Analyis of Presto from Bach Sonata No 1

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Load Data

```r
df_presto_raw = read_excel_allsheets("PRESTO ANALYSIS Part II.xlsx")$Sheet1
tests_names <- paste0("Test", seq(1:9))
formula = paste0(tests_names, collapse = "+")
df_presto_calc <- as.data.table(df_presto_raw)
string_execute <- paste0("df_presto_calc[, Num_of_Flag := ",formula,"]")
eval(parse(text = string_execute))

df_presto_melt <- melt(df_presto_raw, id.vars = c("Bar ID","String_Crossing_One_Bow","String_Crossing_Sp
```

Summary by Bar

```r
df_gg_by_bar <- df_presto_melt %>%

  dplyr::mutate(   NUM_String_Crossing_One_Bow = ifelse(String_Crossing_One_Bow == "T", value, 0),
                   NUM_String_Crossing_Space_String = ifelse(String_Crossing_Space_String == "T", value
                   NUM_Position_Shifting = ifelse(Position_Shifting == "T", value, 0),
                   NUM_Left_Out_Note = ifelse(Left_Out_Note == "T", value, 0)) %>%
  dplyr::group_by(`Bar ID`) %>%
  dplyr::summarise(Total_error = sum(value),
                   String_Crossing_One_Bow = sum(NUM_String_Crossing_One_Bow),
                   String_Crossing_Space_String = sum(NUM_String_Crossing_Space_String),
                   Position_Shifting = sum(NUM_Position_Shifting),
                   Left_Out_Note = sum(NUM_Left_Out_Note)) %>%
  melt(id.vars = "Bar ID") %>%
    as.data.table()

df_gg_by_bar$variable <- as.character(df_gg_by_bar$variable)

 gg_by_bar =  ggplot(df_gg_by_bar,aes(`Bar ID`,value,label = value)) +
    geom_segment( aes(x=`Bar ID`, xend=`Bar ID`, y=0, yend=value), color="grey") +
    geom_point( aes(x=`Bar ID`, y=value), color = "firebrick3", size=4, shape = 19) +
    geom_text(color = "white", size = 2)+
    #coord_flip()+
    theme_light() +
    facet_wrap(~variable, ncol = 1, scales = "fixed")+
    scale_y_continuous( breaks = seq(0,10,2), limits = c(0,10))+
    theme(
      plot.title = element_text(size=10,hjust = 0.5),
      legend.position = "none",
      panel.border = element_blank(),
      axis.text=element_text(size=10)) +
    ggtitle("Error Tracker")
```
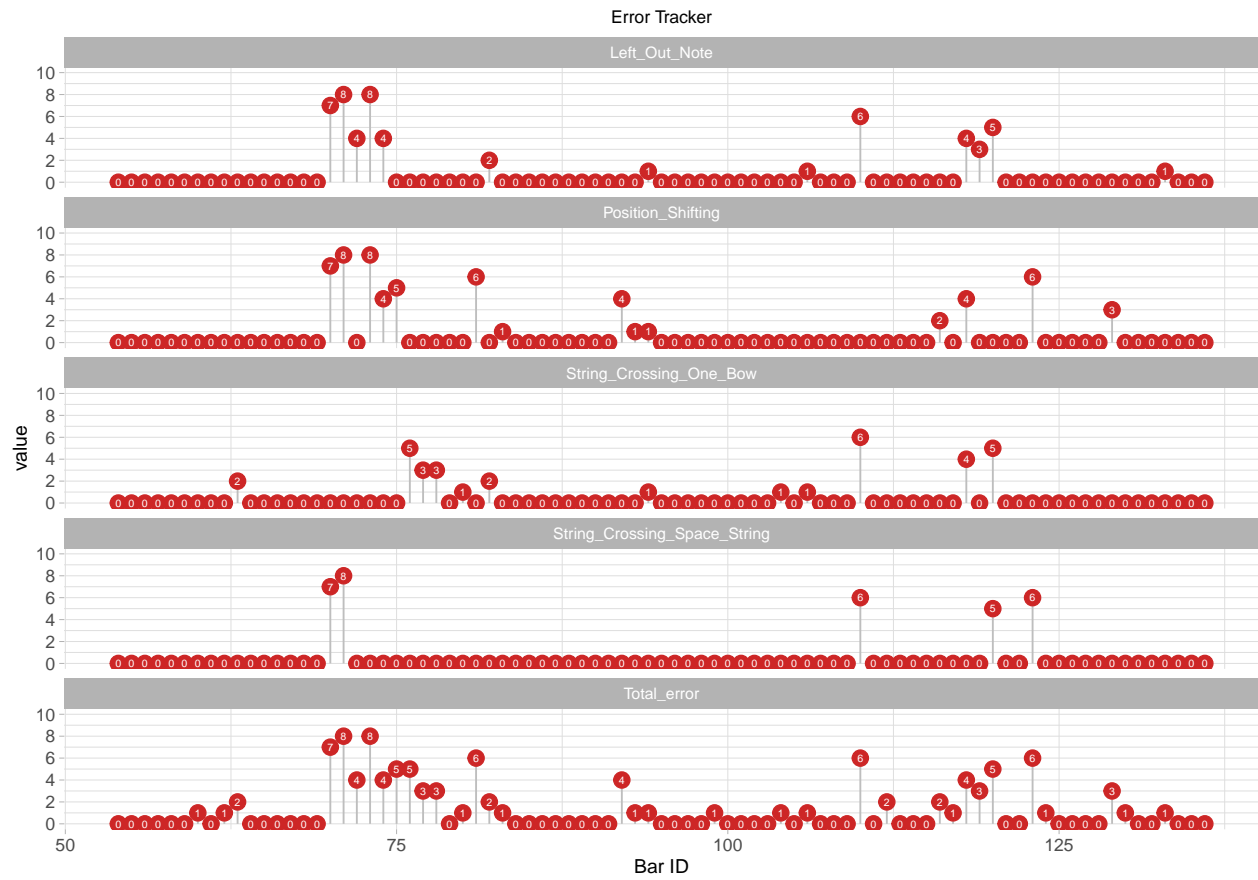
```r
print(gg_by_bar)
```



```r
png("Erro Tracker.png", width = 2000, height = 1500, res=130)
print(gg_by_bar)
dev.off()
```

```
## pdf
##   2
```

