# Latent Topic Modeling on Twitter Data

## Method: CA

Correspondence Analysis (CA) is a multivariate graphical technique designed to explore relationships among categorical variables. The outcome from correspondence analysis is a graphical display of the rows and columns of a contingency table that is designed to permit visualization of the salient relationships among the variable responses in a low-dimensional space. Such a representation reveals a more global picture of the relationships among row-column pairs which would otherwise not be detected through a pairwise analysis.

**Calculate CA:**

- Step 1: Compute row and column averages
- Step 2: Compute the expected values
- Step 3: Compute the residuals
- Step 4: Plotting labels with similar residuals close together
- Step 5: Interpreting the relationship between row and column labels

**How to Interpret Correspondence Analysis Plots**

Correspondence analysis does not show us which rows have the highest numbers, nor which columns have the highest numbers. It instead shows us the relativities.

- The further things are from the origin, the more discriminating they are.
- Look at the length of the line connecting the row label to the origin. Longer lines indicate that the row label is highly associated with some of the column labels (i.e., it has at least one high residual).
- Look at the length of the label connecting the column label to the origin. Longer lines again indicate a high association between the column label and one or more row labels.
- Look at the angle formed between these two lines. Really small angles indicate association. 90 degree angles indicate no relationship. Angles near 180 degrees indicate negative associations.

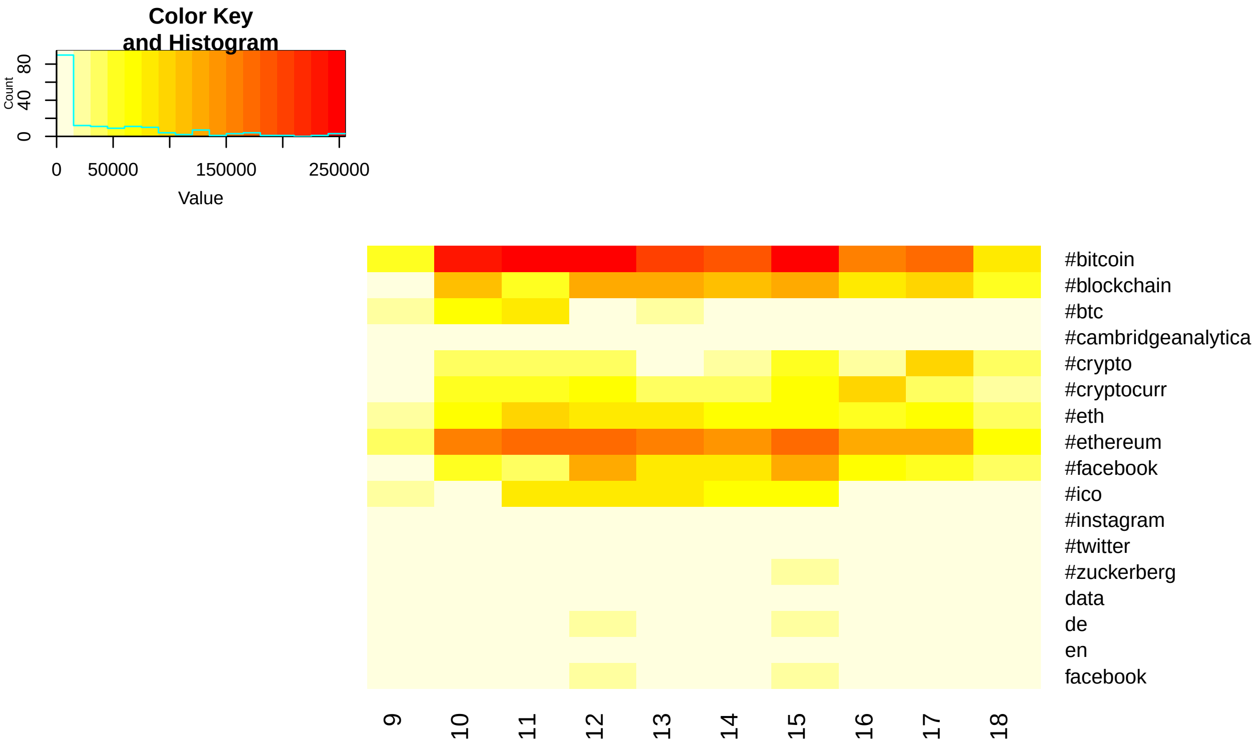
## Dataset

```
##                           9     10     11     12     13     14     15     16
## #bitcoin             50383 229333 245775 245612 195730 190175 255195 157049
## #blockchain           9196 113169  54362 134326 124176 108986 133629  86186
## #btc                 21335  63269  85576      0  28262      0      0      0
## #cambridgeanalytica      0      0      0  13947      0      0      0      0
## #crypto               8461  41888  44723  44898      0  29718  50492  23863
## #cryptocurr          10076  49910  57015  60767  40541  37868  65620  91314
## #eth                 24771  74637  99115  77422  87220  71144  73107  58282
## #ethereum            37892 153520 172861 168796 158829 148538 171729 127553
## #facebook              949  50748  41961 130670  86932  76678 128772  63718
## #ico                 17204      0  80290  75305  76068  68794  70205      0
## #instagram             153   7778   5601      0      0   7760      0   7887
## #twitter               160   8199   6384      0   9690   8526      0   8848
## #zuckerberg              0      0      0      0      0      0  18855      0
## data                     0      0      0  13700   8052      0  11498      0
## de                     113   6790   5513  21954  13265  12369  19778  10902
## en                     120   5497      0      0      0      0      0   7677
## facebook                 0      0   4555  15673  10760   8853  15829      0
##                          17     18
## #bitcoin              170079 79636
## #blockchain           103272 50301
## #btc                       0     0
## #cambridgeanalytica        0     0
## #crypto                91095 43452
## #cryptocurr            37879 17766
## #eth                   67597 32730
## #ethereum             132309 65283
## #facebook              57189 32773
## #ico                       0     0
## #instagram              7987  3791
## #twitter                8827  3895
## #zuckerberg                0     0
## data                       0     0
## de                      8529  5478
## en                      6994     0
## facebook                   0  3817
```

