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Using JMP® and R Integration to Analyze Virtual Chat Messages during a Coronavirus Pandemic

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ABSTRACT

The Coronavirus pandemic has altered the way communications, in-person meetings, and social gatherings take place. Video conferencing technologies such as Zoom, Skype, and Microsoft® Teams have been the predominant ways of conducting and attending meetings, social networks, conferences. Sentiment Analysis is a new add-in feature which came in version 16 of JMP Pro's Text Explorer platform. With JMP® and R Integration, these same capabilities are also available to base JMP users. This paper presents the use of natural language processing techniques of comparison word clouds and sentiment analysis of Zoom chat messages during a video conferencing session that helped uncover the feelings, opinions, and attitudes of SAS User Group participants about professional development.
Keywords: Natural Language Processing, Comparison Word Clouds, Sentiment Analysis

INTRODUCTION

The COVID-19 pandemic has halted many in-person events which has led many SAS® Users Groups (SUGs) to switch to alternative video conferencing and virtual meeting technologies such as Adobe Connect, Zoom, Skype, Google Chat, WebEx, Facebook Live/Chat/Messenger, and Microsoft Teams to conduct meetings and attend conferences (Stanley et al., 2021). The following example describes how Zoom was used to highlight results of a virtual panel meeting that focused on professional development for SAS programming and modeling personnel working in new organizations. Also, I show how text analytic tools of Comparison Word Clouds (Alexander, 2018) and Sentiment Analysis (R Core Team, 2018, Burbank, 2021, Farrelly, 2021, and Sonsa, 2021) using R software summarizes the views of respondents using Chat comments from the Zoom session. Virtual meetings like the Zoom session below represents one of the modern trends organizations and professional groups are changing the way communications, in-person meetings and social gatherings take place in the COVID-19 pandemic.

METHODOLOGY

Virtual meetings with a Professional Development panel of a local SAS Users group were held via Zoom. Three meetings were conducted to develop an agenda, a timeline, and final test the features on the virtual app. Several topics were discussed: building networks, developing nontechnical skills, career development within one organization vs. switching organizations, how to get started in being part of quality community organizations, and analyzing data for the public good. The Zoom hosts allowed participants to move through different breakout sessions. Each session followed a free-flowing format, where attendees could join and leave breakout rooms on their own. The Zoom session lasted 110 minutes for the panel discussion, allowing 20 minutes time for each topic. Attendees posted questions for the panelists and comments in the "chat" section of the Zoom meeting. The "Chat" responses were recorded and reported below:

Respondent 1: "I seek to build networks in new organizations by identifying people who share my interests by talking to my supervisors and mentors in the other departments I hope to collaborate with,

or I find them by browsing the employee profiles. It is important to examine the analytics team makeup and ensure that the right people are in the right places and positions to get work done in order to guarantee a successful transformation."

Respondent 2: "I introduce myself as a new SAS programmer and modeler who joined the organization and mention that we have research interests in common.
I ask if they want to join me for time to grab coffee and chat. People generally would be happy to meet you, especially in a large organization."

Respondent 3: "I like meet people outside of my organization who share the same interests in SAS. I joined my local SAS Users group, which was a way to meet people in a non-work, professional setting. I also joined internal SAS user groups with people outside of my department as another way to meet people."

Respondent 4: " It's helpful to have advocates and mentors who can help guide you when you join an organization. Think of mentors as advocates who can speak up for you positively about your work when you are not in the room. Try to be strategic in identifying potential mentors so they can be in your network."

Respondent 5: "Try to developing nontechnical, communication, leadership, influence, and negotiation skills. They are important for building trust and relationships with co-workers. Building relationships involves finding ways to relate with other people and learn their interests. To build trust always deliver on the things you promise."

Respondent 6: "Think of the four Cs: be clear, concise, correct, and complete in what you write and say. SAS programmers must learn to be multilingual in other languages like Python, SQL, and R. We must be able to think in a different language than the way other people think. Be able to translate what our collaborators talk about in their language so we can actually help them solve their problems. We should be able to translate back into a language they understand so they can actually implement or put into practice the good modeling and programming practices that have been developed to work with them."

Respondent 7: "Become involved with local professional, SAS Users groups, associations or other community volunteer organizations so that you get opportunities to apply and practice your skills."

Respondent 8: "Find ways to complete challenging assignments would lead to job growth and success. Making sure you get recognized for doing good work is important. Practice your quantitative skills by taking part in data science competitions so that you keep your skills sharp."

Respondent 9: "Take part in the organizational transformation, ask questions, stretch yourself and your team, and be prepared to learn a lot along the way. Show up every day focusing on making base-hits by using tools that you know how to use, add new skills and software over time, and to improve data governance, data quality, reliability. We need to learn how to inject our insights into the business and organizational decision making."

The comments above were captured as the SuggEx object and analyzed using commands in the R Submit() command block for sentiment analysis with JMP and R Integration in Appendix 1. R integration with Base JMP was described by Alexander (2020) and Alexander (2014). The JMP Scripting Language (JSL) code below outlines the basic syntax that integrates R and base JMP. First, JSL starts with creating

an *Environmental Variable* (**R_HOME**) that lets JMP know the path where the R execution is located. Second, the *R Init ()* command initiates the R session. Third, R code is embedded inside the *R Submit ()* block. Fourth, the *R Get()* command converts R data frames into JMP data tables. Finally, additional data tables, visualizations and analyses are performed with JMP. The *R Term()* command terminates the R connection.

```
Set Environment Variable( "R_HOME", "C:\Program Files\R\R-4.1.1") ;
R Init();
R Submit(
"\[
# Load chat messages from SAS Users Group (SUG) Virtual Panel Zoom
# meeting respondents as a text data object (SuggEx)
# Load libraries
# Clean, reshape, and process text data with R's text mining
algorithms
# Produce comparison word cloud and other visualizations
# Set up Sentiment Analysis using lexicon dictionaries
# Compute summary statistics and sentiment scores
# Construct control charts and comparative box plots of respondent's
# sentiments
    additional R code to be executed
]\"
);
// Use R Get()function converts R data frames into JMP data tables
// Generate JMP Sentiments Analysis Data Tables, Ishikawa (Cause and
// Effect) Diagrams, Control Charts, and Comparative box plots
// between R and JMP
R Term(); /** terminate R connection **/
```

To integrate R and base SAS, follow these steps:

1. Download the PROC_R macro code from Wei (2012).
2. Save the file in a stored location (e.g., "P:\My SAS Files\Base SAS PROC_R macro.sas").
3. Open the code and update the path of R executable file in the code below.

```
 * add the location path where R version 4.1.1 is installed ;
%macro quit(rpath=%str(C:\Progra~1\R\R-4.1.1\bin\R.exe));
```

   Here the rpath refers to location where the R executable is saved on the same machine where SAS is installed. Be sure to install the R library packages used for the analysis.

4. Open Base SAS and call the PROC_R3 macro, a modification of Xin Wei's PROC_R macro (2012) that executes R code in base SAS. The Proc_R3_fgname.sas program (with the %PROC_R3 macro) suppresses macro variables &fgname and &fgsw from being printed to the SAS log that avoids errors when running the program.
5. Run R inside the SAS environment. See the SAS program below:

```
 %include "P:\My SAS Files\Proc_R3_fgname.sas"  ;
 %Proc_R3(SAS2R =, R2SAS=) ;
 cards4 ;
/************************************************/
```

```
  R code within the R Submit() block in Appendix 1  ;
/*************************************************/
 dev.off()
 ;;;;
 %quit;
```

The macro variables are described as follows:
SAS2R - specifies the names of SAS datasets converted into R data frames or objects. The dataset can be single file names or multiple files names separated by spaces. JMP uses the *R Send()* function to create these R objects.
R2SAS - specifies the names of R data frames or objects that convert into SAS datasets. These objects can be single file names or multiple files names separated by spaces. JMP's *R Get()* function converts R objects into JMP data tables or SAS datasets.

Similarly, the %SUBMIT_R macro may be used according to the instructions described by Bettinger (2016). Gilsen (2018) described other ways of interfacing SAS products with R.

EXAMPLE

Figure 1 shows the Pareto Analyses of the nine most frequently used terms from all respondents. *Peopl, practic,* and *languag* are the base or root terms (stems) reduced from the words, people, practice, and language, respectively. The skipWords function in Appendix 1 performed the stemming on the Respondent's comments.

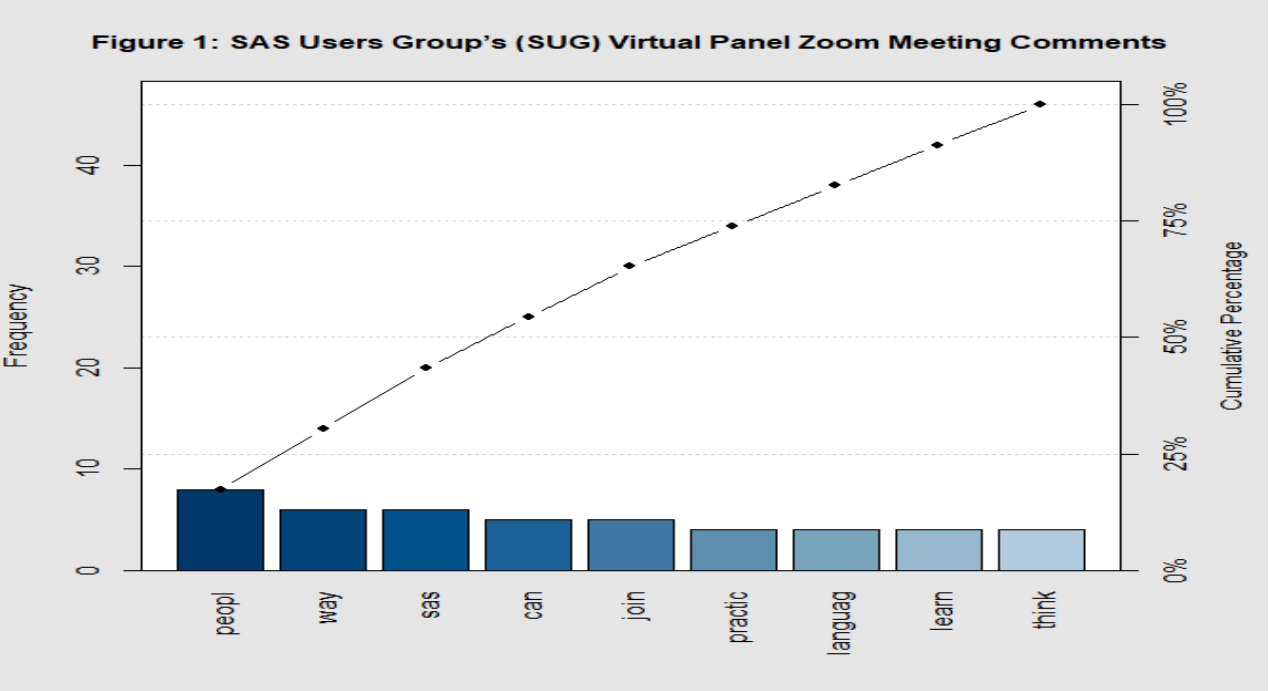
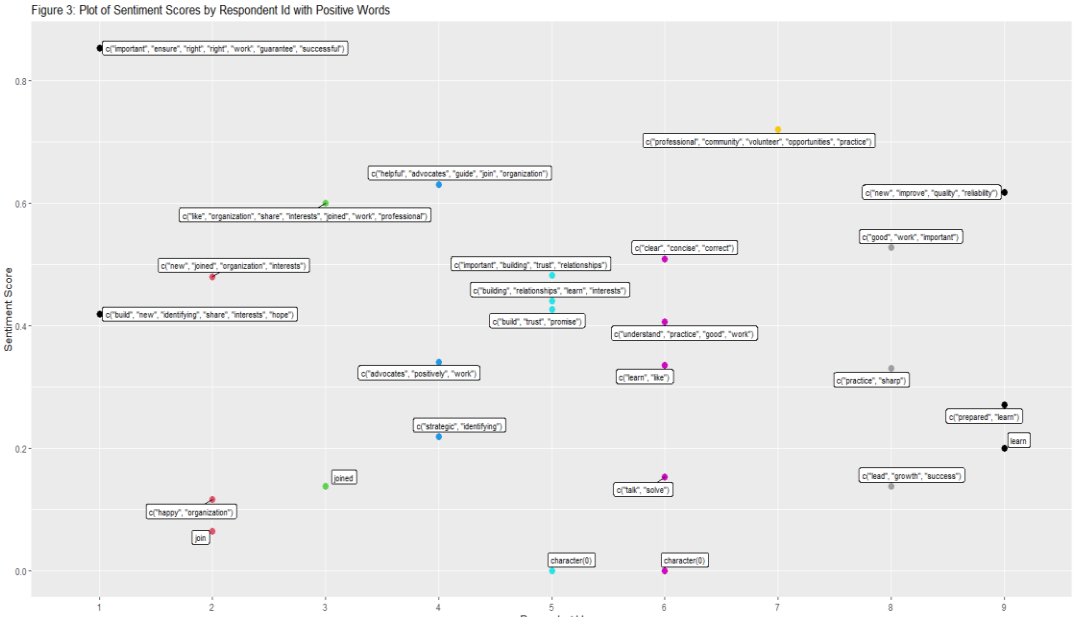


Figure 2 is the Comparison Word Cloud of terms color-coded for each Respondent. Larger-sized words are more frequently used than smaller-sized terms by respondents. For example, the terms advoc, can, and mentor are the most frequently used terms in Respondent 4's Chat message: "It's helpful to have advocates and mentors who can help guide you when you join an organization. Think of mentors as

advocates who can speak up for you positively about your work when you are not in the room. Try to be strategic in identifying potential mentors so they can be in your network." The large-sized terms of Respondent 3 suggested the importance of meeting people who are users of SAS outside of work. Respondent 6 emphasized being able to think and translate in other's language. Respondent 8 sought challenging work assignments to achieve job growth. Alexander (2019) described how to produce a similar plot in with the %PROC_R macro and Base SAS interface.

