***
## Damage_Assessment2  0.3771     0.3219   1.171   0.242
## Hack_Type2       -0.3985     0.3264  -1.221   0.223
## Attribution_Confidence2 -0.4869     0.3315  -1.469   0.143
## Persistence2      0.2287     0.3300   0.693   0.489
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 8.66154)
##
## Null deviance: 2899.9 on 334 degrees of freedom
## Residual deviance: 2858.3 on 330 degrees of freedom
## AIC: 1680.9
##
## Number of Fisher Scoring iterations: 2
logitregH3d <- glm(formula = communicativity ~ Damage_Assessment + Hack_Type + Attribution_Confidence +
summary(logitregH3d)

##
## Call:
## glm(formula = communicativity ~ Damage_Assessment + Hack_Type +
## Attribution_Confidence + Persistence + Time_Lag, data = data1)

```

```
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -4.080   -2.182   -1.306    3.318    6.044
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      4.46395     0.39171  11.396 <2e-16 ***
## Damage_Assessment2  0.37628     0.32290   1.165   0.245
## Hack_Type2       -0.39843     0.32693  -1.219   0.224
## Attribution_Confidence2 -0.48598     0.33272  -1.461   0.145
## Persistence2      0.22590     0.33677   0.671   0.503
## Time_Lag2         0.01407     0.32898   0.043   0.966
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 8.687818)
##
##      Null deviance: 2899.9  on 334  degrees of freedom
## Residual deviance: 2858.3  on 329  degrees of freedom
## AIC: 1682.9
##
## Number of Fisher Scoring iterations: 2
```

## Hypothesis 4: With interaction effects

```
# Hypothesis includes all possible interactions (coercive signal)
logitregH4a <- glm(formula = communicativity ~ Damage_Assessment * Hack_Type * Attribution_Confidence *
                  Time_Lag, data = data1)
summary(logitregH4a)

##
## Call:
## glm(formula = communicativity ~ Damage_Assessment * Hack_Type *
##      Attribution_Confidence * Persistence * Time_Lag, data = data1)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -4.000   -2.117   -1.000    2.659    6.400
##
## Coefficients:
##              Estimate
## (Intercept)      4.25000
## Damage_Assessment2  0.25000
## Hack_Type2       -0.62500
## Attribution_Confidence2  1.53571
## Persistence2      1.89286
## Time_Lag2       -0.82143
## Damage_Assessment2:Hack_Type2 -0.06548
## Damage_Assessment2:Attribution_Confidence2 -1.53571
## Hack_Type2:Attribution_Confidence2 -3.16071
## Damage_Assessment2:Persistence2 -1.55952
```

## Hack_Type2:Persistence2	-0.01786
## Attribution_Confidence2:Persistence2	-3.07857
## Damage_Assessment2:Time_Lag2	-0.05357
## Hack_Type2:Time_Lag2	3.04258
## Attribution_Confidence2:Time_Lag2	-2.96429
## Persistence2:Time_Lag2	-0.75000
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2	3.68452
## Damage_Assessment2:Hack_Type2:Persistence2	1.87500
## Damage_Assessment2:Attribution_Confidence2:Persistence2	2.80774
## Hack_Type2:Attribution_Confidence2:Persistence2	1.93084
## Damage_Assessment2:Hack_Type2:Time_Lag2	-0.31044
## Damage_Assessment2:Attribution_Confidence2:Time_Lag2	3.93929
## Hack_Type2:Attribution_Confidence2:Time_Lag2	0.54313
## Damage_Assessment2:Persistence2:Time_Lag2	1.20833
## Hack_Type2:Persistence2:Time_Lag2	-3.37115
## Attribution_Confidence2:Persistence2:Time_Lag2	4.11753
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2:Persistence2	-4.09291
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2:Time_Lag2	-3.20861
## Damage_Assessment2:Hack_Type2:Persistence2:Time_Lag2	-0.19432
## Damage_Assessment2:Attribution_Confidence2:Persistence2:Time_Lag2	-4.85375
## Hack_Type2:Attribution_Confidence2:Persistence2:Time_Lag2	0.76206
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2:Persistence2:Time_Lag2	3.82372
##	Std. Error
## (Intercept)	0.84528
## Damage_Assessment2	1.25375
## Hack_Type2	1.11820
## Attribution_Confidence2	1.15192
## Persistence2	1.39261
## Time_Lag2	1.39261
## Damage_Assessment2:Hack_Type2	1.58621
## Damage_Assessment2:Attribution_Confidence2	1.74406
## Hack_Type2:Attribution_Confidence2	1.64930
## Damage_Assessment2:Persistence2	2.05566
## Hack_Type2:Persistence2	1.88334
## Attribution_Confidence2:Persistence2	1.84640
## Damage_Assessment2:Time_Lag2	1.96685
## Hack_Type2:Time_Lag2	1.77053
## Attribution_Confidence2:Time_Lag2	2.32589
## Persistence2:Time_Lag2	2.09501
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2	2.40748
## Damage_Assessment2:Hack_Type2:Persistence2	3.24479
## Damage_Assessment2:Attribution_Confidence2:Persistence2	2.66249
## Hack_Type2:Attribution_Confidence2:Persistence2	2.57947
## Damage_Assessment2:Hack_Type2:Time_Lag2	2.48731
## Damage_Assessment2:Attribution_Confidence2:Time_Lag2	3.00894
## Hack_Type2:Attribution_Confidence2:Time_Lag2	3.02942
## Damage_Assessment2:Persistence2:Time_Lag2	2.90890
## Hack_Type2:Persistence2:Time_Lag2	2.74110
## Attribution_Confidence2:Persistence2:Time_Lag2	3.01772
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2:Persistence2	4.09399
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2:Time_Lag2	3.99607
## Damage_Assessment2:Hack_Type2:Persistence2:Time_Lag2	4.20839
## Damage_Assessment2:Attribution_Confidence2:Persistence2:Time_Lag2	4.01117
## Hack_Type2:Attribution_Confidence2:Persistence2:Time_Lag2	4.09972