- Research Question
  - Do we see new words appearing on a particular week

# Analysis

## Heatmap

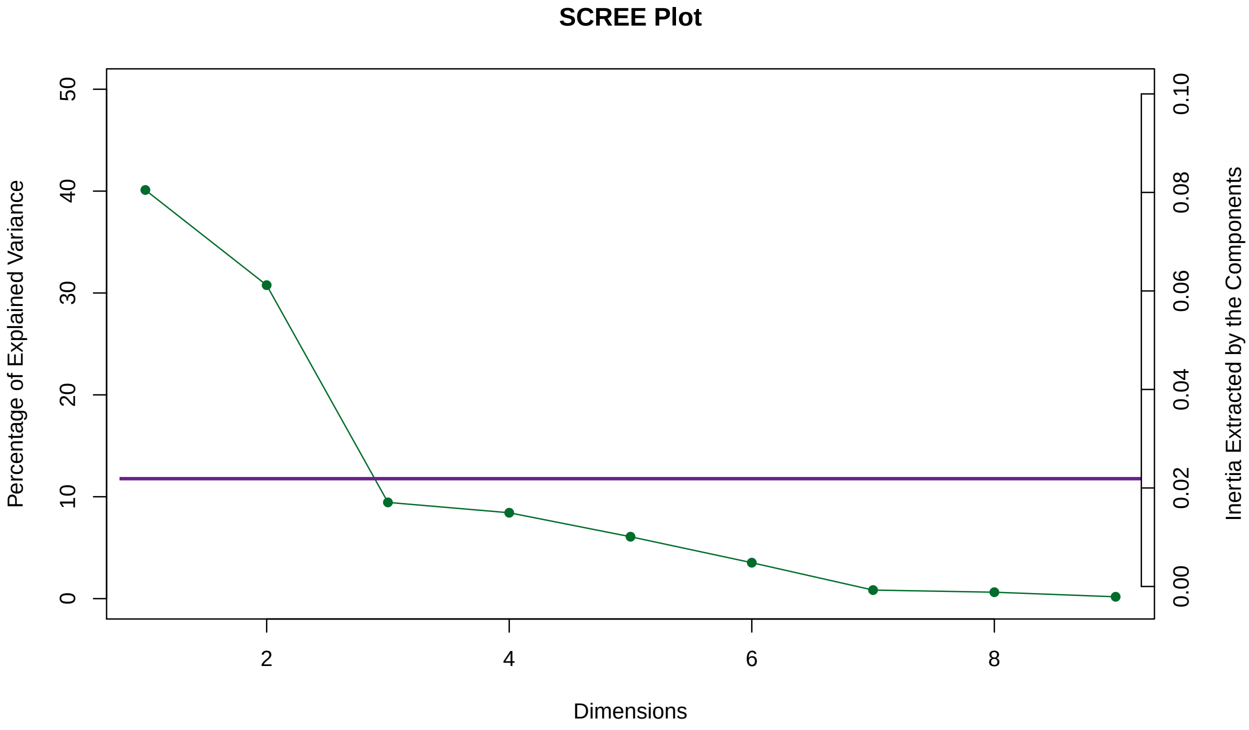


## Scree Plot

Gives amount of information explained by corresponding component. Gives an intuition to decide which components best represent data in order to answer the research question.

