But When Sweden Gets 12 Points From Norway, It's Clearly Just Good Taste: The Determinants of Eurovision Success

Data Processing

To avoid repeating the same code, I've exported my database to a csv and re-imported it here. (I have added 2019 data and also excluded the h3 HTML tag that was including song titles in my lyrics.)

```
set.seed(1)
justsongs <- read.csv("songtitles.csv")
fullscores <- read.csv("fullscores.csv")
english <- subset(justsongs, Language == "English")

english$winner <- ifelse(english$Place == 1, 1, 0)
english$label <- ifelse(english$Year != 2019, 1, NA)
english$num <- 1:nrow(english)
english$Place <- ifelse(english$Place == "26a", "26", english$Place)
english$Place <- ifelse(english$Place == "25 [D]", "25", english$Place)
english$Place <- ifelse(english$Place == "24 [D]", "24", english$Place)
english$Place <- ifelse(english$Place == "23 [D]", "23", english$Place)
english$Place2 <- as.numeric(as.character(english$Place))
english$topfive <- ifelse(english$Place2 < 6, 1, 0)
```

Supervised Learning

I actually do not expect lyrics to be a particularly good predictor of Eurovision success; that is, I do not expect that this will be able to predict a winner very accurately. (I think geopolitical and country-specific factors will matter more; that will be explored further in the poster version.)

```
set.seed(1)

corpus <- corpus(as.character(english$lyrics), docvars=english)
doc.features <- dfm(corpus, remove=stopwords("english"), remove_punct=T)

docvars(corpus, "id") <- 1:ndoc(corpus)
test <- which(is.na(english$label))
labeled <- which(!is.na(english$label))

dfmat_train <- doc.features[labeled,]
dfmat_test <- doc.features[test,]

tmod_nb <- textmodel_nb(dfmat_train, docvars(dfmat_train, "winner"))

#Words associated with winning:
head(sort(tmod_nb$PwGc[2,]/tmod_nb$PwGc[1,], decreasing=T))
```

```
##  hallelujah ding-a-dong    everyway        year    euphoria      stupid
##    90.05650    83.12907    76.20165    76.20165    69.27423    55.41938
```

```
#Words not associated with not winning:
head(sort(tmod_nb$PwGc[1,]/tmod_nb$PwGc[2,], decreasing=T))
```

```
##     lala    ain't     wait    wrong      old  waiting
## 18.62164 11.98137 11.25960 10.39348 10.39348  9.81606
```

```
predict.test <- predict(tmod_nb, newdata = dfmat_test)
predict.test
```

```
##  text1  text2  text3  text4  text5  text6  text7  text8  text9 text10
##      0      0      0      1      0      0      0      0      0      0
## text11 text12 text13 text14 text15 text16 text17
##      0      0      0      0      1      0      0
## Levels: 0 1
```

```
tab_test <- table(docvars(dfmat_test, "winner"), predict.test)
```

This predicts two winners - Russia's "Scream" (placed third) and Azerbaijan's "Truth" (placed seventh). This is better than I expected it to do.