```

## Damage_Assessment2:Hack_Type2:Attribution_Confidence2:Persistence2:Time_Lag2    5.77739
##                                                                 t value
## (Intercept)                                                                 5.028
## Damage_Assessment2                                                            0.199
## Hack_Type2                                                                    -0.559
## Attribution_Confidence2                                                         1.333
## Persistence2                                                                    1.359
## Time_Lag2                                                                      -0.590
## Damage_Assessment2:Hack_Type2                                                  -0.041
## Damage_Assessment2:Attribution_Confidence2                                  -0.881
## Hack_Type2:Attribution_Confidence2                                           -1.916
## Damage_Assessment2:Persistence2                                               -0.759
## Hack_Type2:Persistence2                                                        -0.009
## Attribution_Confidence2:Persistence2                                          -1.667
## Damage_Assessment2:Time_Lag2                                                  -0.027
## Hack_Type2:Time_Lag2                                                           1.718
## Attribution_Confidence2:Time_Lag2                                             -1.274
## Persistence2:Time_Lag2                                                        -0.358
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2                       1.530
## Damage_Assessment2:Hack_Type2:Persistence2                                   0.578
## Damage_Assessment2:Attribution_Confidence2:Persistence2                     1.055
## Hack_Type2:Attribution_Confidence2:Persistence2                             0.749
## Damage_Assessment2:Hack_Type2:Time_Lag2                                      -0.125
## Damage_Assessment2:Attribution_Confidence2:Time_Lag2                       1.309
## Hack_Type2:Attribution_Confidence2:Time_Lag2                               0.179
## Damage_Assessment2:Persistence2:Time_Lag2                                    0.415
## Hack_Type2:Persistence2:Time_Lag2                                           -1.230
## Attribution_Confidence2:Persistence2:Time_Lag2                              1.364
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2:Persistence2          -1.000
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2:Time_Lag2            -0.803
## Damage_Assessment2:Hack_Type2:Persistence2:Time_Lag2                       -0.046
## Damage_Assessment2:Attribution_Confidence2:Persistence2:Time_Lag2          -1.210
## Hack_Type2:Attribution_Confidence2:Persistence2:Time_Lag2                  0.186
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2:Persistence2:Time_Lag2 0.662
##                                                                 Pr(>|t|)
## (Intercept)                                                                 8.5e-07
## Damage_Assessment2                                                            0.8421
## Hack_Type2                                                                    0.5766
## Attribution_Confidence2                                                         0.1835
## Persistence2                                                                    0.1751
## Time_Lag2                                                                      0.5557
## Damage_Assessment2:Hack_Type2                                                  0.9671
## Damage_Assessment2:Attribution_Confidence2                                  0.3793
## Hack_Type2:Attribution_Confidence2                                           0.0563
## Damage_Assessment2:Persistence2                                               0.4487
## Hack_Type2:Persistence2                                                        0.9924
## Attribution_Confidence2:Persistence2                                          0.0965
## Damage_Assessment2:Time_Lag2                                                  0.9783
## Hack_Type2:Time_Lag2                                                           0.0867
## Attribution_Confidence2:Time_Lag2                                             0.2035
## Persistence2:Time_Lag2                                                        0.7206
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2                       0.1269
## Damage_Assessment2:Hack_Type2:Persistence2                                   0.5638
## Damage_Assessment2:Attribution_Confidence2:Persistence2                     0.2925

```