Figure 2: Comparison Cloud of Terms and Scores, Separate Colors for Each Respondent

Figure 3 shows a scatter plot of the Sentiment Scores and Positive Words of each Respondent that appeared in the sentences where they were used from Table 1.



Notice that Respondent 1, Sentence 2 (element_id=1, sentence_id=2, "It is important to examine the analytics team makeup and ensure that the right people are in the right places and positions to get work done in order to guarantee a successful transformation.") had the strongest positive sentiment score of 0.853 that was associated with terms *important, ensure, right, right, work, guarantee*, and *successful*. The terms *professional, community, volunteer, opportunities,* and *practice* for Respondent 7's first sentence (element_id=7, sentence_id=1," Become involved with local professional, SAS Users groups, associations or other community volunteer organizations so that you get opportunities to apply and practice your skills") had a second strongest positive association with a sentiment score of 0.72. The first sentence of Respondent 5 (element_id=5, sentence_id=1) and third sentence of Respondent 6 (element_id=6, sentence_id=3,) yielded sentiment scores of 0.000 with no positive terms.

Figure 4 is a histogram plot of the Sentiment Scores used by the Respondents

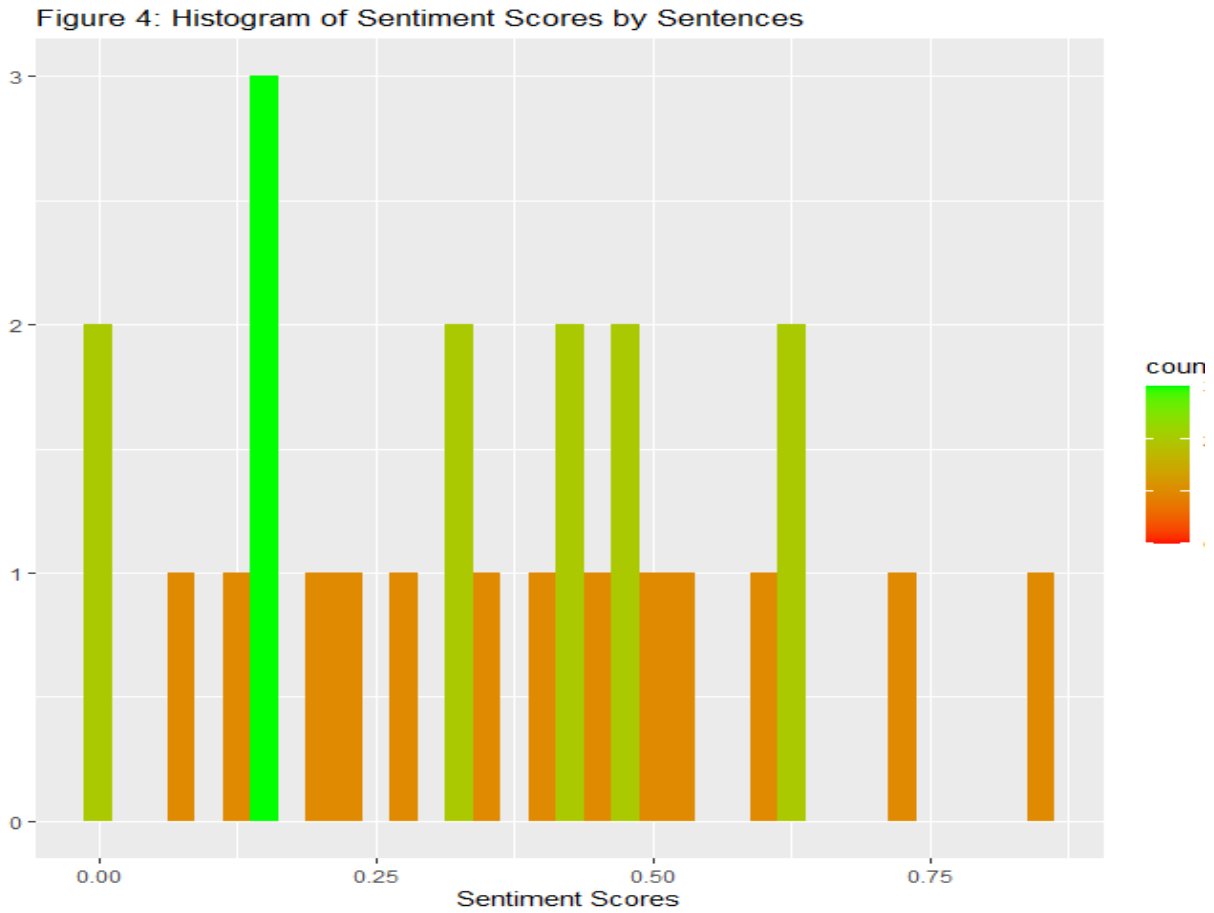
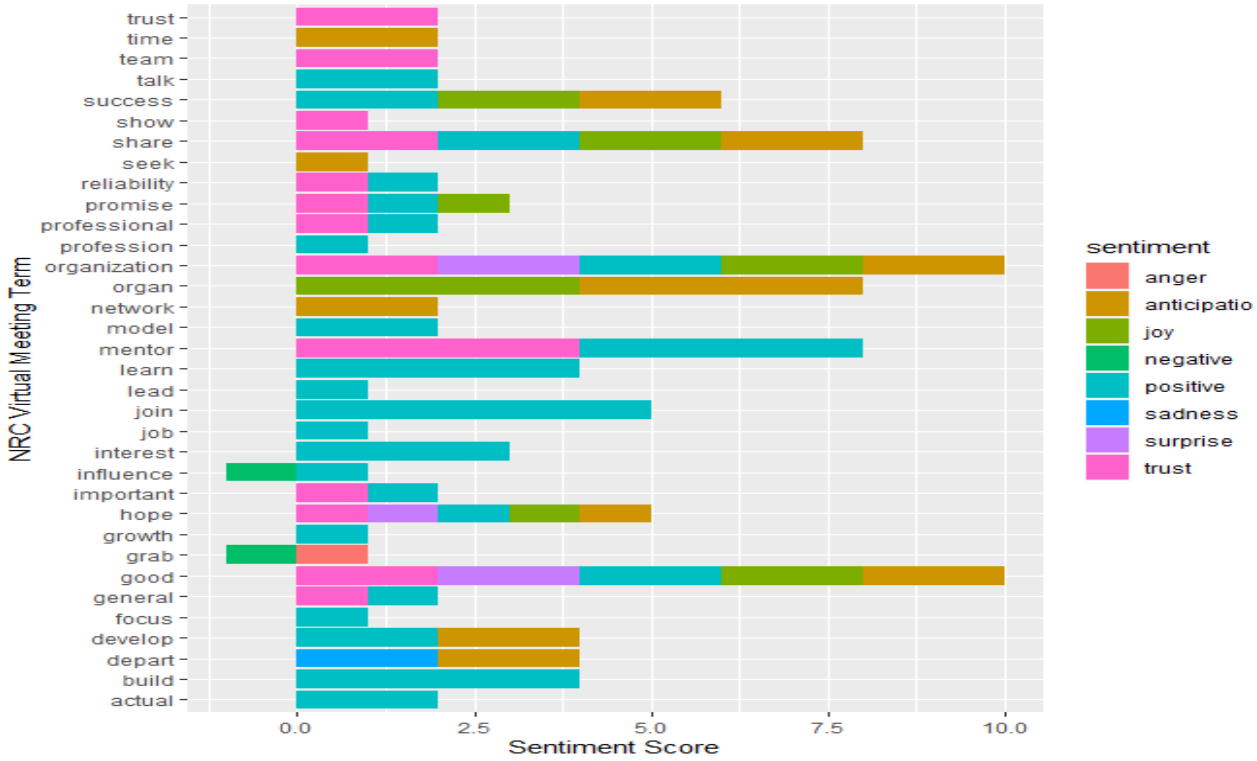


Figure 5 plots the eight sentiments from the NRC Lexicon color coded by the Chat words contributing positively and negatively to the sentiment effects. Words like *organization, organ, share, mentor, and good* contributed high on the positive side while words like *grab,* and *influence* had the opposite effect on the negative side.

Figure 5: Plot Virtual Words by Sentiment Scores from the NRC Lexicon



Figures 6 plots 14 sentiments from the AFINN lexicon that were color coded by their sentiment score frequencies, similar to Figure 5. The words *want*, *trust, success, share, promise, like, join, interests, interest, important, hope, help, growth, good, and clear* conveyed positive sentiments with the term *problems* conveying negative sentiment.

Figure 6: Plot Virtual Words by Sentiment Scores from the AFINN Lexicon

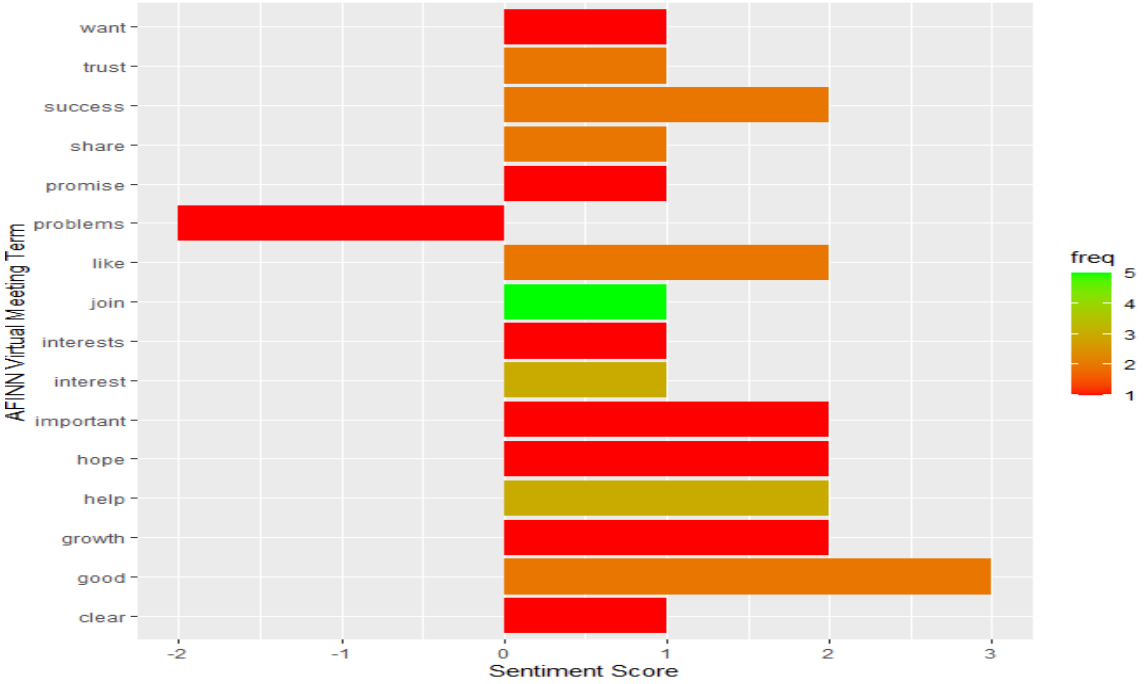


Figure 7 displays the Cause and Effect diagram that listed important causal factors worth considering as potential influences of **Sentiments**. The **Sentiments** causal factors are organized into the categories of machines, methods, measurements, mother nature (environment), humans, and materials. **Sentiments** depend on sub-causal factors such as: Internet of Things (IOT), Cloud computing in the **Mother Nature/*Environmental*** category; CPUs and Laptops/PCs/Macs within the **Machines** category; Analysts and Respondents from the **huMans** category; Lexicon dictionaries used, Respondent comments (Corpus), and text vectors within the ***Materials*** category; Natural Language Processing, text mining libraries, and scoring algorithms within the ***Methods*** category; Scores and metrics within the ***Measurements*** category. The diagram helps identify possible interrelationships among theories that affect sentiment analysis.