Test-Based Impact

String_Crossing_One_Bow

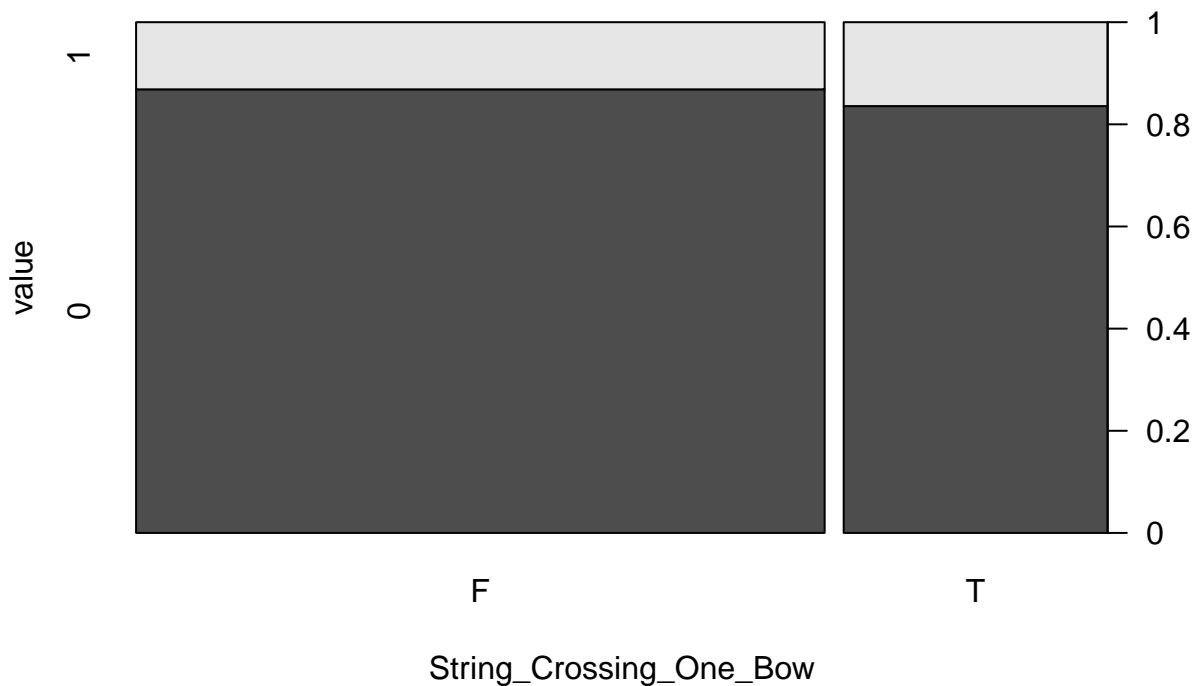```r
test_String_Crossing_One_Bow <- df_presto_melt %>%
  dplyr::mutate(r = 1) %>%
  dplyr::group_by(String_Crossing_One_Bow) %>%
  dplyr::summarise(fail = sum(value),
                   all = sum(r),
                   success = all- fail)