Let's consider how accurately it can find top 5 finishers:

```
set.seed(1)
corpus <- corpus(as.character(english$lyrics), docvars=english)
doc.features <- dfm(corpus, remove=stopwords("english"), remove_punct=T)

docvars(corpus, "id") <- 1:ndoc(corpus)
test <- which(is.na(english$label))
labeled <- which(!is.na(english$label))

dfmat_train <- doc.features[labeled,]
dfmat_test <- doc.features[test,]

tmod_nb <- textmodel_nb(dfmat_train, docvars(dfmat_train, "topfive"))

#Words associated with winning:
head(sort(tmod_nb$PwGc[2,]/tmod_nb$PwGc[1,], decreasing=T))
```

```
##         ay       pump        bom reflection    trumpet    woman's
##  106.12474   54.49649   48.76001   48.76001   45.89178   45.89178
```

```
#Words not associated with not winning:
head(sort(tmod_nb$PwGc[1,]/tmod_nb$PwGc[2,], decreasing=T))
```

```
##    shake    mamma       eh   jennie    gimme      ela
## 22.48769 22.31337 21.26743 19.87284 18.82690 16.38638
```

```
predict.train <- predict(tmod_nb, dfmat_train)
tab_train <- table(docvars(dfmat_train, "topfive"), predict.train)

#recall
diag(tab_train)/colSums(tab_train)
```

```
##         0         1
## 0.9744409 0.9873418
```

```
#precision
diag(tab_train)/rowSums(tab_train)
```

```
##         0         1
## 0.9967320 0.9069767
```

```
predict.test <- predict(tmod_nb, newdata = dfmat_test)
predict.test
```

```
##  text1  text2  text3  text4  text5  text6  text7  text8  text9 text10
##      1      0      0      1      0      1      0      0      0      0
## text11 text12 text13 text14 text15 text16 text17
##      0      1      0      0      0      0      0
## Levels: 0 1
```

```
tab_test <- table(docvars(dfmat_test, "winner"), predict.test)

#recall
diag(tab_test)/colSums(tab_test)
```

```
##         0         1
## 0.9230769 0.0000000
```

```
#precision
diag(tab_test)/rowSums(tab_test)
```

```
##    0    1
## 0.75 0.00
```

Thus, its predicted top five finishers are Malta (placed 16), Russia (placed 3), North Macedonia (placed 8), and the UK (placed 23).

Thus, it correctly found one of the top five - but since 29% of the final ends up in the top five, this isn't all that impressive. In other words, lyrics don't seem to be that predictive.

