Thesis Data Analysis: The Psychology of Scientific Fraud

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# Introduction

This document is intended to track the data analysis for my undergraduate thesis project on the psychology of scientific fraud. I have already planned out (and preregistered) my data analysis plan (see [here](https://benjaminjzubaly.github.io/The-Psychology-of-Scientific-Fraud-Thesis/#data-analysis)), and I will note throughout the document if I deviate from this plan and why. This project is also being tracked in a private GitHub repository in case I need to revert back to a previous version of the project due to a fatal error.

## Overview of Sections

* **Data Cleaning:** The data cleaning section will take the finalized dataset that I have included in the project directory and use it to create the remaining variables that we need for our analysis. We will also save this dataset.
* **Data Exploration:** In the data exploration section, we will check for and deal with missing data, run descriptive statistics of our outcome variables, visualize our data, and run bivariate correlations.
* **Testing Hypotheses:** In the hypothesis testing section, we will test each of our hypotheses one-by-one, according to our analysis plan.

## Directory Set-Up

In order to ensure that this analysis is computationally reproducible, I have included everything that is needed to complete this analysis (just the finalized data file, “study\_dataset.csv”) in the current working directory. The code will be displayed before the output of each analysis.

## Variable Definitions

Although the following variables may not exist until after the data cleaning section, here is what each variable name refers to, so that you can refer to them while examining the code.

DOI: Unique identifier for each paper (i.e., the paper DOI).

PaperType: Categorical variable indicating SAFP, SAGP, MAFP, or MAGP.

LingObf: Continuous variable for linguistic obfuscation.

CertSent: Continuous variable for certainty sentiment.

Refs: Count variable for references.

FraudCorrAuth: Dichotomous variable indicating if the fraudulent author is the corresponding author (1) or is not (0). Unknown cases will be marked in a seperate variable with this variable left blank.

NumAuth: Count variable indicating the number of authors for each paper.

abstraction: Abstraction index composed of the sum of standardized scores for article, prep, and quantity.

article: Articles from LIWC.

prep: Prepositions from LIWC.

quantity: Quantities from LIWC.

cause: Causation terms from LIWC.

jargon: The percent of words not captured by LIWC (100-Dic).

Dic: The percentage of words captured by all LIWC dictionaries.

emo\_pos: Positive emotion terms from LIWC.

flesch\_re: Flesch Reading Ease from ARTE.

## Initial Package Installations

If you would like to reproduce this analysis, here are the package I will be using, so that they can be cued before starting.

install.packages("readr") # For reading data

Installing package into '/Users/benjaminzubaly/Library/R/x86\_64/4.3/library'  
(as 'lib' is unspecified)

The downloaded binary packages are in  
 /var/folders/38/1ybnplc53zdb089bn6drqfn00000gn/T//RtmpwGyVsZ/downloaded\_packages

install.packages("dplyr") # For data manipulation and handling of missing data

Installing package into '/Users/benjaminzubaly/Library/R/x86\_64/4.3/library'  
(as 'lib' is unspecified)

The downloaded binary packages are in  
 /var/folders/38/1ybnplc53zdb089bn6drqfn00000gn/T//RtmpwGyVsZ/downloaded\_packages

install.packages("psych") # For descriptive statistics, correlations

Installing package into '/Users/benjaminzubaly/Library/R/x86\_64/4.3/library'  
(as 'lib' is unspecified)

The downloaded binary packages are in  
 /var/folders/38/1ybnplc53zdb089bn6drqfn00000gn/T//RtmpwGyVsZ/downloaded\_packages

install.packages("ggplot2") # For data visualization

Installing package into '/Users/benjaminzubaly/Library/R/x86\_64/4.3/library'  
(as 'lib' is unspecified)

The downloaded binary packages are in  
 /var/folders/38/1ybnplc53zdb089bn6drqfn00000gn/T//RtmpwGyVsZ/downloaded\_packages

install.packages("car") # For diagnostic tests such as Levene's test

Installing package into '/Users/benjaminzubaly/Library/R/x86\_64/4.3/library'  
(as 'lib' is unspecified)

The downloaded binary packages are in  
 /var/folders/38/1ybnplc53zdb089bn6drqfn00000gn/T//RtmpwGyVsZ/downloaded\_packages

install.packages("rcompanion") # For Games-Howell post-hoc test (if applicable)