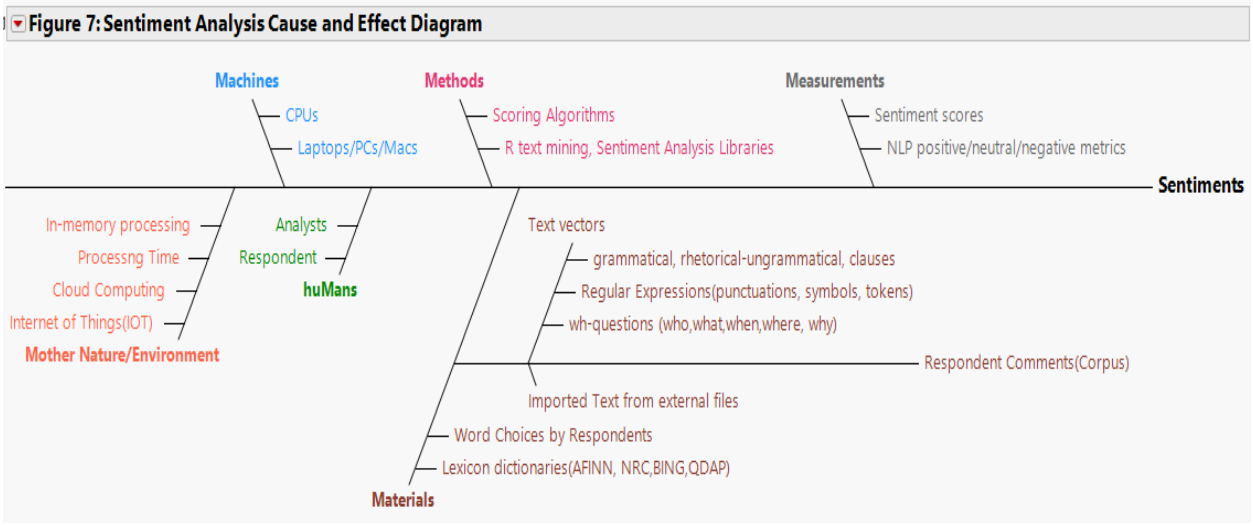
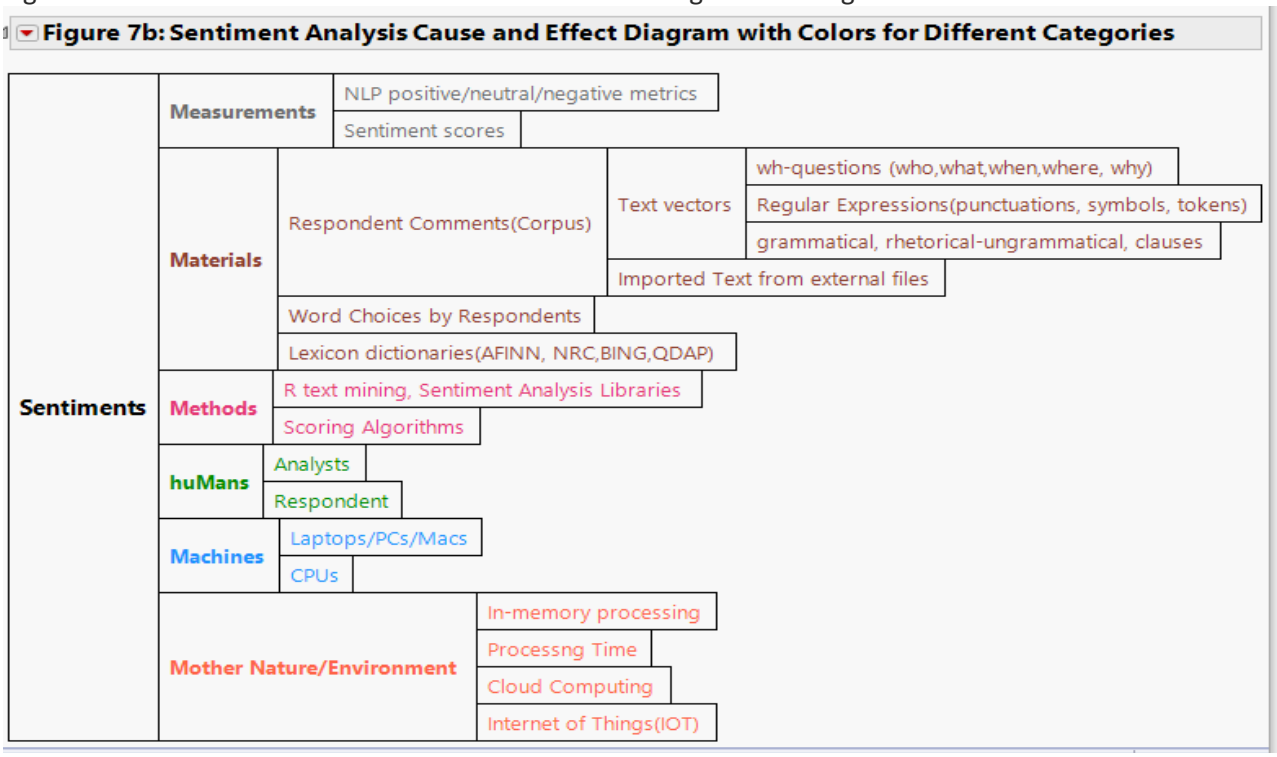


Figure 7b shows a nested form of the Cause and Effect Diagram from Figure 7:



The JMP “Sentiments, ID, and Polarity” Data Table was produced by importing the text file **export_p4_dataframe.txt** which was exported by the sink() function for the p4 data frame from R in Appendix 1. The row state colors for each respondent (element_id) were defined by the colors object assigned to respondents 1-9 with the colors "tomato", "green4", "coral4", "orangered", "dodgerblue", "magenta", and "azure4", “brown”, and “purple”, respectively.

Table 1: JMP Data Table of Sentiment scores of Respondents (element_id) with the columns: sentiment, sentence_id, word count, positive and negative sentiment terms, polarity (which expresses the overall emotional direction in each sentence which is positive when sentiment exceeds zero, neutral when sentiment equals zero, or negative when sentiment is below zero), and Sentence.

Sentiments, ID, and Polarity - JMP

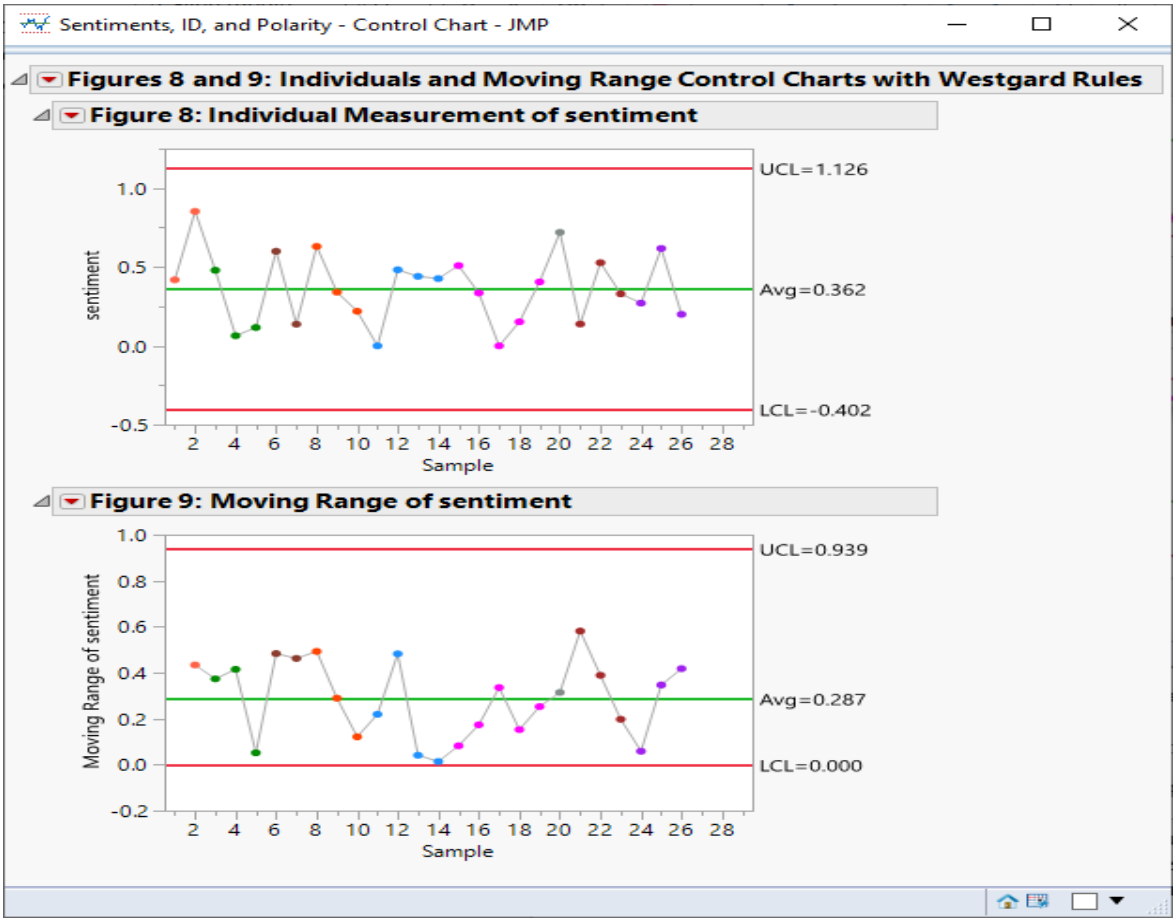
File Edit Tables Rows Cols DOE Analyze Graph Tools Add-Ins View Window Help

9 Cols

26 rows

	id	element_id	sentence_id	word_count	sentiment	positive	negative	polarity	Sentence
1	1	1	1	40	0.41900179	build, new, identifying, share, interests, hope		positive	I seek to build networks in new organizations by identifying people who share my interests by talking to my ...
2	2	1	2	33	0.85298051	important, ensure, right, right, work, guarantee, successful		positive	It is important to examine the analytics team makeup and ensure that the right people are in the right places and ...
3	3	2	1	23	0.47958315	new, joined, organization, interests		positive	I introduce myself as a new SAS programmer and modeler who joined the organization and mention that we have ...
4	4	2	2	15	0.06454972	join		positive	I ask if they want to join me for time to grab coffee and chat.
5	5	2	3	13	0.11648704	happy, organization	would be	positive	People generally would be happy to meet you, especially in a large organization.
6	6	3	1	35	0.60005952	like, organization, share, interests, joined, work, professional		positive	I like meet people outside of my organization who share the same interests in SAS. I joined my local SAS Users ...
7	7	3	2	19	0.13764944	joined		positive	I also joined internal SAS user groups with people outside of my department as another way to meet people.
8	8	4	1	17	0.63059263	helpful, advocates, guide, join, organization		positive	It's helpful to have advocates and mentors who can help guide you when you join an organization.
9	9	4	2	22	0.34112115	advocates, positively, work		positive	Think of mentors as advocates who can speak up for you positively about your work when you are not in the room.
10	10	4	3	15	0.21946806	strategic, identifying		positive	Try to be strategic in identifying potential mentors so they can be in your network.
11	11	5	1	10	0			neutral	Try to developing nontechnical, communication,leadership, influence, and negotiation skills.
12	12	5	2	11	0.48241815	important, building, trust, relationships		positive	They are important for building trust and relationships with co-workers.
13	13	5	3	14	0.44098105	building, relationships, learn, interests		positive	Building relationships involves finding ways to relate with other people and learn their interests.
14	14	5	4	10	0.42690748	build, trust, promise		positive	To build trust always deliver on the things you promise.
15	15	6	1	17	0.50932481	clear, concise, correct		positive	Think of the four Cs: be clear, concise, correct, and complete in what you write and say.
16	16	6	2	15	0.33565856	learn, like		positive	SAS programmers must learn to be multilingual in other languages like Python, SQL, and R.
17	17	6	3	16	0			neutral	We must be able to think in a different language than the way other people think.
18	18	6	4	21	0.15275252	talk, solve	problems	positive	Be able to translate what our collaborators talk about in their language so we can actually help them solve their ...
19	19	6	5	35	0.40567404	understand, practice, good, work		positive	We should be able to translate back into a language they understand so they can actually implement or put into ...
20	20	7	1	25	0.72	professional, community, volunteer, opportunities, practice		positive	Become involved with local professional, SAS Users groups, associations or other community volunteer ...
21	21	8	1	13	0.13867505	lead, growth, success ch	allenging	positive	Find ways to complete challenging assignments would lead to job growth and success.
22	22	8	2	11	0.52764485	good, work, important		positive	Making sure you get recognized for doing good work is important.
23	23	8	3	18	0.32998316	practice, sharp		positive	Practice your quantitative skills by taking part in data science competitions so that you keep your skills sharp.
24	24	9	1	23	0.27106874	prepared, learn		positive	Take part in the organizational transformation, ask questions, stretch yourself and your team, and be prepared to ...
25	25	9	2	33	0.61797568	new, improve, quality, reliability		positive	Show up every day focusing on making base-hits by using tools that you know how to use, add new skills and ...
26	26	9	3	16	0.2	learn		positive	We need to learn how to inject our insights into the business and organizational decision making

Figures 8 and 9 plot the Individuals and Moving Range Control Chart with Westgard pattern rules of the sentiment scores by Respondent Ids of the JMP Data Table 1. Westgard rules raise suspicion over how the sentiments scores are measured if unusual patterns are shown on Figures 8 and 9.