Unsupervised

I theorize there are only a handful of types of Eurovision song - heartbreak songs, "I'm in love", and offbeat songs (see: Lordi, Hatari, etc.)

```
set.seed(1)
out <- convert(doc.features, to = "stm", docvars = english)
stm.out = stm(out$documents, out$vocab, K=3,
              data=out$meta, init.type="Spectral")
```

```
## Beginning Spectral Initialization
##   Calculating the gram matrix...
##   Finding anchor words...
##      ...
##   Recovering initialization...
##      ..................................
## Initialization complete.
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 1 (approx. per word bound = -6.663)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
```

```
## Completing Iteration 2 (approx. per word bound = -6.635, relative change = 4.129e-03)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 3 (approx. per word bound = -6.630, relative change = 7.756e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 4 (approx. per word bound = -6.626, relative change = 6.985e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 5 (approx. per word bound = -6.621, relative change = 6.790e-04)
## Topic 1: love, oh, can, never, yeah
##  Topic 2: know, one, like, now, baby
##  Topic 3: just, go, life, make, take
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 6 (approx. per word bound = -6.616, relative change = 6.940e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 7 (approx. per word bound = -6.612, relative change = 7.134e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 8 (approx. per word bound = -6.607, relative change = 7.328e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 9 (approx. per word bound = -6.602, relative change = 6.764e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 10 (approx. per word bound = -6.598, relative change = 6.240e-04)
## Topic 1: love, oh, can, never, yeah
##  Topic 2: know, one, like, now, baby
##  Topic 3: just, go, life, make, take
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 11 (approx. per word bound = -6.594, relative change = 6.173e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 12 (approx. per word bound = -6.590, relative change = 6.350e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 13 (approx. per word bound = -6.586, relative change = 6.251e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
```

```
## Completing Iteration 14 (approx. per word bound = -6.582, relative change = 5.710e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 15 (approx. per word bound = -6.579, relative change = 5.418e-04)
## Topic 1: love, oh, can, never, yeah
##  Topic 2: know, one, like, baby, now
##  Topic 3: just, go, life, make, take
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 16 (approx. per word bound = -6.575, relative change = 5.517e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 17 (approx. per word bound = -6.571, relative change = 5.746e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 18 (approx. per word bound = -6.568, relative change = 5.371e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 19 (approx. per word bound = -6.564, relative change = 5.278e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 20 (approx. per word bound = -6.561, relative change = 5.416e-04)
## Topic 1: oh, love, can, yeah, never
##  Topic 2: one, know, like, baby, now
##  Topic 3: just, go, life, make, take
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 21 (approx. per word bound = -6.557, relative change = 5.649e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 22 (approx. per word bound = -6.553, relative change = 5.877e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 23 (approx. per word bound = -6.549, relative change = 5.944e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 24 (approx. per word bound = -6.545, relative change = 5.899e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 25 (approx. per word bound = -6.541, relative change = 5.870e-04)
## Topic 1: oh, love, can, yeah, got
##  Topic 2: one, know, love, heart, baby
##  Topic 3: just, go, life, take, make
```

```
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 26 (approx. per word bound = -6.538, relative change = 5.715e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 27 (approx. per word bound = -6.534, relative change = 5.485e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 28 (approx. per word bound = -6.531, relative change = 5.284e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 29 (approx. per word bound = -6.527, relative change = 5.174e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 30 (approx. per word bound = -6.524, relative change = 4.974e-04)
## Topic 1: oh, love, can, yeah, got
##  Topic 2: love, one, know, heart, baby
##  Topic 3: just, go, life, take, make
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 31 (approx. per word bound = -6.521, relative change = 4.631e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 32 (approx. per word bound = -6.518, relative change = 4.417e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 33 (approx. per word bound = -6.515, relative change = 4.299e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 34 (approx. per word bound = -6.513, relative change = 4.282e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 35 (approx. per word bound = -6.510, relative change = 4.170e-04)
## Topic 1: oh, love, can, yeah, got
##  Topic 2: love, one, know, heart, baby
##  Topic 3: just, life, go, take, make
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 36 (approx. per word bound = -6.507, relative change = 3.950e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 37 (approx. per word bound = -6.505, relative change = 3.922e-04)
```

```
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 38 (approx. per word bound = -6.502, relative change = 4.079e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 39 (approx. per word bound = -6.499, relative change = 4.216e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 40 (approx. per word bound = -6.497, relative change = 4.253e-04)
## Topic 1: oh, love, can, yeah, got
##  Topic 2: love, one, know, heart, baby
##  Topic 3: just, life, take, go, believe
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 41 (approx. per word bound = -6.494, relative change = 4.330e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 42 (approx. per word bound = -6.491, relative change = 4.482e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 43 (approx. per word bound = -6.488, relative change = 4.530e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 44 (approx. per word bound = -6.485, relative change = 4.358e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 45 (approx. per word bound = -6.482, relative change = 4.069e-04)