Installing package into '/Users/benjaminzubaly/Library/R/x86\_64/4.3/library'  
(as 'lib' is unspecified)

The downloaded binary packages are in  
 /var/folders/38/1ybnplc53zdb089bn6drqfn00000gn/T//RtmpwGyVsZ/downloaded\_packages

install.packages("dunn.test") # For Dunn post-hoc test (if applicable)

Installing package into '/Users/benjaminzubaly/Library/R/x86\_64/4.3/library'  
(as 'lib' is unspecified)

The downloaded binary packages are in  
 /var/folders/38/1ybnplc53zdb089bn6drqfn00000gn/T//RtmpwGyVsZ/downloaded\_packages

## Initial Import of Data

We will not load in the dataset “study\_dataset.csv” from the working directory.

library(readr) # Loading the readr package  
  
data <- read\_csv("study\_dataset.csv") # Loading in study dataset as "data"

Rows: 88 Columns: 207  
── Column specification ────────────────────────────────────────────────────────  
Delimiter: ","  
chr (26): DOI, Title, Subject, Institution, Journal, Publisher, Country, Au...  
dbl (181): Record ID, RetractionPubMedID, OriginalPaperDate, year, OriginalP...  
  
ℹ Use `spec()` to retrieve the full column specification for this data.  
ℹ Specify the column types or set `show\_col\_types = FALSE` to quiet this message.

I have viewed the data frame, and the data seems to have loaded correctly.

# Data Cleaning

To conduct the analysis, we will first need to calculate the LingObf variable by calculating the abstraction index and jargon words; creating standardized scores for abstraction, cause, jargon, emo\_pos, and flesch\_re; and calculating the LingObf composite variable from these standardized scores.

1. First, we will calculate the abstraction index by creating standardized scores for article, prep, and quantity and summing them.

# Calculate standardized scores for article, prep, and quantity and add them to the dataset  
data$articles\_standardized <- scale(data$article)  
data$prep\_standardized <- scale(data$prep)  
data$quantity\_standardized <- scale(data$quantity)  
  
# Create the new variable 'abstraction' as the sum of the three standardized variables  
data$abstraction <- (data$articles\_standardized + data$prep\_standardized + data$quantity\_standardized)

* After viewing the data, the transformations and variable calculation seem to have occurred appropriately.

1. Next, we will calculate the jargon words by subtracting Dic from 100.

# Calculate the new variable 'jargon' by subtracting 'Dic' from 100  
data$jargon <- (100 - data$Dic)

* After viewing the data, the variable calculation seem to have occurred appropriately.

1. Next, we will create standardized scores for each subcomponent of the LingObf.

# Standardize the new set of variables and add them to the dataset  
data$abstraction\_standardized <- scale(data$abstraction)  
data$cause\_standardized <- scale(data$cause)  
data$jargon\_standardized <- scale(data$jargon)  
data$emo\_pos\_standardized <- scale(data$emo\_pos)  
data$flesch\_re\_standardized <- scale(data$flesch\_re)

* After viewing the data, the variable transformations seem to have occurred appropriately.

1. Now we will calculate the LingObf variable using the following formula: [cause\_standardized + abstraction\_standardized + jargon\_standardized] – [emo\_pos\_standardized + flesch\_re\_standardized].

# Calculate 'LingObf'  
data$LingObf <- (data$cause\_standardized + data$abstraction\_standardized + data$jargon\_standardized) - (data$emo\_pos\_standardized + data$flesch\_re\_standardized)

* After viewing the data, the variable calculation seem to have occurred appropriately.

1. Lastly, our variable that indicates certainty sentiment is currently certainty\_avg, but to make things easier I am going to copy this data into a new variables called CertSent.

data$CertSent <- data$certainty\_avg

To ensure that our clean data is saved, we will write the dataset to the current working directory.

# Writing our data as a csv file in the current working directory  
write.csv(data, "clean\_study\_data.csv")

* I have opened the saved data file outside of Rstudio, and it seems to have been written correctly.