P.S. The most contribution component may not always be most useful for a given research question.

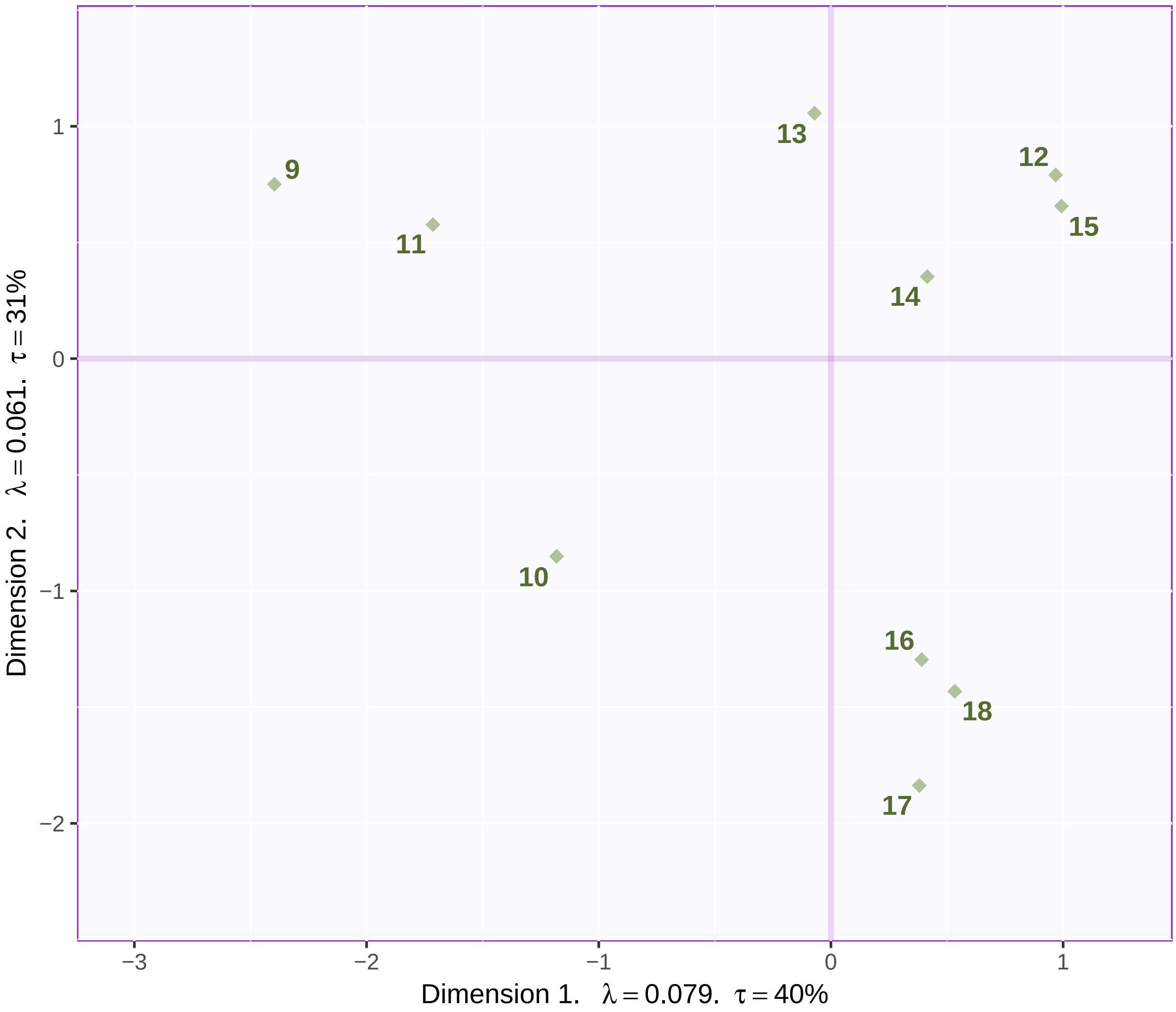
```
PTCA4CATA::PlotScree(ev = resCA.sym$ExPosition.Data$eigs,
                     #p.ev =  we_data_inf$Inference.Data$components$p.vals,
                     title = 'SCREE Plot',
                     plotKaiser = TRUE
)
```