```

## Hack_Type2:Attribution_Confidence2:Persistence2 0.4547
## Damage_Assessment2:Hack_Type2:Time_Lag2 0.9008
## Damage_Assessment2:Attribution_Confidence2:Time_Lag2 0.1915
## Hack_Type2:Attribution_Confidence2:Time_Lag2 0.8578
## Damage_Assessment2:Persistence2:Time_Lag2 0.6781
## Hack_Type2:Persistence2:Time_Lag2 0.2197
## Attribution_Confidence2:Persistence2:Time_Lag2 0.1734
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2:Persistence2 0.3182
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2:Time_Lag2 0.4226
## Damage_Assessment2:Hack_Type2:Persistence2:Time_Lag2 0.9632
## Damage_Assessment2:Attribution_Confidence2:Persistence2:Time_Lag2 0.2272
## Hack_Type2:Attribution_Confidence2:Persistence2:Time_Lag2 0.8527
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2:Persistence2:Time_Lag2 0.5086
##
## (Intercept) ***
## Damage_Assessment2
## Hack_Type2
## Attribution_Confidence2
## Persistence2
## Time_Lag2
## Damage_Assessment2:Hack_Type2
## Damage_Assessment2:Attribution_Confidence2
## Hack_Type2:Attribution_Confidence2 .
## Damage_Assessment2:Persistence2
## Hack_Type2:Persistence2
## Attribution_Confidence2:Persistence2 .
## Damage_Assessment2:Time_Lag2
## Hack_Type2:Time_Lag2 .
## Attribution_Confidence2:Time_Lag2
## Persistence2:Time_Lag2
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2
## Damage_Assessment2:Hack_Type2:Persistence2
## Damage_Assessment2:Attribution_Confidence2:Persistence2
## Hack_Type2:Attribution_Confidence2:Persistence2
## Damage_Assessment2:Hack_Type2:Time_Lag2
## Damage_Assessment2:Attribution_Confidence2:Time_Lag2
## Hack_Type2:Attribution_Confidence2:Time_Lag2
## Damage_Assessment2:Persistence2:Time_Lag2
## Hack_Type2:Persistence2:Time_Lag2
## Attribution_Confidence2:Persistence2:Time_Lag2
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2:Persistence2
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2:Time_Lag2
## Damage_Assessment2:Hack_Type2:Persistence2:Time_Lag2
## Damage_Assessment2:Attribution_Confidence2:Persistence2:Time_Lag2
## Hack_Type2:Attribution_Confidence2:Persistence2:Time_Lag2
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2:Persistence2:Time_Lag2
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 8.573999)
##
## Null deviance: 2899.9 on 334 degrees of freedom
## Residual deviance: 2597.9 on 303 degrees of freedom
## AIC: 1702.9

```

```
##
## Number of Fisher Scoring iterations: 2
```

```
summary(logitregH4a)$coeff[-1,4]<0.05
```

```
##                                     Damage_Assessment2
##                                     FALSE
##                                     Hack_Type2
##                                     FALSE
##                                     Attribution_Confidence2
##                                     FALSE
##                                     Persistence2
##                                     FALSE
##                                     Time_Lag2
##                                     FALSE
##                                     Damage_Assessment2:Hack_Type2
##                                     FALSE
##                                     Damage_Assessment2:Attribution_Confidence2
##                                     FALSE
##                                     Hack_Type2:Attribution_Confidence2
##                                     FALSE
##                                     Damage_Assessment2:Persistence2
##                                     FALSE
##                                     Hack_Type2:Persistence2
##                                     FALSE
##                                     Attribution_Confidence2:Persistence2
##                                     FALSE
##                                     Damage_Assessment2:Time_Lag2
##                                     FALSE
##                                     Hack_Type2:Time_Lag2
##                                     FALSE
##                                     Attribution_Confidence2:Time_Lag2
##                                     FALSE
##                                     Persistence2:Time_Lag2
##                                     FALSE
##                                     Damage_Assessment2:Hack_Type2:Attribution_Confidence2
##                                     FALSE
##                                     Damage_Assessment2:Hack_Type2:Persistence2
##                                     FALSE
##                                     Damage_Assessment2:Attribution_Confidence2:Persistence2
##                                     FALSE
##                                     Hack_Type2:Attribution_Confidence2:Persistence2
##                                     FALSE
##                                     Damage_Assessment2:Hack_Type2:Time_Lag2
##                                     FALSE
##                                     Damage_Assessment2:Attribution_Confidence2:Time_Lag2
##                                     FALSE
##                                     Hack_Type2:Attribution_Confidence2:Time_Lag2
##                                     FALSE
##                                     Damage_Assessment2:Persistence2:Time_Lag2
##                                     FALSE
##                                     Hack_Type2:Persistence2:Time_Lag2
##                                     FALSE
##                                     Attribution_Confidence2:Persistence2:Time_Lag2
##                                     FALSE
```

```

##          Damage_Assessment2:Hack_Type2:Attribution_Confidence2:Persistence2
##                                                     FALSE
##          Damage_Assessment2:Hack_Type2:Attribution_Confidence2:Time_Lag2
##                                                     FALSE
##          Damage_Assessment2:Hack_Type2:Persistence2:Time_Lag2
##                                                     FALSE
##          Damage_Assessment2:Attribution_Confidence2:Persistence2:Time_Lag2
##                                                     FALSE
##          Hack_Type2:Attribution_Confidence2:Persistence2:Time_Lag2
##                                                     FALSE
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2:Persistence2:Time_Lag2
##                                                     FALSE

# Only includes interactions of the Message variables with other message variables and Context with oth
logitregH4b <- glm(formula = communicativity ~ Damage_Assessment + Hack_Type + Attribution_Confidence +
                  Attribution_Confidence + Attribution_Confidence * Hack_Type
                  + Persistence + Time_Lag + Persistence * Time_Lag, data = data1)
summary(logitregH4b)