# Data Exploration

## Dealing with Missing Data

1. Data will be first inspected for missing scores.

library(dplyr) # Loading the dplyr package for data manipulation and handling missing values

Attaching package: 'dplyr'

The following objects are masked from 'package:stats':  
  
 filter, lag

The following objects are masked from 'package:base':  
  
 intersect, setdiff, setequal, union

# To summarize the number of missing values in each column  
missing\_data\_summary <- sapply(data, function(x) sum(is.na(x)))  
  
print(missing\_data\_summary) # To see summary of missing values for all columns

DOI Record ID   
 0 44   
 Title Subject   
 0 44   
 Institution Journal   
 0 0   
 Publisher Country   
 0 0   
 Author URLS   
 0 68   
 ArticleType RetractionDate   
 0 44   
 RetractionDOI RetractionPubMedID   
 48 51   
 OriginalPaperDate year   
 44 0   
 OriginalPaperDOI OriginalPaperPubMedID   
 0 51   
 RetractionNature Reason   
 44 44   
 Paywalled Notes   
 44 70   
 simple\_reason NumAuth   
 44 0   
 inst\_pres PaperType   
 0 0   
 gender matched\_DOI\_SAFP\_MAFP   
 0 44   
 matched\_DOI\_SAFP\_SAGP matched\_DOI\_MAFP\_MAGP   
 44 44   
 matching\_concessions FraudCorrAuth   
 42 80   
 FCA\_unknown FCA\_notes   
 66 66   
 different\_country year\_difference   
 22 22   
 different\_gender different\_inst\_pres   
 22 22   
 different\_journal Refs   
 66 0   
 Abstract flesch\_re   
 0 0   
 wordcount valence\_min   
 0 0   
 valence\_max valence\_avg   
 0 0   
 valence\_std extremity\_min   
 0 0   
 extremity\_max extremity\_avg   
 0 0   
 extremity\_std extremity\_min\_pos   
 0 0   
 extremity\_max\_pos extremity\_avg\_pos   
 0 0   
 extremity\_std\_pos extremity\_min\_neg   
 0 1   
 extremity\_max\_neg extremity\_avg\_neg   
 1 1   
 extremity\_std\_neg extremity\_PosMinNeg   
 5 0   
 emotionality\_min emotionality\_max   
 0 0   
 emotionality\_avg emotionality\_std   
 0 0   
 emotionality\_min\_pos emotionality\_max\_pos   
 0 0   
 emotionality\_avg\_pos emotionality\_std\_pos   
 0 0   
 emotionality\_min\_neg emotionality\_max\_neg   
 1 1   
 emotionality\_avg\_neg emotionality\_std\_neg   
 1 5   
 emotionality\_PosMinNeg count\_unique\_evaluative\_pos   
 0 0   
 count\_total\_evaluative\_pos count\_unique\_evaluative\_neg   
 0 0   
 count\_total\_evaluative\_neg count\_unique\_evaluative   
 0 0   
 count\_total\_evaluative count\_evaluative\_PosMinNeg   
 0 0   
 ambivalent pos\_dichotomous   
 0 87   
 certainty\_min certainty\_max   
 0 0   
 certainty\_avg certainty\_std   
 0 0   
 count\_unique\_certainty count\_total\_certainty   
 0 0   
 Segment WC   
 0 0   
 Analytic Clout   
 0 0   
 Authentic Tone   
 0 0   
 WPS BigWords   
 0 0   
 Dic Linguistic   
 0 0   
 function pronoun   
 0 0   
 ppron i   
 0 0   
 we you   
 0 0   
 shehe they   
 0 0   
 ipron det   
 0 0   
 article number   
 0 0   
 prep auxverb   
 0 0   
 adverb conj   
 0 0   
 negate verb   
 0 0   
 adj quantity   
 0 0   
 Drives affiliation   
 0 0   
 achieve power   
 0 0   
 Cognition allnone   
 0 0   
 cogproc insight   
 0 0   
 cause discrep   
 0 0   
 tentat certitude   
 0 0   
 differ memory   
 0 0   
 Affect tone\_pos   
 0 0   
 tone\_neg emotion   
 0 0   
 emo\_pos emo\_neg   
 0 0   
 emo\_anx emo\_anger   
 0 0   
 emo\_sad swear   
 0 0   
 Social socbehav   
 0 0   
 prosocial polite   
 0 0   
 conflict moral   
 0 0   
 comm socrefs   
 0 0   
 family friend   
 0 0   
 female male   
 0 0   
 Culture politic   
 0 0   
 ethnicity tech   
 0 0   
 Lifestyle leisure   
 0 0   
 home work   
 0 0   
 money relig   
 0 0   
 Physical health   
 0 0   
 illness wellness   
 0 0   
 mental substances   
 0 0   
 sexual food   
 0 0   
 death need   
 0 0   
 want acquire   
 0 0   
 lack fulfill   
 0 0   
 fatigue reward   
 0 0   
 risk curiosity   
 0 0   
 allure Perception   
 0 0   
 attention motion   
 0 0   
 space visual   
 0 0   
 auditory feeling   
 0 0   
 time focuspast   
 0 0   
 focuspresent focusfuture   
 0 0   
 Conversation netspeak   
 0 0   
 assent nonflu   
 0 0   
 filler AllPunc   
 0 0   
 Period Comma   
 0 0   
 QMark Exclam   
 0 0   
 Apostro OtherP   
 0 0   
 Emoji articles\_standardized   
 0 0   
 prep\_standardized quantity\_standardized   
 0 0   
 abstraction jargon   
 0 0   
 abstraction\_standardized cause\_standardized   
 0 0   
 jargon\_standardized emo\_pos\_standardized   
 0 0   
 flesch\_re\_standardized LingObf   
 0 0   
 CertSent   
 0