Figures 8 and 9 depict an unconventional use of control charts of the sentiment variability between respondents. Both Figures 8 and 9 demonstrate stability in the variability of sentiments expressed by the respondents. Therefore, no Westgard rule patterns appear on the plots.

Figure 10 reveals a different pattern. Respondents 1 and 7 had higher median sentiments above the mean sentiment score of 0.362 compared with the other respondents.

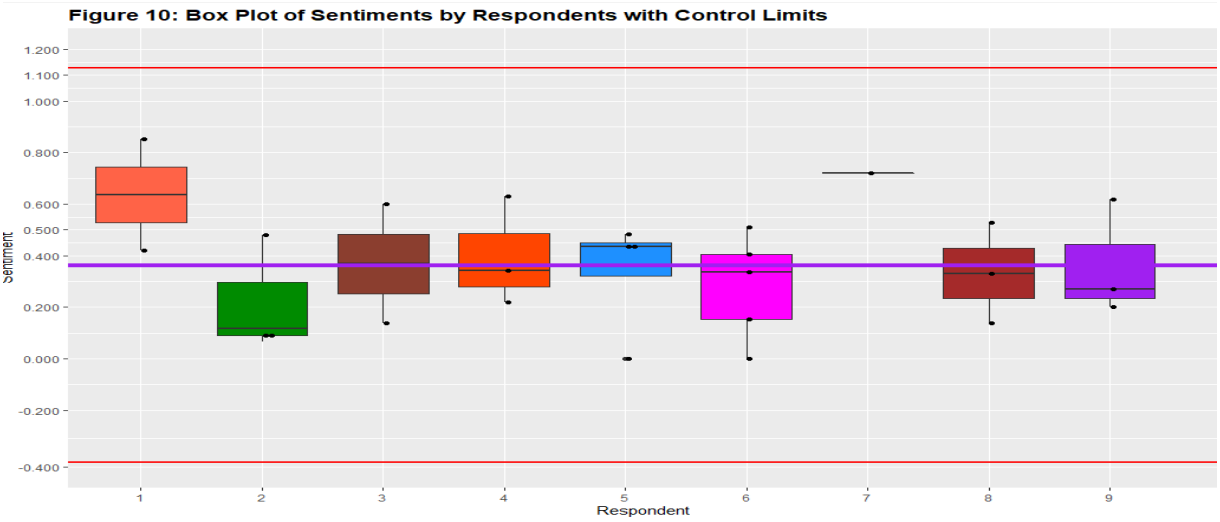
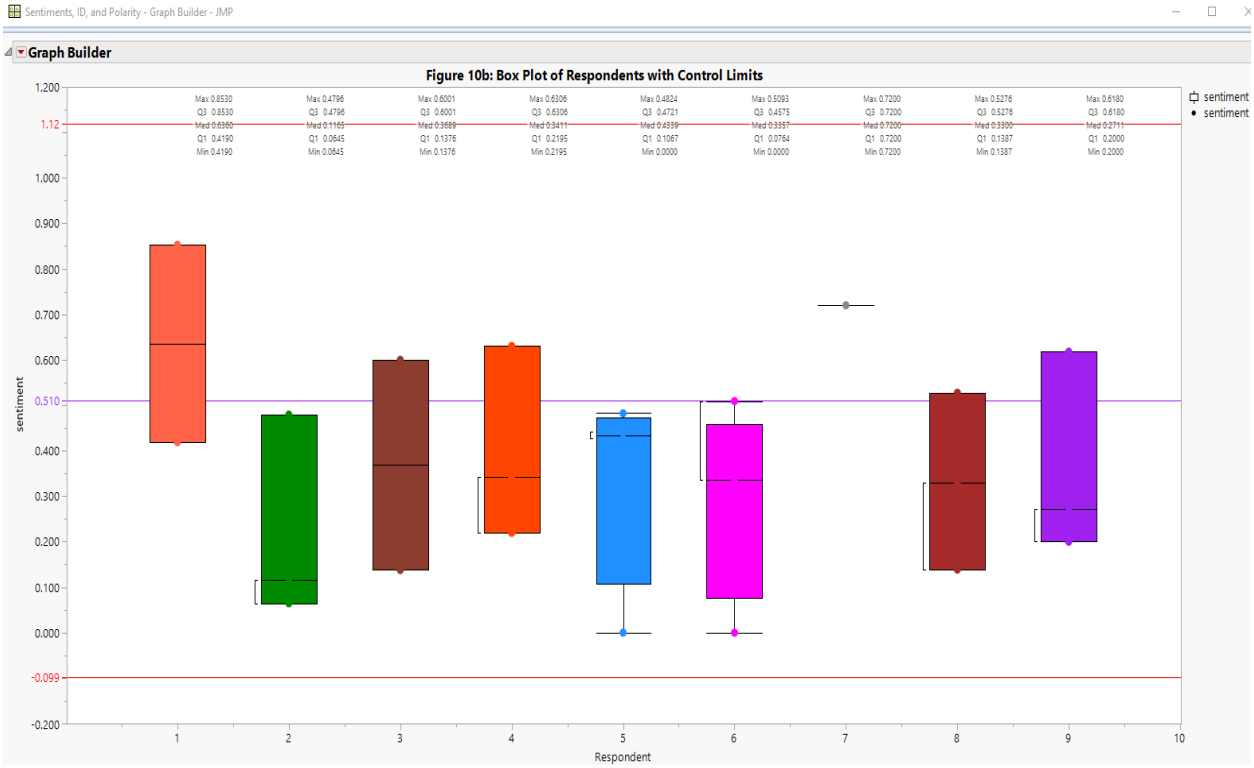


Figure 10b presents a Comparative Box Plot of Sentiment vs. Respondent similar to Figure 10 using JMP's Graph Builder that includes five-number summaries for each respondent.



CONCLUSION

The virtual format made it easy for participants to attend the sessions online safely without physically meeting in-person nor running the risk of in-person COVID-19 infection. The Zoom session was recorded and posted on a website accessible to registered individuals who signed on to view the event.

Sentiment Analysis helped gauge how positively or negatively people feel about the topics discussed, based on their written comments. In this context, Sentiment Analysis helped to uncover feelings, opinions, and attitudes of participants about professional development during the Virtual Panel.

These text analytic tools give useful insights to other machine learning applications that lead to successful transition into new job situations. Other examples (Das and Das, 2017) would involve identifying factors to derive **personality traits** from *sentiment words* such as **introversion**-*alone* or *lonely*, **extroversion**-*energetic*, **openness**-*curious*, **conscientiousness**-*sincere*, **agreeableness**-*trust*, **neuroticism**-*apprehensive* from the AFINN lexicon or any behavioral characteristics (e.g., Figure 5's NRC sentiments) from respondent's word choices, term frequencies, parts-of-speech, and other grammatical relations that may appear in unstructured text and other lexicon dictionaries (e.g., Figures 2, 3, 5, 6, 7, and 7b).

Next steps for following up of the current analysis would include:

(1) Conduct confirmation studies using the current "training" data to build statistical descriptive, prediction models and check the accuracy of the models on separate, validation, "test" datasets consisting of sentiments found in the other chat messages that identify determinants that help

new employees advance in their organizations that they can continue to use throughout their careers. The sub-cause categories in Figures 7 and 7b serve as main effects and interacting factors (sources of variation) that affect the Sentiment scores as response variables. Cross-validation of the text messages is typically done using Training%:Test% splits (= 80:20, 75:25, 70:30, 60:40) or by dividing the respondent text data into k subsets (called k-folds) where k = 5 or 10. Each kth-fold is held out as the test subset with the remaining k-1 folds used as training subsets.

(2) Add new sentiment terms to the lexicon dictionaries that define career or job success in organizations.

(3) Use negative sentiments to identify opportunities for improving quality.

The analysis techniques presented in this example is bound to gain more traction as video conferencing continues to grow past a post COVID-19 period into the Quality 4.0, digital transformation age. Combining R with base JMP gives users the same capabilities without having JMP Pro.

REFERENCES

1. Alexander, M (2020), "Model Comparison of Machine Learning Techniques to detect signs of Penetrating Abdominal and Pelvic Injuries using Base JMP® and R Integration", https://www.lexjansen.com/sesug/2020/SESUG2020_Paper_103_Final_PDF.pdf (accessed 06/16/2021).

2. Alexander, M. (2019), "Comparison Word Clouds Using the %PROC_R macro and Base SAS® Interface," https://www.lexjansen.com/sesug/2019/SESUG2019_Paper-113_Final_PDF.pdf, (accessed 06/16/2021).

3. Alexander, M.(2018), "Word Clouds Using R: Pareto Analysis for Text," *Software Quality Professional*, v21:n1, pp.48-50.

4. Alexander, M (2014), "Using JMP® and R Integration to Assess Inter-rater Reliability in Diagnosing Penetrating Abdominal Injuries from MDCT Radiological Imaging", https://community.jmp.com/docs/DOC-6674 (accessed 04/27/2016).

5. Bettinger, R. (2016), "%SUBMIT_R: A SAS(R) Macro to Interface SAS and R", *SESUG 2016 Conference Proceedings*, https://analytics.ncsu.edu/sesug/2016/AD-118_Final_PDF.pdf, (Accessed 6/10/2021).

6. Noah Burbank, (2021), "How to choose the right model for text classification in an organizational setting", https://towardsdatascience.com/how-to-choose-the-right-model-for-text-classification-in-an-organizational-setting-1a610a0418e1, 6/7/2021 (Accessed 6/10/ 2021).

7. Das, K.G, Das, D. (2017), " Developing Lexicon and Classifier for Personality Identification in Texts," *Proceedings of the 14th International Conference on Natural Language Processing, ICON 2017*, (Sivaji Bandyopadhyay, editor), Kolkata, India, December 18-21, 2017. pp. 362-372, NLP Association of India, https://www.aclweb.org/anthology/W17-7545.pdf (Accessed 6/14/2021)

8. Farrelly, C. (2021), “Natural Language Processing-An Introduction”, *SAS Global Forum 2021 Conference and Proceedings*, 4/8/2021, https://communities.sas.com/t5/SAS-Global-Forum-Proceedings/Natural-Language-Processing-An-Introduction/ta-p/732367 (Accessed 6/10/2021).

9. Gilsen, B. (2018), "Using the R interface SAS® to Call R Functions and Transfer Data", *SESUG 2018 Conference Proceedings*, https://www.lexjansen.com/sesug/2018/SESUG2018_Paper-119_Final_PDF.pdf, (Accessed 6/10/2021).

10. Metusalem, R. (2021), ”Deriving Sentiments from Opinions or Product Choices”, https://community.jmp.com/t5/Mastering-JMP-Videos-and-Files/Deriving-Sentiments-from-Opinions-or-Product-Choices/ta-p/317476 (accessed 06/27/2021).

11. Metusalem, R. (2020), “Sentiment Analysis comes to JMP Pro 16”, https://community.jmp.com/t5/JMP-Blog/Sentiment-Analysis-comes-to-JMP-Pro-16/ba-p/315123 (accessed 06/27/2021).

12. Stanley, R., Amiel, J.P., Dyer, R., Guenette, M., (2021), “A Beginner’s Guide to Virtual Events,” *Quality Progress*, April 2021, pp. 40-47.

13. Wei, X. (2012), "%PROC_R: A SAS Macro that Enables Native R Programming in the Base SAS Environment" *Journal of Statistical Software*, v.46, Code Snippet 2, https://www.jstatsoft.org/article/view/v046c02, (Accessed 6/24/2021).