##
## 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
## -3.971  -2.112  -1.223   3.272   6.293
##
## Coefficients:
##
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      4.5817    0.5232   8.758  <2e-16
## Damage_Assessment2 -0.7593    0.5911  -1.284   0.1999
## Hack_Type2       -0.4701    0.5715  -0.823   0.4114
## Attribution_Confidence2 -0.4289    0.5706  -0.752   0.4528
## Persistence2      0.5954    0.4642   1.282   0.2006
## Time_Lag2        0.3289    0.4648   0.708   0.4797
## Damage_Assessment2:Hack_Type2  1.2931    0.6506   1.987   0.0477
## Damage_Assessment2:Attribution_Confidence2  0.9824    0.6510   1.509   0.1323
## Hack_Type2:Attribution_Confidence2 -1.2139    0.6483  -1.872   0.0621
## Persistence2:Time_Lag2 -0.6862    0.6603  -1.039   0.2995
##
## (Intercept) ***
## Damage_Assessment2
## Hack_Type2
## Attribution_Confidence2
## Persistence2
## Time_Lag2
## Damage_Assessment2:Hack_Type2 *
## Damage_Assessment2:Attribution_Confidence2
## Hack_Type2:Attribution_Confidence2 .
## Persistence2:Time_Lag2
## ---

```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
```

```
## (Dispersion parameter for gaussian family taken to be 8.541814)
```

```
##
```

```
## Null deviance: 2899.9 on 334 degrees of freedom
```

```
## Residual deviance: 2776.1 on 325 degrees of freedom
```

```
## AIC: 1681.1
```

```
##
```

```
## Number of Fisher Scoring iterations: 2
```

```
# Running a regression with all interaction effects between two variables (excludes interaction effects
```

```
logitregH4c <- 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(logitregH4c)
```

```
##
```

```
## 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  
## -4.070 -2.070 -1.098 3.099 6.274
```

```
##
```

```
## Coefficients:
```

```
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 4.90224 0.61744 7.940 3.49e-14  
## Damage_Assessment2 -0.94998 0.72045 -1.319 0.1883  
## Hack_Type2 -1.00319 0.68267 -1.470 0.1427  
## Attribution_Confidence2 -0.22262 0.71826 -0.310 0.7568  
## Persistence2 0.89010 0.76483 1.164 0.2454  
## Time_Lag2 -0.80388 0.76426 -1.052 0.2937  
## Damage_Assessment2:Hack_Type2 1.20287 0.65947 1.824 0.0691  
## Damage_Assessment2:Attribution_Confidence2 0.98345 0.67599 1.455 0.1467  
## Hack_Type2:Attribution_Confidence2 -1.18683 0.66796 -1.777 0.0766  
## Persistence2:Time_Lag2 -0.47464 0.69637 -0.682 0.4960  
## Damage_Assessment2:Persistence2 -0.22908 0.69268 -0.331 0.7411  
## Hack_Type2:Persistence2 -0.20903 0.67977 -0.308 0.7587  
## Attribution_Confidence2:Persistence2 -0.30401 0.69038 -0.440 0.6600  
## Damage_Assessment2:Time_Lag2 0.69674 0.66974 1.040 0.2990  
## Hack_Type2:Time_Lag2 1.39402 0.67090 2.078 0.0385  
## Attribution_Confidence2:Time_Lag2 -0.08703 0.69170 -0.126 0.9000
```

```
##
```

```
## (Intercept) ***
```

```
## Damage_Assessment2
```

```
## Hack_Type2
```

```
## Attribution_Confidence2
```

```

## Persistence2
## Time_Lag2
## Damage_Assessment2:Hack_Type2 .
## Damage_Assessment2:Attribution_Confidence2
## Hack_Type2:Attribution_Confidence2 .
## Persistence2:Time_Lag2
## Damage_Assessment2:Persistence2
## Hack_Type2:Persistence2
## Attribution_Confidence2:Persistence2
## Damage_Assessment2:Time_Lag2
## Hack_Type2:Time_Lag2 *
## Attribution_Confidence2:Time_Lag2
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 8.540591)
##
## Null deviance: 2899.9 on 334 degrees of freedom
## Residual deviance: 2724.4 on 319 degrees of freedom
## AIC: 1686.8
##
## 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
logitregH4d <- glm(formula = communicativity ~ Damage_Assessment + Hack_Type + Attribution_Confidence +
summary(logitregH4d)

##
## 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
## -4.206 -2.088 -1.216 3.153 6.425
##
## Coefficients:
## Estimate Std. Error t value Pr(>|t|)
## (Intercept) 4.8474 0.4181 11.594 < 2e-16 ***
## Damage_Assessment2 0.3588 0.3205 1.120 0.26365
## Hack_Type2 -1.1641 0.4472 -2.603 0.00965 **
## Attribution_Confidence2 -0.4674 0.3302 -1.416 0.15784
## Persistence2 0.2377 0.3342 0.711 0.47741
## Time_Lag2 -0.7844 0.4578 -1.713 0.08757 .
## Hack_Type2:Time_Lag2 1.5923 0.6400 2.488 0.01334 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 8.552898)
##
## Null deviance: 2899.9 on 334 degrees of freedom
## Residual deviance: 2805.4 on 328 degrees of freedom