mat = rbind(test_String_Crossing_One_Bow$success,test_String_Crossing_One_Bow$fail)
row.names(mat) <- c("No String_Crossing_One_Bow", "String_Crossing_One_Bow")
colnames(mat) <- c("Success","Fail")

fisher.test(mat, alternative="greater")
```

```
##
##  Fisher's Exact Test for Count Data
##
## data:  mat
## p-value = 0.1503
## alternative hypothesis: true odds ratio is greater than 1
## 95 percent confidence interval:
##  0.8674401       Inf
## sample estimates:
## odds ratio
##   1.297779
```

```r
spine(xtabs(~String_Crossing_One_Bow+value, data=df_presto_melt))
```


String_Crossing_One_Bow

String_Crossing_Space_String
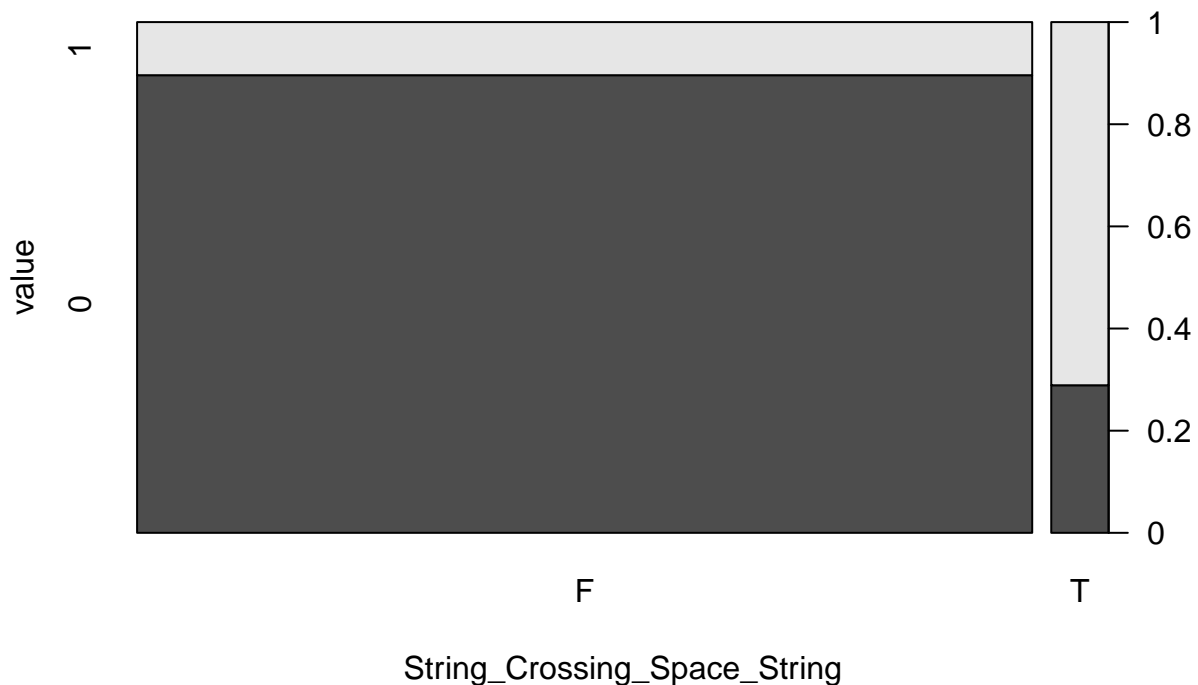
```
test_String_Crossing_Space_String <- df_presto_melt %>%
  dplyr::mutate(r = 1) %>%
  dplyr::group_by(String_Crossing_Space_String) %>%
  dplyr::summarise(fail = sum(value),
                   all = sum(r),
                   success = all- fail)