* Taking a look at our outcome variables, there are no missing scores, so we do not need to impute any values.

## Descriptive Statistics

1. I will now generate descriptive statistics for each relevant variable in the dataset. I originally (in the preregistered plan) was simply going to deploy the describe() function on the entire dataset, but because I retained all of the columns from the Retraction Watch Database (*Retraction Watch Database*, 2023) and all of the output from the text analysis packages (Aggarwal, 2022; Boyd et al., 2022; Rocklage et al., 2023) there are currently 219 variables. Because this would be unmanageable, I am going to only calculate descriptive statistics for a selection of variables of interest. I will first create a dataframe with only the continuous variables that I am interested in generating descriptive statistics for, and I will use the psych package to produce the descriptive statistics for these variables.

library(psych) # Loading the psych package  
  
# Selecting the continuous variables I am interested in getting descriptive statistics for (plus paper type for the next part)  
continuous\_data\_for\_descriptives <- data[c("year", "Refs", "flesch\_re", "WC", "abstraction", "jargon", "CertSent", "LingObf", "cause", "emo\_pos", "article", "prep", "quantity", "PaperType")]  
  
# Generating descriptive statistics for variables of interest  
continuous\_descriptive\_stats\_all <- describe(continuous\_data\_for\_descriptives)  
  
# Displaying the results of the descriptive stats for the variables listed above  
continuous\_descriptive\_stats\_all

vars n mean sd median trimmed mad min max  
year 1 88 2009.70 10.47 2013.00 2011.14 7.41 1980.00 2022.00  
Refs 2 88 45.82 23.47 39.00 43.21 20.02 12.00 146.00  
flesch\_re 3 88 34.90 10.94 36.45 35.46 10.28 -10.89 56.59  
WC 4 88 4436.25 2248.24 3951.50 4238.17 1956.29 1124.00 13901.00  
abstraction 5 88 0.00 1.83 0.09 0.04 1.86 -4.46 3.55  
jargon 6 88 33.33 7.47 34.76 33.50 7.84 17.91 46.67  
CertSent 7 88 6.17 0.25 6.18 6.18 0.22 5.21 6.76  
LingObf 8 88 0.00 1.67 -0.14 -0.01 1.54 -5.84 4.28  
cause 9 88 2.80 1.22 2.62 2.69 1.02 0.89 6.01  
emo\_pos 10 88 0.09 0.22 0.04 0.05 0.06 0.00 1.67  
article 11 88 8.38 2.20 8.31 8.33 2.13 3.53 14.47  
prep 12 88 15.43 1.68 15.66 15.51 1.34 9.76 20.67  
quantity 13 88 4.23 1.32 4.08 4.14 1.33 1.69 8.66  
PaperType\* 14 88 2.50 1.12 2.50 2.50 1.48 1.00 4.00  
 range skew kurtosis se  
year 42.00 -1.25 0.74 1.12  
Refs 134.00 1.41 2.87 2.50  
flesch\_re 67.48 -0.85 2.16 1.17  
WC 12777.00 1.21 2.18 239.66  
abstraction 8.01 -0.20 -0.42 0.20  
jargon 28.76 -0.27 -0.94 0.80  
CertSent 1.55 -0.69 1.42 0.03  
LingObf 10.12 -0.21 1.40 0.18  
cause 5.12 0.80 0.14 0.13  
emo\_pos 1.67 5.66 34.22 0.02  
article 10.94 0.33 -0.19 0.23  
prep 10.91 -0.44 1.22 0.18  
quantity 6.97 0.67 0.42 0.14  
PaperType\* 3.00 0.00 -1.40 0.12

* Now we will create descriptive statistics for each of the continuous variables above within the PaperType groups.