```

```
## AIC: 1678.6
##
## Number of Fisher Scoring iterations: 2
print(xtable::xtable(logitregH4d, digits = 2, caption='Communicativity: High Correlation Variables'),
      file = "logitregH4d.tex",
      caption.placement = 'top', include.colnames = TRUE)

summary(logitregH4d) # 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
## -4.206  -2.088  -1.216   3.153   6.425
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      4.8474     0.4181  11.594 < 2e-16 ***
## Damage_Assessment2  0.3588     0.3205   1.120  0.26365
## Hack_Type2       -1.1641     0.4472  -2.603  0.00965 **
## Attribution_Confidence2 -0.4674     0.3302  -1.416  0.15784
## Persistence2       0.2377     0.3342   0.711  0.47741
## Time_Lag2        -0.7844     0.4578  -1.713  0.08757 .
## Hack_Type2:Time_Lag2  1.5923     0.6400   2.488  0.01334 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 8.552898)
##
##      Null deviance: 2899.9  on 334  degrees of freedom
## Residual deviance: 2805.4  on 328  degrees of freedom
## AIC: 1678.6
##
## Number of Fisher Scoring iterations: 2

summary(logitregH4d)$coeff[-1,4]<0.05

##      Damage_Assessment2      Hack_Type2 Attribution_Confidence2
##              FALSE              TRUE              FALSE
##      Persistence2      Time_Lag2      Hack_Type2:Time_Lag2
##              FALSE              FALSE              TRUE
```

## Hypothesis 5: Escalation

```
# this subsetted data to only communicative attacks

dataH5 <- subset(data1, communicativity>5)
dataH5$Response <- factor(dataH5$Response)
```

```

# run with logit
dataH5b <- dataH5 %>%
  filter(Response != 2) %>%
  mutate(Response = recode(Response, "3" = 2, "1" = 1))

logitregH5a <- glm(Response ~ communicativity + RSUMED, data=dataH5b)
summary(logitregH5a)

##
## Call:
## glm(formula = Response ~ communicativity + RSUMED, data = dataH5b)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -0.83112  -0.25414   0.03473   0.16945   0.74626
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -1.052084   0.665176  -1.582   0.122
## communicativity  0.288468   0.063793   4.522 5.36e-05 ***
## RSUMED        -0.002662   0.472499  -0.006   0.996
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 0.1740301)
##
##      Null deviance: 10.6047  on 42  degrees of freedom
## Residual deviance:  6.9612  on 40  degrees of freedom
## AIC: 51.732
##
## Number of Fisher Scoring iterations: 2

logitregH5b <- glm(Response ~ Damage_Assessment + Hack_Type + Attribution_Confidence + Persistence + Time_Lag + RSUMED, data=dataH5b)
summary(logitregH5b)

##
## Call:
## glm(formula = Response ~ Damage_Assessment + Hack_Type + Attribution_Confidence + Persistence + Time_Lag + RSUMED, data = dataH5b)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -0.82424  -0.37152  -0.07506   0.34401   0.82133
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      1.21930    0.43218   2.821  0.00774 **
## Damage_Assessment2  0.31085    0.16294   1.908  0.06443 .
## Hack_Type2         0.17846    0.15631   1.142  0.26111
## Attribution_Confidence2 0.27115    0.16539   1.639  0.10983
## Persistence2       0.13994    0.16607   0.843  0.40499
## Time_Lag2         -0.02994    0.15180  -0.197  0.84475
## RSUMED            -0.37299    0.60271  -0.619  0.53991
## ---

```



```

## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 0.2267314)
##
## Null deviance: 10.6047 on 42 degrees of freedom
## Residual deviance:  8.1623 on 36 degrees of freedom
## AIC: 66.577
##
## Number of Fisher Scoring iterations: 2
# run with ordinal
logitregH5c <- polr(Response ~ Damage_Assessment + Hack_Type + Attribution_Confidence + Persistence + Time_Lag, data = dataH5)
summary(logitregH5c) # nothing is statistically significant

##
## Re-fitting to get Hessian

## Call:
## polr(formula = Response ~ Damage_Assessment + Hack_Type + Attribution_Confidence +
## Persistence + Time_Lag + RSUMED, data = dataH5)
##
## Coefficients:
##              Value Std. Error t value
## Damage_Assessment2  0.71021    0.4134  1.7181
## Hack_Type2         0.51656    0.4308  1.1991
## Attribution_Confidence2 0.85542    0.4236  2.0194
## Persistence2       0.19320    0.4161  0.4643
## Time_Lag2        -0.05672    0.4065 -0.1395
## RSUMED           -1.16776    1.6385 -0.7127
##
## Intercepts:
##      Value Std. Error t value
## 1|2 -0.8806  1.0806   -0.8149
## 2|3  1.9438  1.1007    1.7660
##
## Residual Deviance: 185.7802
## AIC: 201.7802

logitregH5d <- multinom(Response ~ Damage_Assessment * Hack_Type * Attribution_Confidence * Persistence + Time_Lag, data = dataH5)

## # weights:  99 (64 variable)
## initial value 109.861229
## iter  10 value 75.075980
## iter  20 value 67.793197
## iter  30 value 67.221587
## iter  40 value 67.186861
## iter  50 value 67.185821
## final value 67.185805
## converged

summary(logitregH5d) # nothing is statistically significant

## Call:
## multinom(formula = Response ~ Damage_Assessment * Hack_Type *
## Attribution_Confidence * Persistence * Time_Lag, data = dataH5)
##
## Coefficients:

```

```

## (Intercept) Damage_Assessment2 Hack_Type2 Attribution_Confidence2
## 2 0.6931582 7.051133e-04 -1.386290 1.098966
## 3 -21.0637033 2.106407e+01 7.184788 -4.366342
## Persistence2 Time_Lag2 Damage_Assessment2:Hack_Type2
## 2 -0.6934509 12.826601 1.385356
## 3 -7.3655865 3.466842 -7.185188
## Damage_Assessment2:Attribution_Confidence2 Hack_Type2:Attribution_Confidence2
## 2 -1.100121 4.535187
## 3 -14.996239 20.204897
## Damage_Assessment2:Persistence2 Hack_Type2:Persistence2
## 2 31.16609 1.386713
## 3 14.14322 -5.008657
## Attribution_Confidence2:Persistence2 Damage_Assessment2:Time_Lag2
## 2 -1.098797 -13.52143
## 3 32.795447 -25.47711
## Hack_Type2:Time_Lag2 Attribution_Confidence2:Time_Lag2 Persistence2:Time_Lag2
## 2 10.47771 7.299572 -38.905066
## 3 31.23159 -2.742981 3.616774
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2
## 2 17.54638
## 3 21.23789
## Damage_Assessment2:Hack_Type2:Persistence2
## 2 13.25240
## 3 -16.98184
## Damage_Assessment2:Attribution_Confidence2:Persistence2
## 2 3.510121
## 3 12.960318
## Hack_Type2:Attribution_Confidence2:Persistence2
## 2 -18.740538
## 3 -3.568224
## Damage_Assessment2:Hack_Type2:Time_Lag2
## 2 -9.782422
## 3 -8.528041
## Damage_Assessment2:Attribution_Confidence2:Time_Lag2
## 2 -7.990361
## 3 5.093713
## Hack_Type2:Attribution_Confidence2:Time_Lag2
## 2 -3.196324
## 3 -20.006306
## Damage_Assessment2:Persistence2:Time_Lag2 Hack_Type2:Persistence2:Time_Lag2
## 2 9.126884 -19.48467
## 3 11.615691 -12.06223
## Attribution_Confidence2:Persistence2:Time_Lag2
## 2 20.388386
## 3 -4.340534
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2:Persistence2
## 2 -5.729347
## 3 -2.535231
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2:Time_Lag2
## 2 3.411566
## 3 16.487202
## Damage_Assessment2:Hack_Type2:Persistence2:Time_Lag2
## 2 4.556217
## 3 -12.494725

```

```

## Damage_Assessment2:Attribution_Confidence2:Persistence2:Time_Lag2
## 2 5.098453
## 3 3.496160
## Hack_Type2:Attribution_Confidence2:Persistence2:Time_Lag2
## 2 -15.82049
## 3 -36.18464
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2:Persistence2:Time_Lag2
## 2 -9.2125961
## 3 0.3088698
##
## Std. Errors:
## (Intercept) Damage_Assessment2 Hack_Type2 Attribution_Confidence2
## 2 1.2247459 1.7321419 1.7320493 1.6330871
## 3 0.8000379 0.8196121 0.9838733 0.5752065
## Persistence2 Time_Lag2 Damage_Assessment2:Hack_Type2
## 2 1.5811397 1.0647382 2.449538
## 3 0.7062257 0.6542686 1.110434
## Damage_Assessment2:Attribution_Confidence2 Hack_Type2:Attribution_Confidence2
## 2 2.3805602 0.4441050
## 3 0.6927464 0.4554449
## Damage_Assessment2:Persistence2 Hack_Type2:Persistence2
## 2 0.9666426 2.2360668
## 3 0.6934008 0.7271841
## Attribution_Confidence2:Persistence2 Damage_Assessment2:Time_Lag2
## 2 2.3805236 1.0449479
## 3 0.5144763 0.6584556
## Hack_Type2:Time_Lag2 Attribution_Confidence2:Time_Lag2 Persistence2:Time_Lag2
## 2 1.2948141 1.2226480 0.8614710
## 3 0.7249197 0.7452047 0.6718385
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2
## 2 0.4441050
## 3 0.4554449
## Damage_Assessment2:Hack_Type2:Persistence2
## 2 1.346502
## 3 0.373688
## Damage_Assessment2:Attribution_Confidence2:Persistence2
## 2 0.7371679
## 3 0.4993415
## Hack_Type2:Attribution_Confidence2:Persistence2
## 2 0.4169079
## 3 0.3736880
## Damage_Assessment2:Hack_Type2:Time_Lag2
## 2 1.4231329
## 3 0.6866901
## Damage_Assessment2:Attribution_Confidence2:Time_Lag2
## 2 1.4463741
## 3 0.9525052
## Hack_Type2:Attribution_Confidence2:Time_Lag2
## 2 0.6315010
## 3 0.5684613
## Damage_Assessment2:Persistence2:Time_Lag2 Hack_Type2:Persistence2:Time_Lag2
## 2 0.9851522 1.0531060
## 3 0.6550938 0.5601573
## Attribution_Confidence2:Persistence2:Time_Lag2

```

```
## 2 1.060367
## 3 0.706628
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2:Persistence2
## 2 0.4169079
## 3 0.3736880
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2:Time_Lag2
## 2 0.6315010
## 3 0.5684612
## Damage_Assessment2:Hack_Type2:Persistence2:Time_Lag2
## 2 1.0531060
## 3 0.4886492
## Damage_Assessment2:Attribution_Confidence2:Persistence2:Time_Lag2
## 2 0.5958006
## 3 0.4799060
## Hack_Type2:Attribution_Confidence2:Persistence2:Time_Lag2
## 2 0.4369211
## 3 0.4886493
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2:Persistence2:Time_Lag2
## 2 0.4369211
## 3 0.4886492
##
## Residual Deviance: 134.3716
## AIC: 250.3716
```