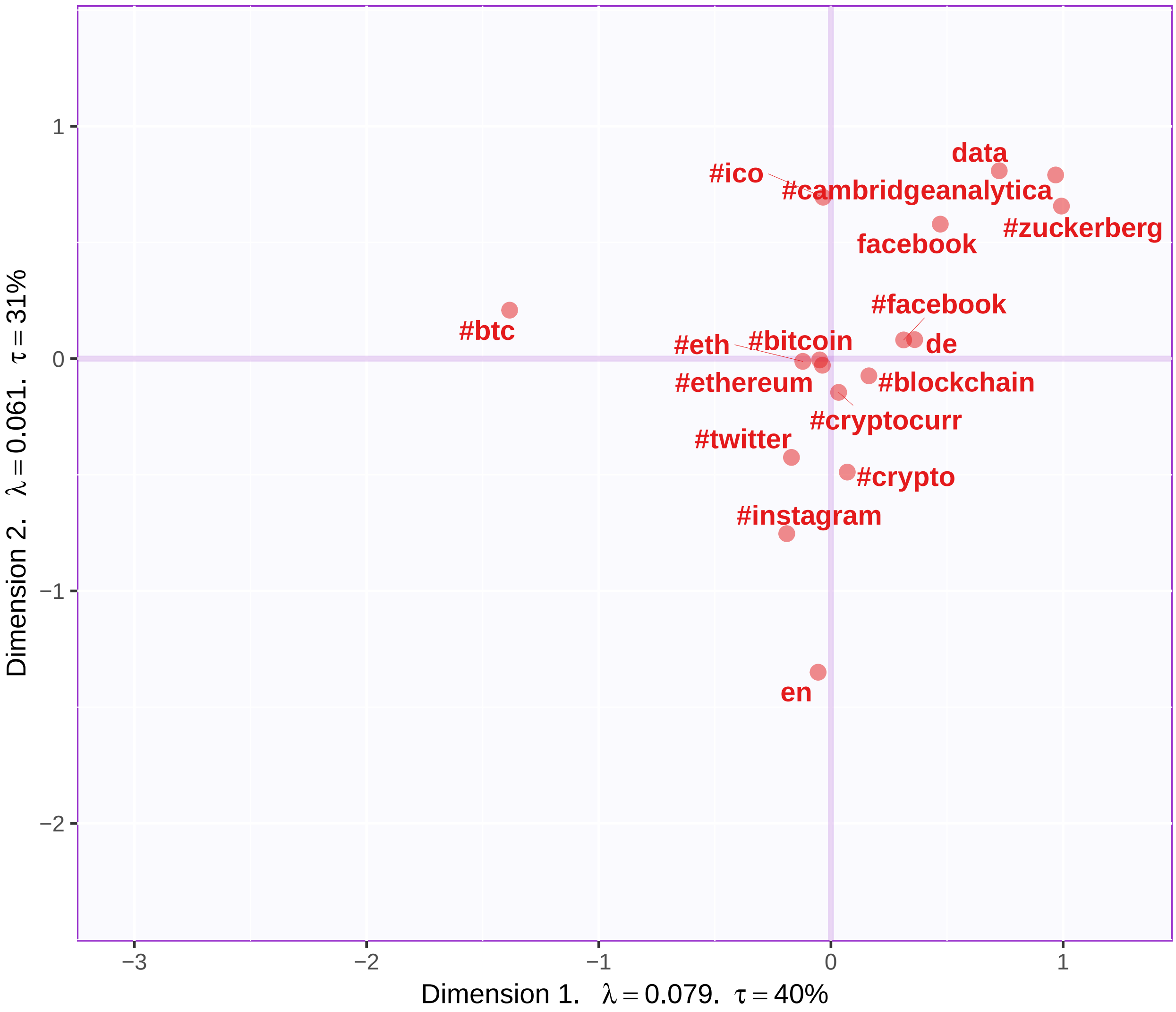
## Factor Scores

### Asymmetric Plot

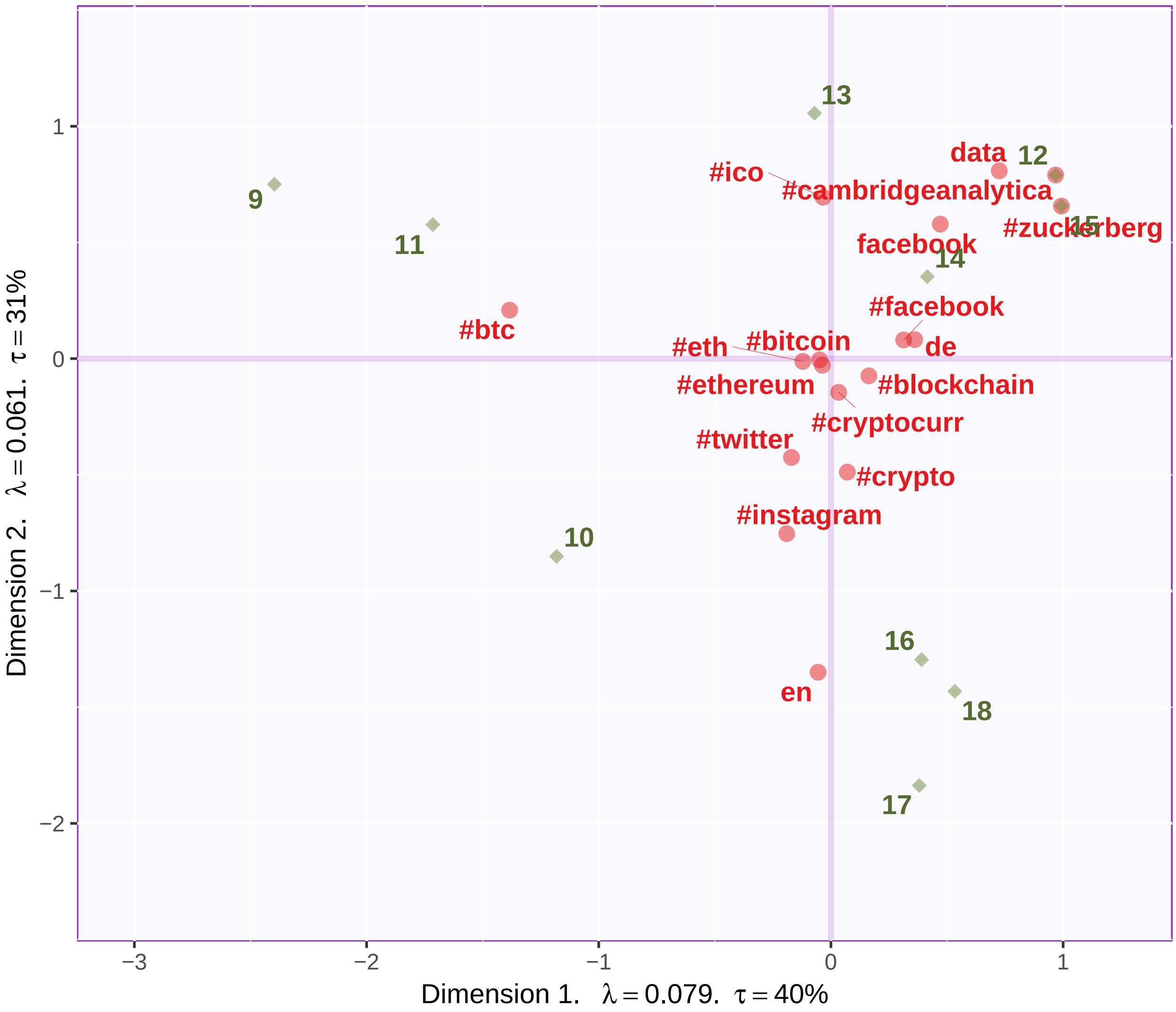
```
#### Asymmetric Plot

map.IJ.asym <- asymMap$baseMap + asymMap$J_labels +
  asymMap$J_points + labels4CA #+ legend$zeMap_dots + legend$zeMap_text
print(map.IJ.asym)
```