## Topic 1: oh, love, can, got, yeah
##  Topic 2: love, one, know, heart, now
##  Topic 3: just, life, take, go, believe
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 46 (approx. per word bound = -6.480, relative change = 3.857e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 47 (approx. per word bound = -6.478, relative change = 3.654e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 48 (approx. per word bound = -6.475, relative change = 3.511e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 49 (approx. per word bound = -6.473, relative change = 3.278e-04)
```

```
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 50 (approx. per word bound = -6.471, relative change = 3.087e-04)
## Topic 1: oh, can, love, got, yeah
##  Topic 2: love, know, one, heart, now
##  Topic 3: just, love, take, believe, life
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 51 (approx. per word bound = -6.469, relative change = 3.130e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 52 (approx. per word bound = -6.467, relative change = 3.328e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 53 (approx. per word bound = -6.465, relative change = 3.198e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 54 (approx. per word bound = -6.463, relative change = 2.715e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 55 (approx. per word bound = -6.462, relative change = 2.354e-04)
## Topic 1: oh, can, love, got, yeah
##  Topic 2: love, know, heart, one, let
##  Topic 3: love, just, believe, take, life
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 56 (approx. per word bound = -6.460, relative change = 2.130e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 57 (approx. per word bound = -6.459, relative change = 2.021e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 58 (approx. per word bound = -6.458, relative change = 1.952e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 59 (approx. per word bound = -6.457, relative change = 1.802e-04)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 60 (approx. per word bound = -6.456, relative change = 1.625e-04)
## Topic 1: oh, can, love, yeah, got
##  Topic 2: love, know, heart, let, one
##  Topic 3: love, just, believe, can, life
## ..........................................................................................
```

```
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 61 (approx. per word bound = -6.455, relative change = 1.495e-04)
## ..............................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 62 (approx. per word bound = -6.454, relative change = 1.443e-04)
## ..............................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 63 (approx. per word bound = -6.453, relative change = 1.487e-04)
## ..............................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 64 (approx. per word bound = -6.452, relative change = 1.614e-04)
## ..............................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 65 (approx. per word bound = -6.451, relative change = 1.567e-04)
## Topic 1: oh, can, love, yeah, know
##  Topic 2: love, heart, know, let, now
##  Topic 3: love, just, believe, can, say
## ..............................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 66 (approx. per word bound = -6.450, relative change = 1.411e-04)
## ..............................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 67 (approx. per word bound = -6.449, relative change = 1.407e-04)
## ..............................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 68 (approx. per word bound = -6.448, relative change = 1.530e-04)
## ..............................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 69 (approx. per word bound = -6.447, relative change = 1.592e-04)
## ..............................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 70 (approx. per word bound = -6.446, relative change = 1.292e-04)
## Topic 1: oh, can, yeah, love, know
##  Topic 2: love, heart, let, know, now
##  Topic 3: love, just, believe, can, say
## ..............................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 71 (approx. per word bound = -6.445, relative change = 1.100e-04)
## ..............................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 72 (approx. per word bound = -6.445, relative change = 9.872e-05)
## ..............................................................................................
```

```
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 73 (approx. per word bound = -6.444, relative change = 8.138e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 74 (approx. per word bound = -6.444, relative change = 7.034e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 75 (approx. per word bound = -6.443, relative change = 6.974e-05)
## Topic 1: oh, can, yeah, love, know
##  Topic 2: love, heart, let, know, now
##  Topic 3: love, just, can, make, believe
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 76 (approx. per word bound = -6.443, relative change = 7.874e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 77 (approx. per word bound = -6.442, relative change = 8.891e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 78 (approx. per word bound = -6.442, relative change = 7.683e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 79 (approx. per word bound = -6.441, relative change = 7.329e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 80 (approx. per word bound = -6.441, relative change = 8.046e-05)
## Topic 1: oh, can, yeah, know, love
##  Topic 2: love, heart, let, know, now
##  Topic 3: love, just, can, make, believe
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 81 (approx. per word bound = -6.440, relative change = 8.164e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 82 (approx. per word bound = -6.440, relative change = 6.970e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 83 (approx. per word bound = -6.439, relative change = 5.916e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 84 (approx. per word bound = -6.439, relative change = 5.483e-05)
## ..........................................................................................
```

```
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 85 (approx. per word bound = -6.439, relative change = 5.394e-05)