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

```
logitregH5e <- multinom(Response ~ Damage_Assessment + Hack_Type + Attribution_Confidence + Persistence
```

```
## # weights: 7 (6 variable)
## initial value 29.805329
## iter 10 value 24.283305
## final value 24.283300
## converged
```

```
summary(logitregH5e) # nothing is statistically significant
```

```
## Call:
## multinom(formula = Response ~ Damage_Assessment + Hack_Type +
## Attribution_Confidence + Persistence + Time_Lag, data = dataH5b)
##
## Coefficients:
## Values Std. Err.
## (Intercept) -2.5877837 1.0316055
## Damage_Assessment2 1.5951937 0.8100547
## Hack_Type2 1.0686365 0.7386178
## Attribution_Confidence2 1.1590523 0.7494987
## Persistence2 0.8096948 0.8103757
## Time_Lag2 -0.2174465 0.7245934
##
## Residual Deviance: 48.5666
## AIC: 60.5666
```

```
# nothing is statistically significant
```

```
logitregH5f <- multinom(Response ~ Damage_Assessment * Hack_Type * Attribution_Confidence * Persistence
```

```
## # weights: 99 (64 variable)
```

```
## initial value 109.861229
## iter 10 value 75.075980
## iter 20 value 67.793197
## iter 30 value 67.221587
## iter 40 value 67.186861
## iter 50 value 67.185821
## final value 67.185805
## converged
```

```
summary(logitregH5f) # nothing is statistically significant
```

```
## Call:
## multinom(formula = Response ~ Damage_Assessment * Hack_Type *
## Attribution_Confidence * Persistence * Time_Lag, data = dataH5)
##
## Coefficients:
## (Intercept) Damage_Assessment2 Hack_Type2 Attribution_Confidence2
## 2 0.6931582 7.051133e-04 -1.386290 1.098966
## 3 -21.0637033 2.106407e+01 7.184788 -4.366342
## Persistence2 Time_Lag2 Damage_Assessment2:Hack_Type2
## 2 -0.6934509 12.826601 1.385356
## 3 -7.3655865 3.466842 -7.185188
## Damage_Assessment2:Attribution_Confidence2 Hack_Type2:Attribution_Confidence2
## 2 -1.100121 4.535187
## 3 -14.996239 20.204897
## Damage_Assessment2:Persistence2 Hack_Type2:Persistence2
## 2 31.16609 1.386713
## 3 14.14322 -5.008657
## Attribution_Confidence2:Persistence2 Damage_Assessment2:Time_Lag2
## 2 -1.098797 -13.52143
## 3 32.795447 -25.47711
## Hack_Type2:Time_Lag2 Attribution_Confidence2:Time_Lag2 Persistence2:Time_Lag2
## 2 10.47771 7.299572 -38.905066
## 3 31.23159 -2.742981 3.616774
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2
## 2 17.54638
## 3 21.23789
## Damage_Assessment2:Hack_Type2:Persistence2
## 2 13.25240
## 3 -16.98184
## Damage_Assessment2:Attribution_Confidence2:Persistence2
## 2 3.510121
## 3 12.960318
## Hack_Type2:Attribution_Confidence2:Persistence2
## 2 -18.740538
## 3 -3.568224
## Damage_Assessment2:Hack_Type2:Time_Lag2
## 2 -9.782422
## 3 -8.528041
## Damage_Assessment2:Attribution_Confidence2:Time_Lag2
## 2 -7.990361
## 3 5.093713
## Hack_Type2:Attribution_Confidence2:Time_Lag2
## 2 -3.196324
## 3 -20.006306
```

```

## Damage_Assessment2:Persistence2:Time_Lag2 Hack_Type2:Persistence2:Time_Lag2
## 2 9.126884 -19.48467
## 3 11.615691 -12.06223
## Attribution_Confidence2:Persistence2:Time_Lag2
## 2 20.388386
## 3 -4.340534
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2:Persistence2
## 2 -5.729347
## 3 -2.535231
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2:Time_Lag2
## 2 3.411566
## 3 16.487202
## Damage_Assessment2:Hack_Type2:Persistence2:Time_Lag2
## 2 4.556217
## 3 -12.494725
## Damage_Assessment2:Attribution_Confidence2:Persistence2:Time_Lag2
## 2 5.098453
## 3 3.496160
## Hack_Type2:Attribution_Confidence2:Persistence2:Time_Lag2
## 2 -15.82049
## 3 -36.18464
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2:Persistence2:Time_Lag2
## 2 -9.2125961
## 3 0.3088698
##
## Std. Errors:
## (Intercept) Damage_Assessment2 Hack_Type2 Attribution_Confidence2
## 2 1.2247459 1.7321419 1.7320493 1.6330871
## 3 0.8000379 0.8196121 0.9838733 0.5752065
## Persistence2 Time_Lag2 Damage_Assessment2:Hack_Type2
## 2 1.5811397 1.0647382 2.449538
## 3 0.7062257 0.6542686 1.110434
## Damage_Assessment2:Attribution_Confidence2 Hack_Type2:Attribution_Confidence2
## 2 2.3805602 0.4441050
## 3 0.6927464 0.4554449
## Damage_Assessment2:Persistence2 Hack_Type2:Persistence2
## 2 0.9666426 2.2360668
## 3 0.6934008 0.7271841
## Attribution_Confidence2:Persistence2 Damage_Assessment2:Time_Lag2
## 2 2.3805236 1.0449479
## 3 0.5144763 0.6584556
## Hack_Type2:Time_Lag2 Attribution_Confidence2:Time_Lag2 Persistence2:Time_Lag2
## 2 1.2948141 1.2226480 0.8614710
## 3 0.7249197 0.7452047 0.6718385
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2
## 2 0.4441050
## 3 0.4554449
## Damage_Assessment2:Hack_Type2:Persistence2
## 2 1.346502
## 3 0.373688
## Damage_Assessment2:Attribution_Confidence2:Persistence2
## 2 0.7371679
## 3 0.4993415
## Hack_Type2:Attribution_Confidence2:Persistence2