CONTACT INFORMATION

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APPENDIX 1: JMP JSL SCRIPT TO PERFORM JMP AND R INTEGRATION

```
// clear log() ;
/*****************************************************************
TITLE: JMP and R Integration Script for Word Cloud and Sentiment
       Analysis from Zoom Meetingb.jsl

AUTHOR: Melvin Alexander

PURPOSE: JMP JSL scripting language code to Analyze Chat messages
         from a Zoom meeting within the base JMP and R
         Integration Environment.

Versions: JMP 14.+ (or higher), R 4.+ (or higher)
```

```
INPUTS to R:
SuggEx, SuggEx2:    Corpus Text file of the Zoom chat messages
                    from Respondents separated by quotes ("").
corpus2b.tdm:        Term-document-matrix after parsing, cleaning,
                    preparing the Corpus chats
colnames(m):     The text vector of the Respondents

DATA TABLES:
"Sentiments Ishikawa Table"
"Sentiments, ID, and Polarity"

OUTPUTS:
1. Plots of Comparison Word Clouds, Sentiments and Scores from the
   AFINN, BING, NRC, and QDAP lexicon dictionaries in R;
2. Individuals (with 2-sigma warning limits) and Moving Range
   Control charts using Levey-Jennings, Westgard Statistical
   Control rules (1:2S means one measurement exceeded
   2-standard deviations either above or below the mean of the
   reference range);
3. Sentiments Analysis Cause and Effects Diagram;
4. Box Plot of Sentiment Scores for Respondents.

USAGE: Create Environmental Variable for R 4.1.1 to let JMP know
the path where the R execution is located. Originally used
Set Environment Variable( "R_HOME", "C:\Program Files\R\R-3.5.0" ) ;
Updated to run R on version 4.1.1

NOTES:
As a workaround to avoid getting the error:
"The final R statement is incomplete.
 Get data for "p2_sent_df" failed{25}"
as described in
https://community.jmp.com/t5/Discussions/Problem-with-JMP-and-R-R-Send-R-Get-return-
quot-The-final-R/m-p/338409#M58627,
run the R Get()command outside the R Submit() block
within the comments for the Pxmr object.
*********************************************************************/
Set Environment Variable( "R_HOME", "C:\Program Files\R\R-4.1.1") ;
R Init();
R Submit(
"\[
# Load suggestions from SAS Users Group (SUG) Virtual Panel Zoom meeting respondents:
SuggEx <-
c("I seek to build networks in new organizations by identifying people who share my
interests by talking to my supervisors and mentors in the other departments
I hope to collaborate with, or I find them by browsing the employee profiles. It is
important to examine the analytics team makeup and ensure that the right people
are in the right places and positions to get work done in order to guarantee a
successful transformation.",

"I introduce myself as a new SAS programmer and modeler who joined the organization
and mention that we have research interests in common.
I ask if they want to join me for time to grab coffee and chat. People generally would
be happy to meet you, especially in a large organization.",

"I like meet people outside of my organization who share the same interests in SAS. I
joined my local SAS Users group, which was a way to meet
people in a non-work, professional setting. I also joined internal SAS user groups
with people outside of my department as another way to meet people.",

"It's helpful to have advocates and mentors who can help guide you when you join an
organization. Think of mentors as advocates who can speak up for
```

```
you positively about your work when you are not in the room. Try to be strategic in
identifying potential mentors so they can be in your network.",

"Try to developing nontechnical, communication,leadership, influence, and negotiation
skills. They are important for building trust and relationships
with co-workers. Building relationships involves finding ways to relate with other
people and learn their interests. To build trust always deliver on the
things you promise.",

"Think of the four Cs: be clear, concise, correct, and complete in what you write and
say. SAS programmers must learn to be multilingual in other languages
like Python, SQL, and R. We must be able to think in a different language than the way
other people think. Be able to translate what our collaborators talk
about in their language so we can actually help them solve their problems. We should
be able to translate back into a language they understand so they can
actually implement or put into practice the good modeling and programming practices
that have been developed to work with them.",

"Become involved with local professional, SAS Users groups, associations or other
community volunteer organizations so that you get opportunities to
apply and practice your skills.",

"Find ways to complete challenging assignments would lead to job growth and success.
Making sure you get recognized for doing good work is important.
Practice your quantitative skills by taking part in data science competitions so that
you keep your skills sharp.",

"Take part in the organizational transformation, ask questions, stretch yourself and
your team, and be prepared to learn a lot along the way.
Show up every day focusing on making base-hits by using tools that you know how to
use, add new skills and software over time, and to improve
data governance, data quality, reliability. We need to learn how to inject our
insights into the business and organizational decision making")


# load libraries
library(wordcloud)   # draw wordclouds
library(tm)          # text analysis functions
library(SnowballC)   # reduce words to common stems
library(slam)        # do hierarchical clustering
library(qcc)         # prepare Pareto chart
library(ggplot2)     # create other plots
library(qdap)        # finds out positive, negative, negation, amplification, and de-
amplification keywords to get a conclusive sentiment score
library(qdapDictionaries) # dictionary that goes with the qdap package
library(tidytext)    # structures text data into tokenized formatb (characters,
sentences, lines, words, etc.) similar to the tm package
library(sentimentr)  # another sentiment package that contains negators, amplifiers,
de-amplifiers, and adversative valence shifters
library(ggplot2)     # plots the data visualizations
library(dplyr)       # handles data manipulations functions
library(tidyr)       # tools changing the shape (pivoting) and hierarchy (nesting,
unnesting) of data
library(ggrepel)     # adds readable text to plots away from points without overlap
library(qicharts2) # Produce SPC control charts in R
library(ggQC)        # create QC control charts within the ggplot framework

# load text data
Suggestion <- matrix(SuggEx)
TEXTFILE = Corpus(VectorSource(c(Suggestion)))
inspect(TEXTFILE)

# clean and process text data
```

```
newstopwords <- c("and", "for", "the", "to", "of", "in",
"as", "is", "with", "an", "then", "by", "they", "than", "he", "she")
skipWords <- function(x) removeWords(x, stopwords("english"))
funcs <- list(tolower, removePunctuation, removeNumbers,
      stripWhitespace, stemDocument, skipWords)
corpus2.proc <- tm_map(TEXTFILE, FUN = tm_reduce, tmFuns = funcs)
corpus2.proc <- tm_map(corpus2.proc, removeWords, newstopwords)
corpus2.proc <- tm_map(corpus2.proc, removeWords, stopwords("english"))

# create term-document matrix and label column names with scores
corpus2b.tdm <- TermDocumentMatrix(corpus2.proc)
m <- as.matrix(corpus2b.tdm)
colnames(m) <- c("Respondent 1", "Respondent 2", "Respondent 3",
    "Respondent 4", "Respondent 5", "Respondent 6", "Respondent 7",
    "Respondent 8", "Respondent 9")

# produce Pareto chart with top 9 terms
# freq_terms <- freq_terms[which(freq_terms>1)]
freq_terms <- rowSums(as.matrix(corpus2b.tdm))

x11()
pareto.chart( rev(sort(freq_terms))[1:9],
    main="Figure 1: SAS Users Group's (SUG) Virtual Panel Zoom Meeting Comments")

dtm_m <- as.matrix(corpus2b.tdm)
# Sort by descearing value of frequency
dtm_v <- sort(rowSums(dtm_m),decreasing=TRUE)
dtm_d <- data.frame(word = names(dtm_v),freq=dtm_v)
# Display the top 9 most frequent words
head(dtm_d, 9)
 library(tidytext)

# Link with information about Lexicons, Sentiment Analysis, and Opinion Mining
# https://www.cs.uic.edu/~liub/FBS/sentiment-analysis.html
# Afinn has a dictionary (lexicon) of words from each sentence classified into
positive and negative
# sentiments.
# Afinn assigns mathematical values to words with negative (-5) or positive (+5) signs
# negative scores indicate negative sentiment, positive scores indicate positive
sentiment.
get_sentiments("afinn")
# nrc has a dictionary of words with emotion sentiments and classifies
# words into emotions like positive, negative, anger, anticipation, disgust, fear,
joy, sadness, surprise,
# and trust
get_sentiments("nrc")
# bing has a dictionary of positive and negative sentiment words
get_sentiments("bing")
get_sentiments("bing") %>% filter(sentiment=="positive")

# get Sentiments from AFINN, NRC, and BING as data frames
sent_AFINN <- as.data.frame(get_sentiments("afinn"))
sent_BING <- as.data.frame(get_sentiments("bing"))
sent_NRC <- as.data.frame(get_sentiments("nrc"))
head(sent_AFINN)

# convert dtm_d into a data frame
df.dtm.d <- as.data.frame(dtm_d)

# use merge function to inner join df.dtm.d data frame with AFINN, BING sentiments
dtm.d_afinn <- merge(df.dtm.d, sent_AFINN, by = "word")
dtm.d.bing <- merge(df.dtm.d, sent_BING, by = "word")
dtm.d.nrc <- merge(df.dtm.d, sent_NRC, by = "word")
```

```
# add new variable, new_Freq, which assign -1 times freq if sentiment is negative
dtm.d.nrc$new_Freq <- with(dtm.d.nrc, ifelse(sentiment == "negative", -freq, freq))

# visualize the words present in the Virtual meeting based on their NRC
# frequencies corresponding to the positive and negative sentiment values.
x11()
 ggplot(dtm.d.nrc, aes(word, new_Freq, fill = sentiment))+
 geom_col() +
 coord_flip() +
 labs(x = "NRC Virtual Meeting Term", y = "Sentiment Score") + ggtitle("Figure 5: Plot
Virtual Words by Sentiment Scores from the NRC Lexicon")

# visualize the words present in the Virtual meeting based on their AFINN
# frequencies corrosponding to the positive and negative sentiment values.
x11()
 ggplot(dtm.d_afinn, aes(word, value, fill = freq))+
 geom_col() +
 coord_flip() +  scale_fill_gradient(low="red", high = "green") +
 labs(x = "AFINN Virtual Meeting Term", y = "Sentiment Score") + ggtitle("Figure 6:
Plot Virtual Words by Sentiment Scores from the AFINN Lexicon")


# Find associations to analyze which words are most associated (or correlated)
# with the most frequently occurring words in Chat comments,
# which helps to see the context around these words
findAssocs(corpus2b.tdm,
           terms = c("peopl","sas","way", "join","build", "mentor", "organ", "work"),
            corlimit = 0.7)

# shows which words are most frequently associated with the top nine terms
# where corlimit = 0.7 is set as the lower limit/threshold.
#(corlimit can be set lower to see more words, or higher to see less).
# The output indicates that the words "also", "professional organization", "career",
"group", "intern",
# "people", "nonwork", "outsid" (the root for word "outside"), "quality",
# "section", "set", "setting", and "tri" occur 89% of the time with the word "peopl".
# We interpret this as the context around the most frequently occurring word ("peopl"
root for
# "people") is positive.
# Similarly, the root of the words  "way", "also", and "professional organization" are
highly correlated
# with the word "work". This indicates that most responses are saying that
# career advancement can occur when  "intern with professional organization in nonwork
settings" help
# can be interpreted in a positive context.


# produce comparison cloud
x11()
# choose grey backgound
# par(bg="grey")
comparison.cloud(m,max.words=100,
colors = c("tomato", "green4", "coral4", "orangered",
"dodgerblue", "magenta", "azure4", "brown", "purple"),
title.bg.colors=c("white"),
title.colors=c("tomato", "green4", "coral4", "orangered",
"dodgerblue", "magenta", "azure4", "brown", "purple"),
title.size=2.0,random.order=FALSE)
text(x=0.5, y=1.0, "Figure 2: Comparison Cloud of Terms and Scores, Separate Colors
for Each Respondent")
```

```
# Set up Sentiment Analysis

# We make a list of positive and negative words, using qdap and qdapDioctionaries
packages
#rm(list = ls())
# Install package qdap if not already installed
#if (!require(qdap)) install.packages("qdap")
#library(qdap)
#library(qdapDictionaries)
all_words =as.data.frame(key.pol)
Pos_words = all_words[all_words$y == 1,1]
Neg_words = all_words[all_words$y == -1,1]
SuggEx2 <- SuggEx

Suggestion2 <- matrix(SuggEx2)

TEXTFILE2 = Corpus(VectorSource(c(Suggestion2)))
TEXTFILE2 = tm_map(TEXTFILE2,removeWords,stopwords("english"))
TEXTFILE2 = tm_map(TEXTFILE2,stripWhitespace)
inspect(TEXTFILE2)

x = as.data.frame(TEXTFILE2)
clean_review = x$text

# merge cleaned responses back to data
data_2 = cbind(Suggestion2[,c(1,1)], clean_review, TEXTFILE2)
data_2 <- as.data.frame(data_2)
#rm(Suggestion2, x,clean_review,TEXTFILE2)

# Use the built-in dictionaries to score the corpus on the sentiment scale.
# The qdap package finds out positive, negative, negation, amplification,
# and de-amplification keywords to get a conclusive sentiment score.
#
# This approach overcomes almost all the demerits of previous
# sentiment analysis methods.

senti_score = polarity(data_2$clean_review,
              polarity.frame= qdapDictionaries::key.pol, constrain=FALSE,
              negators = qdapDictionaries::negation.words,
              amplifiers = qdapDictionaries::amplification.words,
              deamplifiers = qdapDictionaries::deamplification.words)

#X11()
score=senti_score$all[,3]
data_2=cbind(data_2,score)

# load the sentiment package
library(sentimentr)
# get the cumulative sentiment scores for sentences of each respondent
sentiment_by(SuggEx2)

# extract the positive and negative terms for each respondent
extract_sentiment_terms(SuggEx2)

# get extracted sentiments by sentence_id and sentiments
get_pos_neu_neg_terms <- as.data.frame(extract_sentiment_terms(SuggEx2))
pos_words <- get_pos_neu_neg_terms$positive

# get sentences
get_sentences(SuggEx2)

# get sentiments, sentences, terms, and word counts as a dataframe review_sentiment
sent_SuggEx2 <- as.data.frame(sentiment(SuggEx2))
```

```
pol_words <- extract_sentiment_terms(SuggEx2)
pol_words
pol_words$sentence
pol_words$positive
sent_text <- data.table::as.data.table(pol_words)
review_sentiment  <- cbind(sent_text, sent_SuggEx2$word_count)

# combine positive terms with sent_SuggEx2 to form sent_text_com data frame
pos_words2 <- review_sentiment %>%
  select(positive)
neg_words2 <- review_sentiment %>%