# Making PaperType a factor variable in the continuous variable dataframe to allow for grouping  
continuous\_data\_for\_descriptives$PaperType <- factor(continuous\_data\_for\_descriptives$PaperType, levels = c("SAFP", "MAFP", "SAGP", "MAGP"), labels = c("Single-Authored Fraudulent Papers", "Multi-Authored Fraudulent Papers", "Single-Authored Genuine Papers", "Multi-Authored Genuine Papers"))  
  
# Generating descriptive statistics within PaperType groups  
descriptive\_stats\_by\_PaperType <- describeBy(continuous\_data\_for\_descriptives, group = continuous\_data\_for\_descriptives$PaperType)  
  
descriptive\_stats\_by\_PaperType

Descriptive statistics by group   
group: Single-Authored Fraudulent Papers  
 vars n mean sd median trimmed mad min max  
year 1 22 2008.95 11.74 2013.00 2010.39 6.67 1983.00 2022.00  
Refs 2 22 44.18 19.93 36.00 42.89 17.79 18.00 87.00  
flesch\_re 3 22 36.09 9.17 37.06 36.29 10.53 18.49 54.36  
WC 4 22 3998.91 1741.31 3796.50 3911.39 1829.53 1273.00 7330.00  
abstraction 5 22 0.21 1.54 0.04 0.27 1.25 -3.27 2.95  
jargon 6 22 34.23 8.33 36.94 34.90 8.49 17.91 44.35  
CertSent 7 22 6.21 0.21 6.18 6.20 0.18 5.87 6.66  
LingObf 8 22 -0.24 1.79 -0.04 -0.05 1.97 -4.23 2.25  
cause 9 22 2.71 1.48 2.50 2.56 1.07 0.89 6.01  
emo\_pos 10 22 0.15 0.35 0.06 0.08 0.06 0.00 1.67  
article 11 22 8.35 2.60 8.48 8.41 2.90 3.53 12.25  
prep 12 22 15.75 1.60 15.75 15.79 1.43 11.79 18.42  
quantity 13 22 4.27 0.97 4.11 4.21 1.13 2.59 6.59  
PaperType 14 22 1.00 0.00 1.00 1.00 0.00 1.00 1.00  
 range skew kurtosis se  
year 39.00 -1.02 -0.29 2.50  
Refs 69.00 0.56 -1.06 4.25  
flesch\_re 35.87 -0.01 -0.63 1.95  
WC 6057.00 0.54 -0.67 371.25  
abstraction 6.21 -0.23 -0.33 0.33  
jargon 26.44 -0.56 -1.04 1.78  
CertSent 0.78 0.44 -0.57 0.04  
LingObf 6.48 -0.70 -0.32 0.38  
cause 5.12 0.93 -0.05 0.32  
emo\_pos 1.67 3.81 13.82 0.07  
article 8.72 -0.16 -1.18 0.55  
prep 6.63 -0.34 -0.15 0.34  
quantity 4.00 0.49 -0.41 0.21  
PaperType 0.00 NaN NaN 0.00  
------------------------------------------------------------   
group: Multi-Authored Fraudulent Papers  
 vars n mean sd median trimmed mad min max  
year 1 22 2010.14 9.59 2012.50 2011.67 8.15 1982.00 2022.00  
Refs 2 22 44.00 19.66 39.50 42.06 17.05 18.00 94.00  
flesch\_re 3 22 34.18 9.64 31.41 33.58 9.38 20.08 56.59  
WC 4 22 4705.91 2047.63 4274.00 4559.39 1931.83 1823.00 9004.00  
abstraction 5 22 -0.45 1.83 -0.53 -0.44 1.95 -4.10 3.55  
jargon 6 22 35.97 6.97 37.36 36.23 6.28 23.85 46.48  
CertSent 7 22 6.22 0.18 6.20 6.23 0.24 5.82 6.47  
LingObf 8 22 0.47 1.43 0.18 0.36 1.57 -1.66 4.13  
cause 9 22 2.84 1.08 2.74 2.75 1.03 1.14 5.66  
emo\_pos 10 22 0.03 0.04 0.01 0.02 0.02 0.00 0.15  
article 11 22 8.19 1.94 8.51 8.12 1.53 4.90 12.66  
prep 12 22 14.84 1.64 15.19 14.84 1.75 11.80 17.58  
quantity 13 22 4.22 1.39 4.10 4.15 1.54 2.27 6.95  
PaperType 14 22 2.00 0.00 2.00 2.00 0.00 2.00 2.00  
 range skew kurtosis se  
year 40.00 -1.37 1.52 2.05  
Refs 76.00 0.86 -0.01 4.19  
flesch\_re 36.51 0.59 -0.62 2.05  
WC 7181.00 0.56 -0.81 436.56  