```

```

## 2 0.4169079
## 3 0.3736880
## Damage_Assessment2:Hack_Type2:Time_Lag2
## 2 1.4231329
## 3 0.6866901
## Damage_Assessment2:Attribution_Confidence2:Time_Lag2
## 2 1.4463741
## 3 0.9525052
## Hack_Type2:Attribution_Confidence2:Time_Lag2
## 2 0.6315010
## 3 0.5684613
## Damage_Assessment2:Persistence2:Time_Lag2 Hack_Type2:Persistence2:Time_Lag2
## 2 0.9851522 1.0531060
## 3 0.6550938 0.5601573
## Attribution_Confidence2:Persistence2:Time_Lag2
## 2 1.060367
## 3 0.706628
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2:Persistence2
## 2 0.4169079
## 3 0.3736880
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2:Time_Lag2
## 2 0.6315010
## 3 0.5684612
## Damage_Assessment2:Hack_Type2:Persistence2:Time_Lag2
## 2 1.0531060
## 3 0.4886492
## Damage_Assessment2:Attribution_Confidence2:Persistence2:Time_Lag2
## 2 0.5958006
## 3 0.4799060
## Hack_Type2:Attribution_Confidence2:Persistence2:Time_Lag2
## 2 0.4369211
## 3 0.4886493
## Damage_Assessment2:Hack_Type2:Attribution_Confidence2:Persistence2:Time_Lag2
## 2 0.4369211
## 3 0.4886492
##
## Residual Deviance: 134.3716
## AIC: 250.3716

```

## Hypothesis 6: Norm Adoption — Future research could focus on!

```

dataH6 <- dataH5 %>%
  filter(!is.na(Norm)) %>%
  mutate(Norm = recode(Norm, "No" = 0, "Yes" = 1))

nrow(dataH6) # 31 results not sufficient for statistical tests

## [1] 24

summary(dataH6)

```

```

## communicativity AttackDef Response Norm Time_Lag
## Min. : 6.000 1:24 1:24 Min. : NA 1:12

```

```
## 1st Qu.: 8.000    2: 0      2: 0      1st Qu.: NA    2:12
## Median : 8.000      3: 0      Median : NA
## Mean   : 8.125      Mean   : NaN
## 3rd Qu.: 9.000      3rd Qu.: NA
## Max.    :10.000      Max.    : NA
##                               NA's    :24
## Attribution_Confidence Damage_Assessment Hack_Type Persistence
## 1:16                    1:14              1:14      1:11
## 2: 8                    2:10              2:10      2:13
##
##
##
##
##      RSUMED
## Min.    :0.2595
## 1st Qu.:0.5571
## Median :0.6381
## Mean    :0.6282
## 3rd Qu.:0.7333
## Max.    :0.8167
##
```

```
logitregH6a <- glm(Norm ~ Damage_Assessment + Hack_Type + Attribution_Confidence + Persistence + Time_Lag, data = dataH4)
summary(logitregH6a)
```

```
##
## Call:
## glm(formula = Norm ~ Damage_Assessment + Hack_Type + Attribution_Confidence + Persistence + Time_Lag, data = dataH4)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -0.7746  -0.5287   0.3091   0.4458   0.6191
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      1.23421    0.30368   4.064 7.84e-05 ***
## Damage_Assessment  0.01954    0.08371   0.233   0.816
## Hack_Type         0.06544    0.08534   0.767   0.444
## Attribution_Confidence 0.13343    0.08520   1.566   0.120
## Persistence       0.09295    0.08647   1.075   0.284
## Time_Lag        -0.08233    0.08241  -0.999   0.319
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 0.2476775)
##
##      Null deviance: 37.342  on 151  degrees of freedom
## Residual deviance: 36.161  on 146  degrees of freedom
## AIC: 227.1
##
## Number of Fisher Scoring iterations: 2
```



```
# 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 7: Effect of Supplementary Variables on Confidence

```
logitregH7a <- glm(formula = AssessConfNo ~ Damage_Assessment + Hack_Type + Attribution_Confidence + Persistence + Time_Lag + KSUM + RSUMED + MSUM, data = stacked_data)
summary(logitregH7a)
```

```
##
## 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
## -2.62094  -0.57926   0.04557   0.56983   1.74510
##
## 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 0.6971657)
##
##      Null deviance: 251.03  on 334  degrees of freedom
## Residual deviance: 227.28  on 326  degrees of freedom
## AIC: 840.72
##
## Number of Fisher Scoring iterations: 2

```