mat = rbind(test_String_Crossing_Space_String$success,test_String_Crossing_Space_String$fail)
row.names(mat) <- c("No String_Crossing_Space_String", "String_Crossing_Space_String")
colnames(mat) <-  c("Success","Fail")

fisher.test(mat, alternative="greater")
```

```
##
##  Fisher's Exact Test for Count Data
##
## data:  mat
## p-value < 2.2e-16
## alternative hypothesis: true odds ratio is greater than 1
## 95 percent confidence interval:
##  11.31727      Inf
## sample estimates:
## odds ratio
##   21.03807
```

```
spine(xtabs(~String_Crossing_Space_String+value, data=df_presto_melt))
```

Position__Shifting
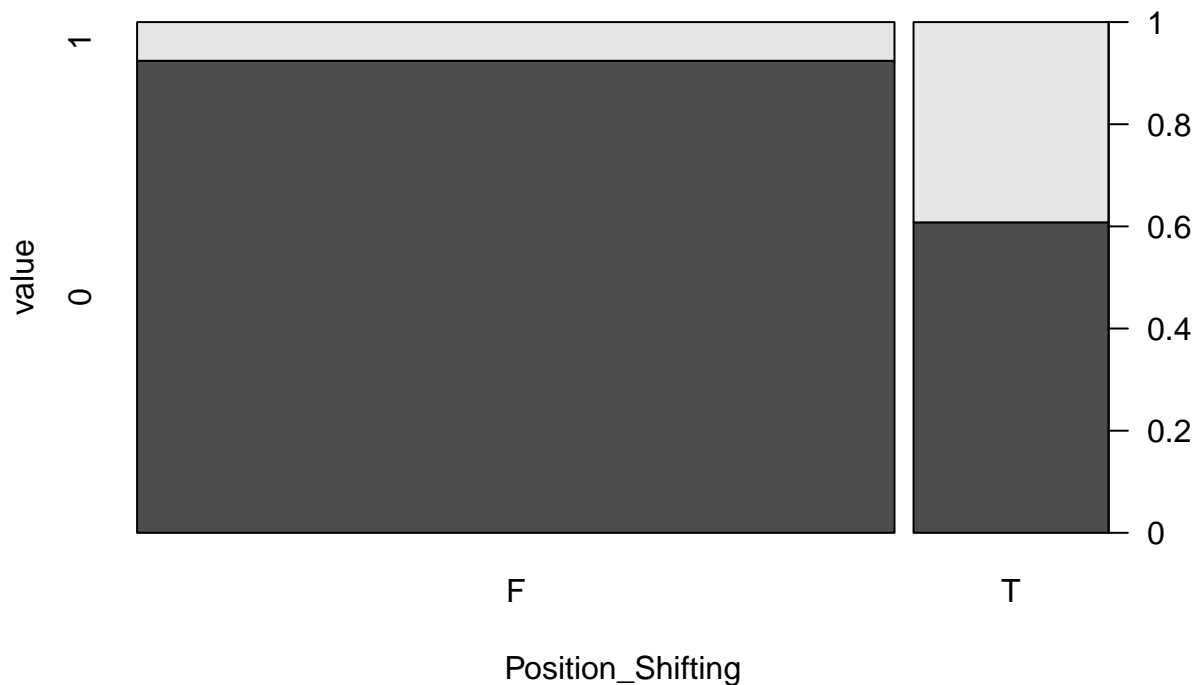
```
test_Position_Shifting <- df_presto_melt %>%
  dplyr::mutate(r = 1) %>%
  dplyr::group_by(Position_Shifting) %>%
  dplyr::summarise(fail = sum(value),
                   all = sum(r),
                   success = all- fail)