  select(negative)
sent_text_com <- cbind(sent_SuggEx2, pos_words2)
# add negative column
sent_text_com_n <- cbind(sent_SuggEx2, pos_words2, neg_words2)
p2 <- sent_text_com # I know, you've seen this set before
p3 <- sent_text_com_n
#p2$index <- rownames(sent_text_com)
p2$id <- as.factor(c(1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20, 21, 22, 23,
24, 25, 26))
p3$id <- as.factor(c(1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20, 21, 22, 23,
24, 25, 26))

p2 <- sent_text_com # I know, you've seen this set before
#p2$index <- rownames(sent_text_com)
p2$id <-
as.factor(c(1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26))

# summary statistics of the calculated sentiment scores
summary(sent_SuggEx2$sentiment)
x11()
ggplot(p2, aes(x = p2$element_id, p2$sentiment)) +
  geom_point(size = 3, color = p2$element_id) +
   geom_label_repel(label = p2$positive, size= 2.70) +
   labs(
    x = "Respondent Id", y = "Sentiment Score",
    title = "Figure 3: Plot of Sentiment Scores by Respondent Id with Positive Words"
) + scale_x_discrete(limit = c("1", "2", "3", "4", "5", "6", "7", "8", "9"))


x11()
# histogram of sentiment scores with gradient colors
sentiment_plot <- qplot(x=sent_SuggEx2$sentiment,
      geom="histogram",binwidth=0.025, fill = ..count..,
      main="Figure 4: Histogram of Sentiment Scores by Sentences",xlab="Sentiment
Scores" )
#sentiment_plot
#sequential color scheme
sentiment_plot + scale_fill_gradient(low="red", high = "green")
#rm(all_words)

# SuggEx2 is collection of documents (copied as a Corpus from SuggEx earlier) which
were Chat
# written comments by respondents in the Zoom meeting

# Use case_when clause from dplyr library to assign colors of respondents
# from the comparison word cloud to the color_points variable which displays
# in the plot
p2$color_points <-case_when(
    p2$element_id == 1 ~ "tomato",    p2$element_id == 2 ~ "green4",
    p2$element_id == 3 ~ "coral4",    p2$element_id == 4 ~ "orangered",
    p2$element_id == 5 ~ "dodgerblue",  p2$element_id == 6 ~ "magenta",
```

```
    p2$element_id == 7 ~ "azure4",  p2$element_id == 8 ~ "brown",
    p2$element_id == 9 ~ "purple",  TRUE ~ "black")
# select id and sentiments as a p2_df data frame from the p2 object
p2_df <- data.frame(p2)
head(p2_df)
##p2_df_sent <- p2_df %>% select(id, sentiment)
p2_df_sent <- select(p2_df, id,sentiment)

# form data frame with id, sentiment and color_points
p2_sent_df  <- data.frame(cbind(p2$element_id, p2_df_sent$id, p2_df_sent$sentiment,
p2$color_points, p2$word_count))
colnames(p2_sent_df) <- c("Respondent","id", "sentiment", "color_points",
"word_count")
# change character variables id, sentiment, and word_count to numeric
# check the conversion

p2_sent_df$Respondent=as.numeric(p2_sent_df$Respondent)
p2_sent_df$id=as.numeric(p2_sent_df$id)
p2_sent_df$sentiment=as.numeric(p2_sent_df$sentiment)
p2_sent_df$word_count=as.numeric(p2_sent_df$word_count)

str(p2_sent_df)
#https://search.r-project.org/CRAN/refmans/ggQC/html/stat_QC.html
# for XmR charting using ggQC
x11()
plot(p2_sent_df$id, p2_sent_df$sentiment,
main="Plot of Sentiment by Id",
ylab="sentiment",
type="b",
col=p2_sent_df$color_points)

# map the respondent's colors of the sentiment points to the
# id variable for each each resondent (id).
# https://cran.r-project.org/web/packages/ggQC/vignettes/XbarR_HOTTO.html
# Individuals Chart
x11()
EX1.1 <- ggplot(p2_sent_df, aes(x=id, y = sentiment, color=color_points)) +
 geom_line() +
 geom_point( ) + stat_QC(method="XmR",
 auto.label = T) +
 geom_label_repel(label = p2$element_id, size= 2.70) +
 stat_QC_labels(method="XmR", digits = 3, show.1n2.sigma = T ) +
 scale_x_continuous(expand =  expansion(mult = .3)) +
 ggtitle("Figure 8: Individuals Plot of Sentiments by Id") +
 scale_x_discrete(limit = c("1", "2", "3", "4", "5", "6", "7", "8", "9",
  "10", "11", "12","13", "14", "15", "16", "17", "18", "19",
  "20", "21", "22", "23", "24", "25", "26"))
 EX1.1
# Moving Range Plot
x11()
EX1.2 <- ggplot(p2_sent_df, aes(x=id, y = sentiment)) +
stat_mR() + ylab("Moving Range") +
 stat_QC_labels(method="mR", digits = 3, show.1n2.sigma = T ) +
  ggtitle("Figure 9: Moving Range Plot of Sentiments by Id") +
scale_x_discrete(limit = c("1", "2", "3", "4", "5", "6", "7", "8", "9",
  "10", "11", "12","13", "14", "15", "16", "17", "18", "19",
  "20", "21", "22", "23", "24", "25", "26"))
EX1.2

# examine box plots of sentiments by Respondents to compare variation of sentiments
between respondents

p3 <- sent_text_com_n
```

```
p3$id <- as.factor(c(1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20, 21, 22, 23,
24, 25, 26))

library(stringr)
max(nchar(p3$positive))

# assign polarity base on sentiment value of p3
#p3$polarity <-case_when(
#    p3$sentiment < 0.0 ~ "negative",
#    p3$sentiment > 0.0 ~ "positive",
#    TRUE ~ "neutral")

p3$polarity <-case_when(
    p3$sentiment < 0.0 ~ "negative",
    p3$sentiment > 0.05 ~ "positive",
    (p3$sentiment >= 0) & (p3$sentiment <= 0.05) ~ "neutral",
    TRUE ~ "n/a")

p3

#p4 <- select(p3, id,element_id, sentence_id, word_count, sentiment, positive,
negative, polarity)

p4 <- p3 %>% select(id, element_id, sentence_id, word_count, sentiment, polarity,
negative, positive)

p4a <- p4
# add Respondent as a factor column
p4a$Respondent <- as.factor(p4a$element_id)
# set colors for the center line, and control limits
col <- c("red", "purple", "red")
# fmt_dcimals forces 3 digits after the decimal on the yaxis
fmt_dcimals <- function(decimals=0){
    function(x) format(x,nsmall = decimals,scientific = FALSE) }

x11()
EX1.3 <- ggplot(data = p4a, aes(x = Respondent, y = sentiment)) +
  geom_boxplot(fill = c("tomato", "green4", "coral4", "orangered",
"dodgerblue", "magenta", "azure4", "brown", "purple")) +
  labs(title = 'Figure 10: Box Plot of Sentiments by Respondents with Control Limits',
face='bold') +
  scale_colour_manual(values = col) +
  geom_hline(yintercept=-0.402, linetype="solid", lwd=1,color=col[1] ) +
  geom_hline(yintercept=0.362, linetype="solid", lwd=2, color=col[2]) +
  geom_hline(yintercept=1.127, linetype="solid", lwd=1, color=col[3]) +
  theme(plot.title = element_text(color="black", size=14, face="bold")) +
  scale_y_continuous("Sentiment",
  limits = c(-0.42, 1.2),
  breaks = c( -0.42, -0.2, 0.0, 0.2, 0.4, 0.5, 0.6, 0.8, 1.0, 1.1, 1.2),
  labels = c( "-0.400", "-0.200", "0.000" , "0.200", "0.400", "0.500" ,"0.600",
"0.800", "1.000", "1.100", "1.200"), ) +
    geom_dotplot(binaxis = 'y',  dotsize = .3, stackdir = 'up')
EX1.3
# getwd() finds the working directory where to write the p4 dataframe
getwd()

#use the sink function to export p4 dataframe as a text file to the working directory
# "C:/Users/Owner/Documents"
sink('export_p4_dataframe.txt')
p4
sink()

]\"
```

```
);

// Sentiments Analysis Data Table for Cause and Effect Diagram
New Table( "Sentiments Ishikawa Table",
	Add Rows( 26 ),
	New Script( "Diagram", Diagram( Y( :Child ), X( :Parent ) ) ),
	New Column( "Parent",
		Character,
		"Nominal",
		Set Values(
			{"Sentiments", "Measurements", "Measurements", "Sentiments",
"Materials",
			"Respondent Comments(Corpus)", "Text vectors", "Text vectors",
			"Text vectors", "Respondent Comments(Corpus)", "Materials",
"Materials",
			"Sentiments", "Methods", "Methods", "Sentiments", "huMans",
"huMans",
			"Sentiments", "Machines", "Machines", "Sentiments",
			"Mother Nature/Environment", "Mother Nature/Environment",
			"Mother Nature/Environment", "Mother Nature/Environment"}
		),
		Set Display Width( 195 )
	),
	New Column( "Child",
		Character,
		"Nominal",
		Set Values(
			{"Measurements", "NLP positive/neutral/negative metrics",
			"Sentiment scores", "Materials", "Respondent Comments(Corpus)",
			"Text vectors", "wh-questions (who,what,when,where, why)",
			"Regular Expressions(punctuations, symbols, tokens)",
			"grammatical, rhetorical-ungrammatical, clauses",
			"Imported Text from external files", "Word Choices by
Respondents",
			"Lexicon dictionaries(AFINN, NRC,BING,QDAP)", "Methods",
			"R text mining, Sentiment Analysis Libraries", "Scoring
Algorithms",
			"huMans", "Analysts", "Respondent", "Machines",
"Laptops/PCs/Macs",
			"CPUs", "Mother Nature/Environment", "In-memory processing",
			"Processng Time", "Cloud Computing", "Internet of Things(IOT)"}
		),
		Set Display Width( 258 )
	)
)
;

dt = Data Table ("Sentiments Ishikawa Table") ;
// dt << Get Script ;

// Fishbone with colors for different cause categories
dt <<
Diagram(
	hierarchy(
		Hier Box(
			Text Edit Box( "Sentiments",
				Set Font Size( 11 ),
				Set Font Style( "Bold" )
			),
			Hier Box(
				Text Edit Box( "Measurements",
					Set Font Style( "Bold" ),
					Font Color( -7039851 )
```

```
                        ),
                        Hier Box(
                              Text Edit Box( "NLP positive/neutral/negative
metrics",
                                    Font Color( -7039851 )
                              ),
                              <<Change Type( "Fishbone" ),
                              <<direction( 1 )
                        ),
                        Hier Box(
                              Text Edit Box( "Sentiment scores", Font Color( -
7039851 ) ),
                              <<Change Type( "Fishbone" ),
                              <<direction( 1 )
                        ),
                        <<Change Type( "Fishbone" ),
                        <<direction( 1 )
                  ),
                  Hier Box(
                        Text Edit Box( "Materials",
                              Set Font Style( "Bold" ),
                              Font Color( -9125423 )
                        ),
                        Hier Box(
                              Text Edit Box( "Respondent Comments(Corpus)",
                                    Font Color( -9125423 )
                              ),
                              Hier Box(
                                    Text Edit Box( "Text vectors", Font Color( -
9125423 ) ),
                                    Hier Box(
                                          Text Edit Box( "wh-questions
(who,what,when,where, why)",
                                                Font Color( -9125423 )
                                          ),
                                          <<Change Type( "Fishbone" ),
                                          <<direction( 1 )
                                    ),
                                    Hier Box(
                                          Text Edit Box(
                                                "Regular
Expressions(punctuations, symbols, tokens)",
                                                Font Color( -9125423 )
                                          ),
                                          <<Change Type( "Fishbone" ),
                                          <<direction( 1 )
                                    ),
                                    Hier Box(
                                          Text Edit Box(
                                                "grammatical, rhetorical-
ungrammatical, clauses",
                                                Font Color( -9125423 )
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                                          <<direction( 1 )
                                    ),
                                    <<Change Type( "Fishbone" ),
                                    <<lean( 1 ),
                                    <<direction( 1 )
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                              Hier Box(
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files",
```

```
                                        Font Color( -9125423 )
                                    ),
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                                    <<lean( 1 )
                              ),
                              <<Change Type( "Fishbone" ),
                              <<direction( 1 )
                        ),
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                                    Font Color( -9125423 )
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                              <<Change Type( "Fishbone" ),
                              <<direction( 1 )
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NRC,BING,QDAP)",
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                              Font Color( -14956147 )
                        ),
                        Hier Box(
                              Text Edit Box( "R text mining, Sentiment Analysis
Libraries",
                                    Font Color( -14956147 )
                              ),
                              <<Change Type( "Fishbone" ),
                              <<direction( 1 )
                        ),
                        Hier Box(
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14956147 ) ),
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                              <<direction( 1 )
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                        <<direction( 1 )
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                              Font Color( -35584 )
                        ),
                        Hier Box(
                              Text Edit Box( "Analysts", Font Color( -35584 ) ),
                              <<Change Type( "Fishbone" )
                        ),
                        Hier Box(
                              Text Edit Box( "Respondent", Font Color( -35584 ) ),
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                        ),
                        <<Change Type( "Fishbone" )
                  ),
                  Hier Box(
```

```
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                              Font Color( -2003199 )
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                        Hier Box(
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                  Hier Box(
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                        ),
                        Hier Box(
                              Text Edit Box( "In-memory processing", Font Color( -
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                              <<Change Type( "Fishbone" )
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                              Text Edit Box( "Processng Time", Font Color( -
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                              <<Change Type( "Fishbone" )
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                              Text Edit Box( "Cloud Computing", Font Color( -