abstraction 7.65 0.02 -0.64 0.39  
jargon 22.63 -0.38 -1.16 1.49  
CertSent 0.64 -0.27 -1.00 0.04  
LingObf 5.79 0.68 -0.15 0.30  
cause 4.52 0.78 0.30 0.23  
emo\_pos 0.15 1.55 1.39 0.01  
article 7.76 0.16 -0.34 0.41  
prep 5.78 -0.11 -1.18 0.35  
quantity 4.68 0.46 -1.11 0.30  
PaperType 0.00 NaN NaN 0.00  
------------------------------------------------------------   
group: Single-Authored Genuine Papers  
 vars n mean sd median trimmed mad min max  
year 1 22 2008.95 12.24 2013.50 2010.61 5.93 1980.00 2022.00  
Refs 2 22 51.05 32.53 40.50 46.28 28.91 12.00 146.00  
flesch\_re 3 22 34.46 15.72 38.40 36.15 10.34 -10.89 54.97  
WC 4 22 4632.36 2424.81 4148.00 4491.00 2364.01 1141.00 9670.00  
abstraction 5 22 0.80 1.89 1.00 0.91 2.13 -3.39 3.43  
jargon 6 22 29.50 6.19 31.79 29.61 5.77 19.26 38.66  
CertSent 7 22 6.07 0.28 6.13 6.07 0.31 5.55 6.49  
LingObf 8 22 -0.25 1.77 -0.30 -0.15 1.56 -5.84 2.97  
cause 9 22 2.73 1.04 2.55 2.67 1.05 1.18 4.91  
emo\_pos 10 22 0.12 0.26 0.06 0.06 0.09 0.00 1.23  
article 11 22 9.13 2.45 8.61 8.95 2.64 5.91 14.47  
prep 12 22 15.66 1.15 15.89 15.83 0.76 12.82 17.22  
quantity 13 22 4.66 1.64 4.46 4.55 1.43 2.05 8.66  
PaperType 14 22 3.00 0.00 3.00 3.00 0.00 3.00 3.00  
 range skew kurtosis se  
year 42.00 -1.11 -0.07 2.61  
Refs 134.00 1.32 1.43 6.94  
flesch\_re 65.86 -1.16 0.90 3.35  
WC 8529.00 0.42 -0.93 516.97  
abstraction 6.82 -0.42 -0.84 0.40  
jargon 19.40 -0.30 -1.34 1.32  
CertSent 0.94 -0.27 -1.13 0.06  
LingObf 8.81 -1.03 2.29 0.38  
cause 3.73 0.42 -0.61 0.22  
emo\_pos 1.23 3.38 11.22 0.06  
article 8.56 0.48 -0.91 0.52  
prep 4.40 -1.22 0.76 0.25  
quantity 6.61 0.62 -0.27 0.35  
PaperType 0.00 NaN NaN 0.00  
------------------------------------------------------------   
group: Multi-Authored Genuine Papers  
 vars n mean sd median trimmed mad min max  
year 1 22 2010.77 8.50 2012.50 2011.89 8.15 1990.00 2022.00  
Refs 2 22 44.05 20.05 36.50 41.94 15.57 19.00 91.00  
flesch\_re 3 22 34.86 8.34 36.17 35.12 6.35 15.95 49.45  
WC 4 22 4407.82 2741.91 3624.00 4009.67 1307.65 1124.00 13901.00  
abstraction 5 22 -0.56 1.83 -0.42 -0.48 1.65 -4.46 3.07  
jargon 6 22 33.61 7.19 35.03 33.51 6.42 20.86 46.67  
CertSent 7 22 6.19 0.31 6.22 6.20 0.19 5.21 6.76  
LingObf 8 22 0.02 1.69 -0.45 -0.16 1.05 -2.50 4.28  
cause 9 22 2.90 1.30 2.44 2.83 0.79 1.04 5.56  
emo\_pos 10 22 0.04 0.05 0.04 0.04 0.05 0.00 0.17  
article 11 22 7.88 1.62 7.71 7.78 1.06 4.22 12.06  
prep 12 22 15.48 2.15 15.66 15.58 1.41 9.76 20.67  
quantity 13 22 3.75 1.09 3.74 3.76 1.21 1.69 5.53  
PaperType 14 22 4.00 0.00 4.00 4.00 0.00 4.00 4.00  
 range skew kurtosis se  
year 32.00 -0.95 0.15 1.81  
Refs 72.00 0.77 -0.61 4.27  
flesch\_re 33.50 -0.41 -0.37 1.78  
WC 12777.00 1.90 3.92 584.58  
abstraction 7.53 -0.26 -0.37 0.39  
jargon 25.81 -0.16 -1.01 1.53  
CertSent 1.55 -1.02 2.09 0.07  
LingObf 6.78 1.08 0.44 0.36  
cause 4.52 0.65 -0.77 0.28  
emo\_pos 0.17 0.88 0.00 0.01  
article 7.84 0.52 0.94 0.35  
prep 10.91 -0.37 1.33 0.46  
quantity 3.84 -0.05 -1.19 0.23  
PaperType 0.00 NaN NaN 0.00