mat = rbind(test_Position_Shifting$success,test_Position_Shifting$fail)
row.names(mat) <- c("No Position_Shifting", "Position_Shifting")
colnames(mat) <-  c("Success","Fail")

fisher.test(mat, alternative="greater")
```

```
##
##  Fisher's Exact Test for Count Data
##
## data:  mat
## p-value < 2.2e-16
## alternative hypothesis: true odds ratio is greater than 1
## 95 percent confidence interval:
##  5.278367       Inf
## sample estimates:
## odds ratio
##    7.84076
```

```
spine(xtabs(~Position_Shifting+value, data=df_presto_melt))
```

Left_Out_Note

```r
test_Left_Out_Note <- df_presto_melt %>%
  dplyr::mutate(r = 1) %>%
  dplyr::group_by(Left_Out_Note) %>%
  dplyr::summarise(fail = sum(value),
                   all = sum(r),
                   success = all- fail)


mat = rbind(test_Left_Out_Note$success,test_Left_Out_Note$fail)
row.names(mat) <- c("No Left_Out_Note", "Left_Out_Note")
colnames(mat) <-  c("Success","Fail")

fisher.test(mat, alternative="greater")
```

```
##
##  Fisher's Exact Test for Count Data
##
## data:  mat
## p-value = 1.072e-14
## alternative hypothesis: true odds ratio is greater than 1
## 95 percent confidence interval:
##  3.914877      Inf
## sample estimates:
## odds ratio
##   5.788509
```

```r
spine(xtabs(~Left_Out_Note+value, data=df_presto_melt))
```
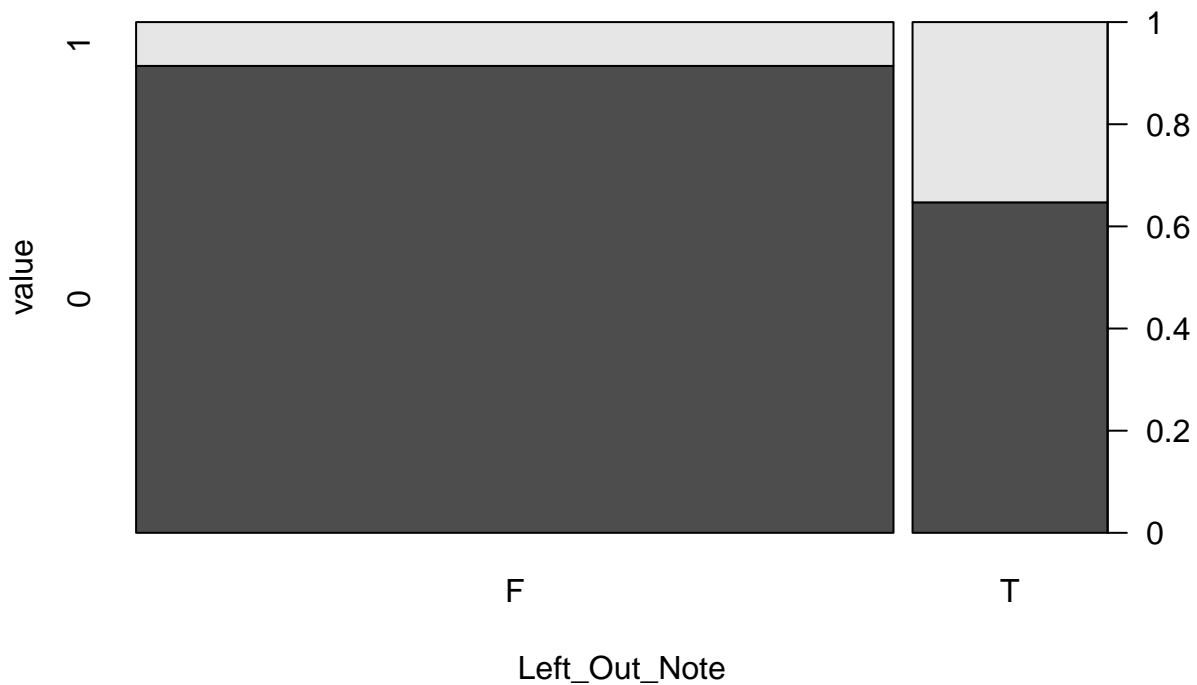
Model-Based Impact