16737095 ) ),
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                        <<Change Type( "Fishbone" )
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                  <<Change Type( "Fishbone" )
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Diagram" )}
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                  "Sentiments",
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            ),
```

```
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		Dispatch( {}, "Sentiment scores", TextEditBox, {Font Color( -7039851 )}
),
		Dispatch(
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			"Materials",
			TextEditBox,
			{Set Font Style( "Bold" ), Font Color( -9125423 )}
		),
		Dispatch(
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			"Respondent Comments(Corpus)",
			TextEditBox,
			{Font Color( -9125423 )}
		),
		Dispatch( {}, "Text vectors", TextEditBox, {Font Color( -9125423 )} ),
		Dispatch(
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			"wh-questions (who,what,when,where, why)",
			TextEditBox,
			{Font Color( -9125423 )}
		),
		Dispatch(
			{},
			"Regular Expressions(punctuations, symbols, tokens)",
			TextEditBox,
			{Font Color( -9125423 )}
		),
		Dispatch(
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			"grammatical, rhetorical-ungrammatical, clauses",
			TextEditBox,
			{Font Color( -9125423 )}
		),
		Dispatch(
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			"Imported Text from external files",
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			{Font Color( -9125423 )}
		),
		Dispatch(
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			"Word Choices by Respondents",
			TextEditBox,
			{Font Color( -9125423 )}
		),
		Dispatch(
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			"Lexicon dictionaries(AFINN, NRC,BING,QDAP)",
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			{Font Color( -9125423 )}
		),
		Dispatch(
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			"Methods",
			TextEditBox,
			{Set Font Style( "Bold" ), Font Color( -14956147 )}
```

```
		),
		Dispatch(
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			TextEditBox,
			{Font Color( -14956147 )}
		),
		Dispatch( {}, "Scoring Algorithms", TextEditBox, {Font Color( -14956147
)} ),
		Dispatch(
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			"huMans",
			TextEditBox,
			{Set Font Style( "Bold" ), Font Color( -35584 )}
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		Dispatch( {}, "Analysts", TextEditBox, {Font Color( -35584 )} ),
		Dispatch( {}, "Respondent", TextEditBox, {Font Color( -35584 )} ),
		Dispatch(
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			"Machines",
			TextEditBox,
			{Set Font Style( "Bold" ), Font Color( -2003199 )}
		),
		Dispatch( {}, "Laptops", TextEditBox, {Font Color( -2003199 )} ),
		Dispatch( {}, "CPUs", TextEditBox, {Font Color( -2003199 )} ),
		Dispatch(
			{},
			"Mother Nature",
			TextEditBox,
			{Set Font Style( "Bold" ), Font Color( -16737095 )}
		),
		Dispatch(
			{},
			"In-memory processing",
			TextEditBox,
			{Font Color( -16737095 )}
		),
		Dispatch( {}, "Processng Time", TextEditBox, {Font Color( -16737095 )} ),
		Dispatch( {}, "Cloud Computing", TextEditBox, {Font Color( -16737095 )}
),
		Dispatch(
			{},
			"Internet of Things(IOT)",
			TextEditBox,
			{Font Color( -16737095 )}
		)
	)
)
;
// Nested Cause and Effect with color categories (a.k.a. cause-and-effect systematic
// diagram). Systematic diagrams add sequencing to a cause and effect diagram.
// Effects on the far right-side contribute to the left-side sub-causes for the
// categories that determine Sentiments.
dt <<
Diagram(
	hierarchy(
		Hier Box(
			Text Edit Box( "Sentiments",
				Set Font Size( 11 ),
				Set Font Style( "Bold" )
			),
			Hier Box(
				Text Edit Box( "Measurements",
```

```
                              Set Font Style( "Bold" ),
                              Font Color( -7039851 )
                        ),
                        Hier Box(
                              Text Edit Box( "NLP positive/neutral/negative
metrics",
                                    Font Color( -7039851 )
                              ),
                              <<Change Type( "Nested" ),
                              <<direction( 1 )
                        ),
                        Hier Box(
                              Text Edit Box( "Sentiment scores", Font Color( -
7039851 ) ),
                              <<Change Type( "Nested" ),
                              <<direction( 1 )
                        ),
                        <<Change Type( "Nested" ),
                        <<direction( 1 )
                  ),
                  Hier Box(
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                              Set Font Style( "Bold" ),
                              Font Color( -9125423 )
                        ),
                        Hier Box(
                              Text Edit Box( "Respondent Comments(Corpus)",
                                    Font Color( -9125423 )
                              ),
                              Hier Box(
                                    Text Edit Box( "Text vectors", Font Color( -
9125423 ) ),
                                    Hier Box(
                                          Text Edit Box( "wh-questions
(who,what,when,where, why)",
                                                Font Color( -9125423 )
                                          ),
                                          <<Change Type( "Nested" ),
                                          <<direction( 1 )
                                    ),
                                    Hier Box(
                                          Text Edit Box(
                                                "Regular
Expressions(punctuations, symbols, tokens)",
                                                Font Color( -9125423 )
                                          ),
                                          <<Change Type( "Nested" ),
                                          <<direction( 1 )
                                    ),
                                    Hier Box(
                                          Text Edit Box(
                                                "grammatical, rhetorical-
ungrammatical, clauses",
                                                Font Color( -9125423 )
                                          ),
                                          <<Change Type( "Nested" ),
                                          <<direction( 1 )
                                    ),
                                    <<Change Type( "Nested" ),
                                    <<lean( 1 ),
                                    <<direction( 1 )
                              ),
                              Hier Box(
```

```
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files",
                                          Font Color( -9125423 )
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                                    <<Change Type( "Nested" ),
                                    <<lean( 1 )
                              ),
                              <<Change Type( "Nested" ),
                              <<direction( 1 )
                        ),
                        Hier Box(
                              Text Edit Box( "Word Choices by Respondents",
                                    Font Color( -9125423 )
                              ),
                              <<Change Type( "Nested" ),
                              <<direction( 1 )
                        ),
                        Hier Box(
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NRC,BING,QDAP)",
                                    Font Color( -9125423 )
                              ),
                              <<Change Type( "Nested" ),
                              <<direction( 1 )
                        ),
                        <<Change Type( "Nested" )
                  ),
                  Hier Box(
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                              Set Font Style( "Bold" ),
                              Font Color( -14956147 )
                        ),
                        Hier Box(
                              Text Edit Box( "R text mining, Sentiment Analysis
Libraries",
                                    Font Color( -14956147 )
                              ),
                              <<Change Type( "Nested" ),
                              <<direction( 1 )
                        ),
                        Hier Box(
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14956147 ) ),
                              <<Change Type( "Nested" ),
                              <<direction( 1 )
                        ),
                        <<Change Type( "Nested" ),
                        <<direction( 1 )
                  ),
                  Hier Box(
                        Text Edit Box( "huMans",
                              Set Font Style( "Bold" ),
                              Font Color( -35584 )
                        ),
                        Hier Box(
                              Text Edit Box( "Analysts", Font Color( -35584 ) ),
                              <<Change Type( "Nested" )
                        ),
                        Hier Box(
                              Text Edit Box( "Respondent", Font Color( -35584 ) ),
                              <<Change Type( "Nested" )
                        ),
                        <<Change Type( "Nested" )
```

```
                    ),
                    Hier Box(
                           Text Edit Box( "Machines",
                                  Set Font Style( "Bold" ),
                                  Font Color( -2003199 )
                           ),
                           Hier Box(
                                  Text Edit Box( "Laptops/PCs/Macs", Font Color( -
2003199 ) ),
                                  <<Change Type( "Nested" ),
                                  <<direction( 1 )
                           ),
                           Hier Box(
                                  Text Edit Box( "CPUs", Font Color( -2003199 ) ),
                                  <<Change Type( "Nested" ),
                                  <<direction( 1 )
                           ),
                           <<Change Type( "Nested" ),
                           <<direction( 1 )
                    ),
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                           Text Edit Box( "Mother Nature/Environment",
                                  Set Font Style( "Bold" ),
                                  Font Color( -16737095 )
                           ),
                           Hier Box(
                                  Text Edit Box( "In-memory processing", Font Color( -
16737095 ) ),
                                  <<Change Type( "Nested" )
                           ),
                           Hier Box(
                                  Text Edit Box( "Processng Time", Font Color( -
16737095 ) ),
                                  <<Change Type( "Nested" )
                           ),
                           Hier Box(
                                  Text Edit Box( "Cloud Computing", Font Color( -
16737095 ) ),
                                  <<Change Type( "Nested" )
                           ),
                           Hier Box(
                                  Text Edit Box( "Internet of Things(IOT)",
                                         Font Color( -16737095 )
                                  ),
                                  <<Change Type( "Nested" )
                           ),
                           <<Change Type( "Nested" )
                    ),
                    <<Change Type( "Nested" )
             )
      ),
      SendToReport(
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                    OutlineBox,
                    {Set Title(
                           "Figure 7b: Sentiment Analysis Cause and Effect Diagram
with Colors for Different Categories"
                    )}
             ),
             Dispatch(
                    {},
```

```
                        "Sentiments",
                        TextEditBox,
                        {Set Font Size( 11 ), Set Font Style( "Bold" )}
                ),
                Dispatch( {}, "Measurements", TextEditBox, {Set Font Style( "Bold" )} ),
                Dispatch( {}, "Materials", TextEditBox, {Set Font Style( "Bold" )} ),
                Dispatch( {}, "Methods", TextEditBox, {Set Font Style( "Bold" )} ),
                Dispatch( {}, "huMans", TextEditBox, {Set Font Style( "Bold" )} ),
                Dispatch( {}, "Machines", TextEditBox, {Set Font Style( "Bold" )} ),
                Dispatch( {}, "Mother Nature", TextEditBox, {Set Font Style( "Bold" )} )
        )
);

/*******************************************************************************/

// Create new data table of sentiments that
// assigns colors to each data point so that
// they matches the colors of respondents in
// the comparison word cloud.
Pxmr = New Table( "Sentiments, ID, and Polarity",
        Add Rows( 26 ),
        New Script(
                "Source",
                Open(
                        "C:\Users\Owner\Documents\export_p4_dataframe.txt",
                        columns(
                                New Column( "Column 1",
                                        Numeric,
                                        "Continuous",
                                        Format( "Best", 12 )
                                ),
                                New Column( "id", Numeric, "Continuous", Format( "Best", 12
) ),
                                New Column( "element_id",
                                        Numeric,
                                        "Continuous",
                                        Format( "Best", 12 )
                                ),
                                New Column( "sentence_id",
                                        Numeric,
                                        "Continuous",
                                        Format( "Best", 12 )
                                ),
                                New Column( "word_count",
                                        Numeric,
                                        "Continuous",
                                        Format( "Best", 12 )
                                ),