## Topic 1: oh, can, yeah, know, love
##  Topic 2: love, heart, know, let, now
##  Topic 3: love, just, can, make, say
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 86 (approx. per word bound = -6.438, relative change = 5.084e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 87 (approx. per word bound = -6.438, relative change = 5.160e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 88 (approx. per word bound = -6.438, relative change = 5.461e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 89 (approx. per word bound = -6.437, relative change = 4.731e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 90 (approx. per word bound = -6.437, relative change = 4.635e-05)
## Topic 1: oh, can, yeah, know, love
##  Topic 2: love, heart, know, let, now
##  Topic 3: love, just, make, can, say
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 91 (approx. per word bound = -6.437, relative change = 5.617e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 92 (approx. per word bound = -6.436, relative change = 8.568e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 93 (approx. per word bound = -6.436, relative change = 8.045e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 94 (approx. per word bound = -6.435, relative change = 4.125e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 95 (approx. per word bound = -6.435, relative change = 2.867e-05)
## Topic 1: oh, can, yeah, know, got
##  Topic 2: love, heart, know, let, now
##  Topic 3: love, just, make, can, say
## ..........................................................................................
## Completed E-Step (0 seconds).
```

```
## Completed M-Step.
## Completing Iteration 96 (approx. per word bound = -6.435, relative change = 2.682e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 97 (approx. per word bound = -6.435, relative change = 3.127e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 98 (approx. per word bound = -6.434, relative change = 4.360e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 99 (approx. per word bound = -6.434, relative change = 3.678e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 100 (approx. per word bound = -6.434, relative change = 2.690e-05)
## Topic 1: oh, can, yeah, know, got
##  Topic 2: love, heart, know, let, one
##  Topic 3: love, just, make, can, say
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 101 (approx. per word bound = -6.434, relative change = 2.631e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 102 (approx. per word bound = -6.434, relative change = 2.893e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 103 (approx. per word bound = -6.433, relative change = 3.018e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 104 (approx. per word bound = -6.433, relative change = 3.018e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 105 (approx. per word bound = -6.433, relative change = 2.756e-05)
## Topic 1: oh, can, yeah, know, got
##  Topic 2: love, heart, know, let, one
##  Topic 3: love, just, make, can, say
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 106 (approx. per word bound = -6.433, relative change = 2.596e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 107 (approx. per word bound = -6.433, relative change = 2.586e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
```

```
## Completed M-Step.
## Completing Iteration 108 (approx. per word bound = -6.433, relative change = 2.851e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 109 (approx. per word bound = -6.432, relative change = 3.057e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 110 (approx. per word bound = -6.432, relative change = 3.408e-05)
## Topic 1: oh, can, yeah, know, got
##  Topic 2: love, heart, know, let, one
##  Topic 3: love, just, make, can, say
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 111 (approx. per word bound = -6.432, relative change = 3.955e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 112 (approx. per word bound = -6.432, relative change = 3.392e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 113 (approx. per word bound = -6.431, relative change = 2.813e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 114 (approx. per word bound = -6.431, relative change = 3.203e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 115 (approx. per word bound = -6.431, relative change = 3.677e-05)
## Topic 1: oh, can, yeah, know, got
##  Topic 2: love, heart, know, let, one
##  Topic 3: love, just, make, can, one
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 116 (approx. per word bound = -6.431, relative change = 3.585e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 117 (approx. per word bound = -6.431, relative change = 4.110e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 118 (approx. per word bound = -6.430, relative change = 3.634e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 119 (approx. per word bound = -6.430, relative change = 2.502e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
```

```
## Completed M-Step.
## Completing Iteration 120 (approx. per word bound = -6.430, relative change = 2.747e-05)
## Topic 1: oh, can, yeah, know, come
##  Topic 2: love, heart, know, let, one
##  Topic 3: love, just, make, can, one
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 121 (approx. per word bound = -6.430, relative change = 2.457e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 122 (approx. per word bound = -6.430, relative change = 2.130e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 123 (approx. per word bound = -6.430, relative change = 2.670e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 124 (approx. per word bound = -6.429, relative change = 3.816e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 125 (approx. per word bound = -6.429, relative change = 2.893e-05)
## Topic 1: oh, can, yeah, know, come
##  Topic 2: love, heart, know, let, one
##  Topic 3: love, just, make, can, one
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 126 (approx. per word bound = -6.429, relative change = 1.406e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 127 (approx. per word bound = -6.429, relative change = 1.238e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 128 (approx. per word bound = -6.429, relative change = 1.242e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 129 (approx. per word bound = -6.429, relative change = 1.281e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 130 (approx. per word bound = -6.429, relative change = 1.367e-05)
## Topic 1: oh, can, yeah, know, come
##  Topic 2: love, heart, know, let, one
##  Topic 3: love, just, make, can, one
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
```