```
t.ctrl <- caret::trainControl(method = "repeatedcv",
                        number = 10,
                        savePredictions = TRUE)
tic()
svm.grid <- expand.grid(C = 2^(1:3), sigma = seq(0.25, 2, length = 8))

df_presto_melt_classify <- copy(df_presto_melt)
df_presto_melt_classify$value <- 1-df_presto_melt_classify$value

svm.train <- train(factor(value) ~ String_Crossing_One_Bow + String_Crossing_Space_String + Position_Sh:
  data = df_presto_melt_classify,
  method = "svmRadial",
  trControl = t.ctrl,
  tuneGrid = svm.grid,
  preProcess = c("center", "scale")
)
# confusionMatrix(svm.predict, factor(df_presto_melt$value))
varImp(svm.train)
```

```
## loess r-squared variable importance
##
##                               Overall
## String_Crossing_Space_String  100.00
## Position_Shifting              77.91
## Left_Out_Note                  55.21
## String_Crossing_One_Bow        0.00
```

```
toc()
```

```
## 16.634 sec elapsed
```

Interaction Terms

Placeholder here for interaction terms where multiple factors impact on the success rate

String_Crossing_One_Bow + String_Crossing_Space_String

```
structable(value~ String_Crossing_One_Bow + String_Crossing_Space_String, data = df_presto_melt)
```

```
##                                                           value   0    1
## String_Crossing_One_Bow String_Crossing_Space_String
## F                       F                                       463   50
##                         T                                         6   21
## T                       F                                       166   23
##                         T                                         7   11
```

String_Crossing_One_Bow + Position_Shifting

```
structable(value~ String_Crossing_One_Bow + Position_Shifting, data = df_presto_melt)
```

```
##                                      value   0   1
## String_Crossing_One_Bow Position_Shifting
## F                       F                  389  16
##                         T                   80  55
## T                       F                  160  29
##                         T                   13   5
```

String_Crossing_One_Bow + Left_Out_Note

structable(value~ String_Crossing_One_Bow **+** Left_Out_Note, data **=** df_presto_melt)

```
##                                  value   0   1
## String_Crossing_One_Bow Left_Out_Note
## F                       F              441  36
##                         T               28  35
## T                       F              102  15
##                         T               71  19
```

String_Crossing_Space_String + Position_Shifting

structable(value~ String_Crossing_Space_String **+** Position_Shifting, data **=** df_presto_melt)

```
##                                          value   0   1
## String_Crossing_Space_String Position_Shifting
## F                            F                 542  34
##                              T                  87  39
## T                            F                   7  11
##                              T                   6  21
```

String_Crossing_Space_String + Left_Out_Note

structable(value~ String_Crossing_Space_String **+** Left_Out_Note, data **=** df_presto_melt)

```
##                                      value   0   1
## String_Crossing_Space_String Left_Out_Note
## F                            F             540  45
##                              T              89  28
## T                            F               3   6
##                              T              10  26
```

Position_Shifting + Left_Out_Note

structable(value~ Position_Shifting **+** Left_Out_Note, data **=** df_presto_melt)

```
##                              value   0   1
## Position_Shifting Left_Out_Note
## F                 F                472  23
##                   T                 77  22
## T                 F                 71  28
##                   T                 22  32
```