1. Frequency tables will now be produced for categorical variables, both for the data in general and within PaperType groups. A proportion table will be produced to more easily compare frequencies across PaperType groups.

* First, we will make the variables inst\_pres, gender, simple\_reason, Country, and PaperType factor variables.

# Changing inst\_pres (institutional prestige), gender, simple\_reason, Country, and PaperType into factor variables  
data$inst\_pres <- factor(data$inst\_pres, levels = c(0, 1), labels = c("Not Major Research Institution", "Major Research Institution"))  
data$gender <- factor(data$gender, levels = c("FEMALE", "MALE"), labels = c("Female", "Male"))  
data$simple\_reason <- factor(data$simple\_reason, levels = c("f\_data", "f\_image", "m\_image", "f\_data f\_image"), labels = c("Fabricated/Falsified Data", "Fabricated/Falsified Image", "Manipulated Image", "Fabricated/Falsified Data and Image"))  
data$Country <- factor(data$Country)  
data$PaperType <- factor(data$PaperType)

* Next, we will produce frequency tables for each categorical variable of interest for the whole dataset.

# Creating the frequency tables for each categorical variable  
freq\_tab\_inst\_pres <- table(data$inst\_pres)  
freq\_tab\_gender <- table(data$gender)  
freq\_tab\_simple\_reason <- table(data$simple\_reason)  
freq\_tab\_Country <- table(data$Country)  
freq\_tab\_PaperType <- table(data$PaperType)  
  
# Displaying the frequency tables  
freq\_tab\_inst\_pres

Not Major Research Institution Major Research Institution   
 70 18

freq\_tab\_gender

Female Male   
 15 73

freq\_tab\_simple\_reason

Fabricated/Falsified Data Fabricated/Falsified Image   
 27 3   
 Manipulated Image Fabricated/Falsified Data and Image   
 12 2

freq\_tab\_Country

Australia Belgium China Egypt Ethiopia   
 1 1 10 3 2   
 India Iran Israel Italy Japan   
 10 1 1 1 3   
 Latvia Malaysia Netherlands Pakistan Poland   
 1 2 6 3 2   
 Portugal South Africa South Korea Taiwan Turkey   
 2 1 2 1 2   
United Kingdom United States   
 4 29

freq\_tab\_PaperType

MAFP MAGP SAFP SAGP   
 22 22 22 22

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