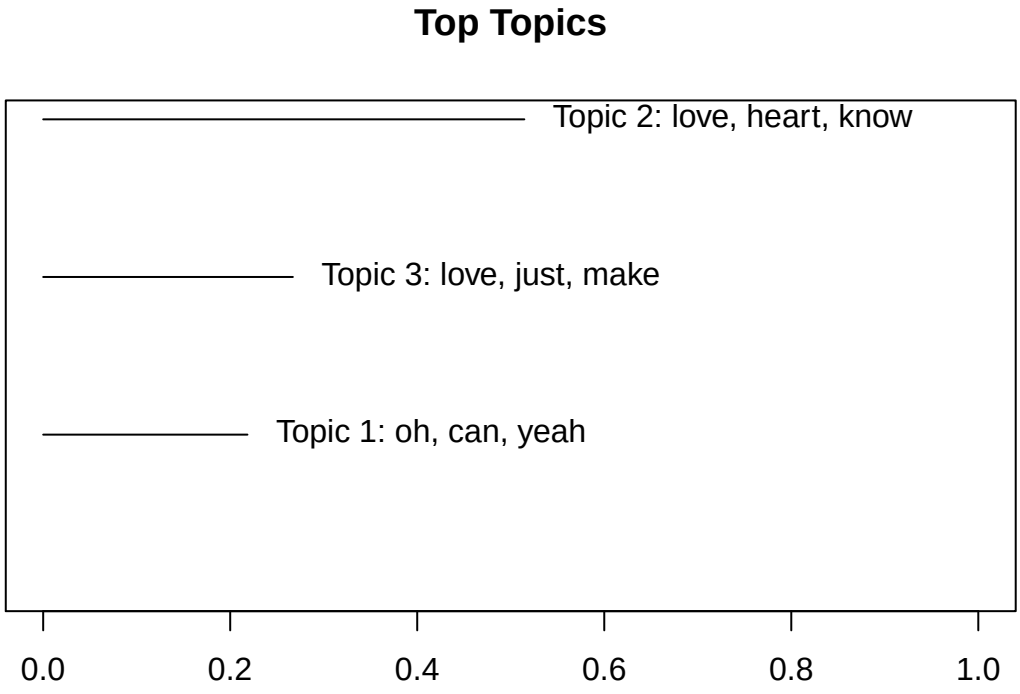
```
## Completing Iteration 131 (approx. per word bound = -6.429, relative change = 1.576e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 132 (approx. per word bound = -6.428, relative change = 2.014e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 133 (approx. per word bound = -6.428, relative change = 2.580e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 134 (approx. per word bound = -6.428, relative change = 2.380e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 135 (approx. per word bound = -6.428, relative change = 2.177e-05)
## Topic 1: oh, can, yeah, know, come
##  Topic 2: love, heart, know, let, one
##  Topic 3: love, just, make, can, one
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 136 (approx. per word bound = -6.428, relative change = 2.004e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 137 (approx. per word bound = -6.428, relative change = 2.004e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 138 (approx. per word bound = -6.428, relative change = 2.411e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 139 (approx. per word bound = -6.427, relative change = 2.174e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 140 (approx. per word bound = -6.427, relative change = 1.700e-05)
## Topic 1: oh, can, yeah, know, come
##  Topic 2: love, heart, know, let, one
##  Topic 3: love, just, make, can, one
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 141 (approx. per word bound = -6.427, relative change = 1.508e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 142 (approx. per word bound = -6.427, relative change = 1.542e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
```

```
## Completing Iteration 143 (approx. per word bound = -6.427, relative change = 1.556e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 144 (approx. per word bound = -6.427, relative change = 1.438e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 145 (approx. per word bound = -6.427, relative change = 1.704e-05)
## Topic 1: oh, can, yeah, know, come
##  Topic 2: love, heart, know, let, one
##  Topic 3: love, just, make, can, one
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 146 (approx. per word bound = -6.427, relative change = 2.742e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 147 (approx. per word bound = -6.426, relative change = 2.197e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Completing Iteration 148 (approx. per word bound = -6.426, relative change = 1.427e-05)
## ..........................................................................................
## Completed E-Step (0 seconds).
## Completed M-Step.
## Model Converged
```