                                New Column( "sentiment",
                                        Numeric,
                                        "Continuous",
                                        Format( "Best", 12 )
                                ),
                                New Column( "positive", Character, "Nominal" ),
                                New Column( "negative", Character, "Nominal" ),
                                New Column( "polarity", Character, "Nominal" )
                        ),
                        Import Settings(
                                Fixed Column Widths( 3, 3, 11, 12, 11, 11, 67, 10, 128 ),
                                Strip Quotes( 0 ),
                                Use Apostrophe as Quotation Mark( 0 ),
                                Use Regional Settings( 0 ),
                                Scan Whole File( 1 ),
```

```
                        Treat empty columns as numeric( 0 ),
                        CompressNumericColumns( 0 ),
                        CompressCharacterColumns( 0 ),
                        CompressAllowListCheck( 0 ),
                        Labels( 1 ),
                        Column Names Start( 1 ),
                        Data Starts( 2 ),
                        Lines To Read( "All" ),
                        Year Rule( "20xx" )
                    )
                )
            ),
            New Column( "Column 1",
                Numeric,
                "Continuous",
                Format( "Best", 12 ),
                Set Values(
                    [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20,
                    21, 22, 23, 24, 25, 26]
                )
            ),
            New Column( "id",
                Numeric,
                "Continuous",
                Format( "Best", 12 ),
                Set Values(
                    [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20,
                    21, 22, 23, 24, 25, 26]
                )
            ),
            New Column( "element_id",
                Numeric,
                "Continuous",
                Format( "Best", 12 ),
                Set Values(
                    [1, 1, 2, 2, 2, 3, 3, 4, 4, 4, 5, 5, 5, 5, 6, 6, 6, 6, 6, 7, 8, 8,
8, 9,
                    9, 9]
                )
            ),
            New Column( "sentence_id",
                Numeric,
                "Continuous",
                Format( "Best", 12 ),
                Set Values(
                    [1, 2, 1, 2, 3, 1, 2, 1, 2, 3, 1, 2, 3, 4, 1, 2, 3, 4, 5, 1, 1, 2,
3, 1,
                    2, 3]
                )
            ),
            New Column( "word_count",
                Numeric,
                "Continuous",
                Format( "Best", 12 ),
                Set Values(
                    [40, 33, 23, 15, 13, 35, 19, 17, 22, 15, 10, 11, 14, 10, 17, 15,
16, 21,
                    35, 25, 13, 11, 18, 23, 33, 16]
                )
            ),
            New Column( "sentiment",
```

```
			Numeric,
			"Continuous",
			Format( "Best", 12 ),
			Set Values(
				[0.41900179, 0.85298051, 0.47958315, 0.06454972, 0.11648704,
0.60005952,
				0.13764944, 0.63059263, 0.34112115, 0.21946906, 0, 0.48241815,
				0.44098105, 0.42690748, 0.50932481, 0.33565856, 0, 0.15275252,
				0.40567404, 0.72, 0.13867505, 0.52764485, 0.32998316, 0.27106874,
				0.61797568, 0.2]
			)
		),
		New Column( "positive",
			Character,
			"Nominal",
			Set Values(
				{"                build, new, identifying, share, interests,
hope",
				"    important, ensure, right, right, work, guarantee,
successful",
				"                           new, joined, organization,
interests",
				"
join",
				"                                                 happy,
organization",
				"like, organization, share, interests, joined, work,
professional",
				"
joined",
				"                    helpful, advocates, guide, join,
organization",
				"                                        advocates, positively,
work",
				"                                             strategic,
identifying", "",
				"                        important, building, trust,
relationships",
				"                        building, relationships, learn,
interests",
				"                                           build, trust,
promise",
				"                                         clear, concise,
correct",
				"                                                      learn,
like", "",
				"                                                      talk,
solve",
				"                                  understand, practice, good,
work",
				"     professional, community, volunteer, opportunities,
practice",
				"                                           lead, growth, success
ch",
				"                                           good, work,
important",
				"                                                 practice,
sharp",
				"                                                 prepared,
learn",
				"                               new, improve, quality,
reliability",
```

```
                    "
learn"}
            ),
            Set Display Width( 417 )
      ),
      New Column( "negative",
            Character,
            "Nominal",
            Set Values(
                  {"", "", "", "", " would be", "", "", "", "", "", "", "", "", "",
"", "",
                  "", " problems", "", "", "allenging", "", "", "", "", ""}
            )
      ),
      New Column( "polarity",
            Character,
            "Nominal",
            Set Values(
                  {"positive", "positive", "positive", "positive", "positive",
"positive",
                  "positive", "positive", "positive", "positive", " neutral",
"positive",
                  "positive", "positive", "positive", "positive", " neutral",
"positive",
                  "positive", "positive", "positive", "positive", "positive",
"positive",
                  "positive", "positive"}
            )
      )
);


Pxmr <<
      Set Row States(
            [8960.99760860205, 8960.99760860205, 5120.00212097168, 5120.00212097168,
            5120.00212097168, 13824.5439175963, 13824.5439175963, 1536.99714660645,
            1536.99714660645, 1536.99714660645, 1280.11939996481, 1280.11939996481,
            1280.11939996481, 1280.11939996481, 2816.99610894918, 2816.99610894918,
            2816.99610894918, 2816.99610894918, 2816.99610894918, 21248.5138480067,
            13056.6451746225, 13056.6451746225, 13056.6451746225, 2048.62550258636,
            2048.62550258636, 2048.62550258636]
      ) ;
// Delete Column 1 since its the same as element_id

Pxmr << delete columns(1);
Pxmr
<<
Control Chart(
      Group Size( 1 ),
      KSigma( 3 ),
      Chart Col(
            :sentiment,
            Individual Measurement(
                  Rule 1 2S( 1 ),
                  Rule 1 3S( 1 ),
                  Rule 2 2S( 1 ),
                  Rule R 4S( 1 ),
                  Rule 4 1S( 1 ),
                  Rule 10 X( 1 )
            ),
            Moving Range
      ),
      SendToReport(
```

```
		Dispatch(
			{},
			"Control Chart",
			OutlineBox,
			{Set Title(
				"Figures 8 and 9: Individuals and Moving Range Control
Charts with Westgard Rules"
			)}
		),
		Dispatch(
			{},
			"Individual Measurement of sentiment",
			OutlineBox,
			{Set Title( "Figure 8: Individual Measurement of sentiment" )}
		),
		Dispatch(
			{"Individual Measurement of sentiment"},
			"Control Chart Limits frame",
			FrameBox,
			{Frame Size( 82, 208 )}
		),
		Dispatch(
			{},
			"Moving Range of sentiment",
			OutlineBox,
			{Set Title( "Figure 9: Moving Range of sentiment" )}
		),
		Dispatch(
			{"Moving Range of sentiment"},
			"Control Chart Limits frame",
			FrameBox,
			{Frame Size( 82, 208 )}
		)
	)
);


// Create Comparative Box Plot of Sentement vs. Respondents

Pxmr <<
Graph Builder(
	Size( 1480, 773 ),
	Show Control Panel( 0 ),
	Variables( X( :element_id ), Y( :sentiment ) ),
	Elements(
		Box Plot( X, Y, Legend( 2 ), Name( "5 Number Summary" )(1) ),
		Points( X, Y, Legend( 3 ) ) ),
	SendToReport(
		Dispatch(
			{},
			"element_id", ScaleBox,
			{Min( 0.00701754385964912 ), Max( 10.0070175438596 ), Inc( 1 ),
			Minor Ticks( 1 )}   ),
		Dispatch(
			{},
			"sentiment",  ScaleBox,
			{Format( "Fixed Dec", 12, 3 ), Min( -0.2 ), Max( 1.2 ), Inc( 0.1
),
			Minor Ticks( 1 ), Add Ref Line( 1.12, "Solid", {255, 0, 0},
"1.12", 1 ),
			Add Ref Line( -0.099, "Solid", {255, 0, 0}, "-0.099", 1 ),
			Add Ref Line( 0.51, "Solid", {160, 32, 240}, "0.510", 1 )}  ),
		Dispatch(
```

```
                  {}, "graph title",  TextEditBox,
                  {Set Text( "Figure 10b: Box Plot of Respondents with Control
Limits " )} ),
            Dispatch( {}, "X title", TextEditBox, {Set Text( "Respondent" )} ),
            Dispatch(
                  {},
                  "Graph Builder",
                  FrameBox,
                  {Marker Size( 6 ), Marker Selection Mode( "Selected Larger" ),
                  DispatchSeg(
                        Box Plot Seg( "Box Plot (1)" ),
                        Fill Color( {255, 99, 71} )
                  ), DispatchSeg(
                        Box Plot Seg( "Box Plot (2)" ),
                        {Shortest Half Bracket( 1 ), Shortest Half Color( "Black"
),
                        Fill Color( {0, 139, 0} )}
                  ), DispatchSeg(
                        Box Plot Seg( "Box Plot (3)" ),
                        Fill Color( {139, 62, 47} )
                  ), DispatchSeg(
                        Box Plot Seg( "Box Plot (4)" ),
                        {Shortest Half Bracket( 1 ), Shortest Half Color( "Black"
),
                        Fill Color( {255, 69, 0} )}
                  ), DispatchSeg(
                        Box Plot Seg( "Box Plot (5)" ),
                        {Shortest Half Bracket( 1 ), Shortest Half Color( "Black"
),
                        Fill Color( {30, 144, 255} )}
                  ), DispatchSeg(
                        Box Plot Seg( "Box Plot (6)" ),
                        {Shortest Half Bracket( 1 ), Shortest Half Color( "Black"
),
                        Fill Color( {255, 0, 255} )}
                  ), DispatchSeg(
                        Box Plot Seg( "Box Plot (7)" ),
                        Fill Color( {131, 139, 139} )
                  ), DispatchSeg(
                        Box Plot Seg( "Box Plot (8)" ),
                        {Shortest Half Bracket( 1 ), Shortest Half Color( "Black"
),
                        Fill Color( {165, 42, 42} )}
                  ), DispatchSeg(
                        Box Plot Seg( "Box Plot (9)" ),
                        {Shortest Half Bracket( 1 ), Shortest Half Color( "Black"
),
                        Fill Color( {160, 32, 240} )}
                  )}
            ),
            Dispatch( {}, "400", LegendBox, {Set Title( "" )} )
      )
);
// add sentences for each ID to Pxmr
Pxmr <<  New Column( "Sentence", Character, "Unstructured Text",
            Set Values(
                  {
                  "I seek to build networks in new organizations by identifying
people who share my interests by talking to my supervisors and mentors in the other
departments I hope to collaborate with, or I find them by browsing the employee
profiles",
```

```
                    "It is important to examine the analytics team makeup and ensure
that the right people are in the right places and positions to get work done in order
to guarantee a successful transformation.",
                    "I introduce myself as a new SAS programmer and modeler who joined
the organization and mention that we have research interests in common",
                    " I ask if they want to join me for time to grab coffee and
chat.",
                    "People generally would be happy to meet you, especially in a
large organization.",
                    "I like meet people outside of my organization who share the same
interests in SAS. I joined my local SAS Users group, which was a way to meet people in
a non-work, professional setting.",
                    "I also joined internal SAS user groups with people outside of my
department as another way to meet people.",
                    "It's helpful to have advocates and mentors who can help guide you
when you join an organization.",
                    "Think of mentors as advocates who can speak up for you positively
about your work when you are not in the room.",
                    "Try to be strategic in identifying potential mentors so they can
be in your network.",
                    "Try to developing nontechnical, communication,leadership,
influence, and negotiation skills.",
                    "They are important for building trust and relationships with co-
workers.",
                    "Building relationships involves finding ways to relate with other
people and learn their interests.",
                    "To build trust always deliver on the things you promise.",
                    "Think of the four Cs: be clear, concise, correct, and complete in
what you write and say.",
                    "SAS programmers must learn to be multilingual in other languages
like Python, SQL, and R.",
                    "We must be able to think in a different language than the way
other people think.",
                    "Be able to translate what our collaborators talk about in their
language so we can actually help them solve their problems.",
                    "We should be able to translate back into a language they
understand so they can actually implement or put into practice the good modeling and
programming practices that have been developed to work with them.",
                    "Become involved with local professional, SAS Users groups,
associations or other community volunteer organizations so that you get opportunities
to apply and practice your skills.",
                    "Find ways to complete challenging assignments would lead to job
growth and success.",
                    "Making sure you get recognized for doing good work is
important.",
                    "Practice your quantitative skills by taking part in data science
competitions so that you keep your skills sharp.",
                    "Take part in the organizational transformation, ask questions,
stretch yourself and your team, and be prepared to learn a lot along the way.",
                    "Show up every day focusing on making base-hits by using tools
that you know how to use, add new skills and software over time, and to improve ndata
governance, data quality, reliability.",
                    "We need to learn how to inject our insights into the business and
organizational decision making"  } ), Set Display Width( 626 ) );

R Term();
```