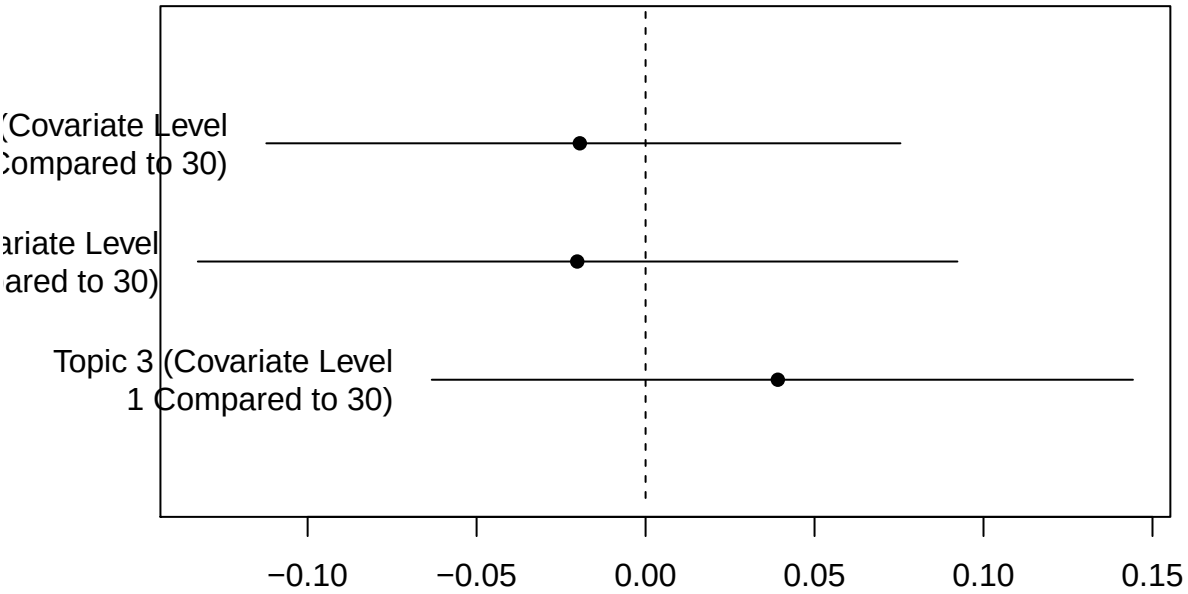
```
labelTopics(stm.out)
```

```
## Topic 1 Top Words:
##       Highest Prob: oh, can, yeah, know, come, like, got
##       FREX: nanana, yay, shut, doo, n, check, lalala
##       Lift: blend, casual, ding-dang-dong, horoscopes, mr, oh-oh-oh, oh-oh-oh-oh-oh
##       Score: lala, vote, popular, winners, vegas, las, dum
## Topic 2 Top Words:
##       Highest Prob: love, heart, know, let, one, now, never
##       FREX: mamma, eh, nobody, jennie, bigger, gimme, apart
##       Lift: carving, chains, 808, a-limping, a-lyin, aaahhh, abandon
##       Score: jennie, mamma, babada, eh, nobody, gimme, bigger
## Topic 3 Top Words:
##       Highest Prob: love, just, make, can, one, say, go
##       FREX: na, ela, ay, dab, brother, northern, toy
##       Lift: badly, boyfriend, calms, choco, combination, freakin, frosty
##       Score: na, shake, ela, ay, password, dab, toy
```

```
plot.STM(stm.out, n=3)
```




```
prep <- estimateEffect(c(1:3) ~ Place2, stm.out, out$meta)
plot.estimateEffect(prep, covariate = "Place2",
                    method="difference", cov.value1=1, cov.value2=30)
```



These do not seem notably different (nor do other iterations with different numbers of clusters produce more useful clusters).

There is no statistically significant difference by category (even comparing placing first to 30th).

Prediction

I think a more accurate, but less text-based, approach would be to consider the factors outlined in my first memo, perhaps combined with a sentiment score. This is less text-based, but is more similar to the methods used in the prior Eurovision literaure.