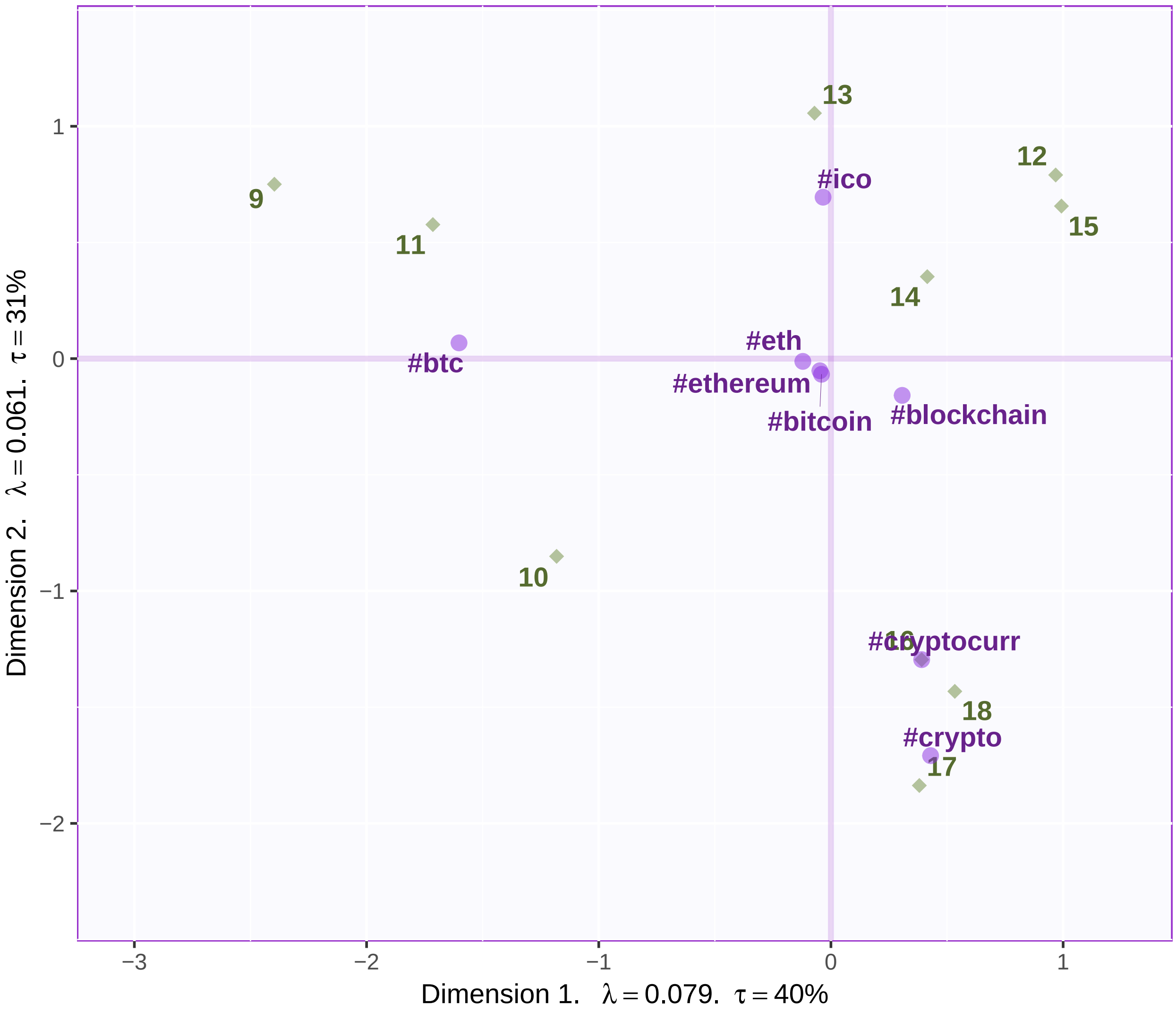
```
#### Asymmetric Plot

map.IJ.asym <- asymMap$baseMap + asymMap$I_labels +
  asymMap$I_points + labels4CA #+ legend$zeMap_dots + legend$zeMap_text
print(map.IJ.asym)
```



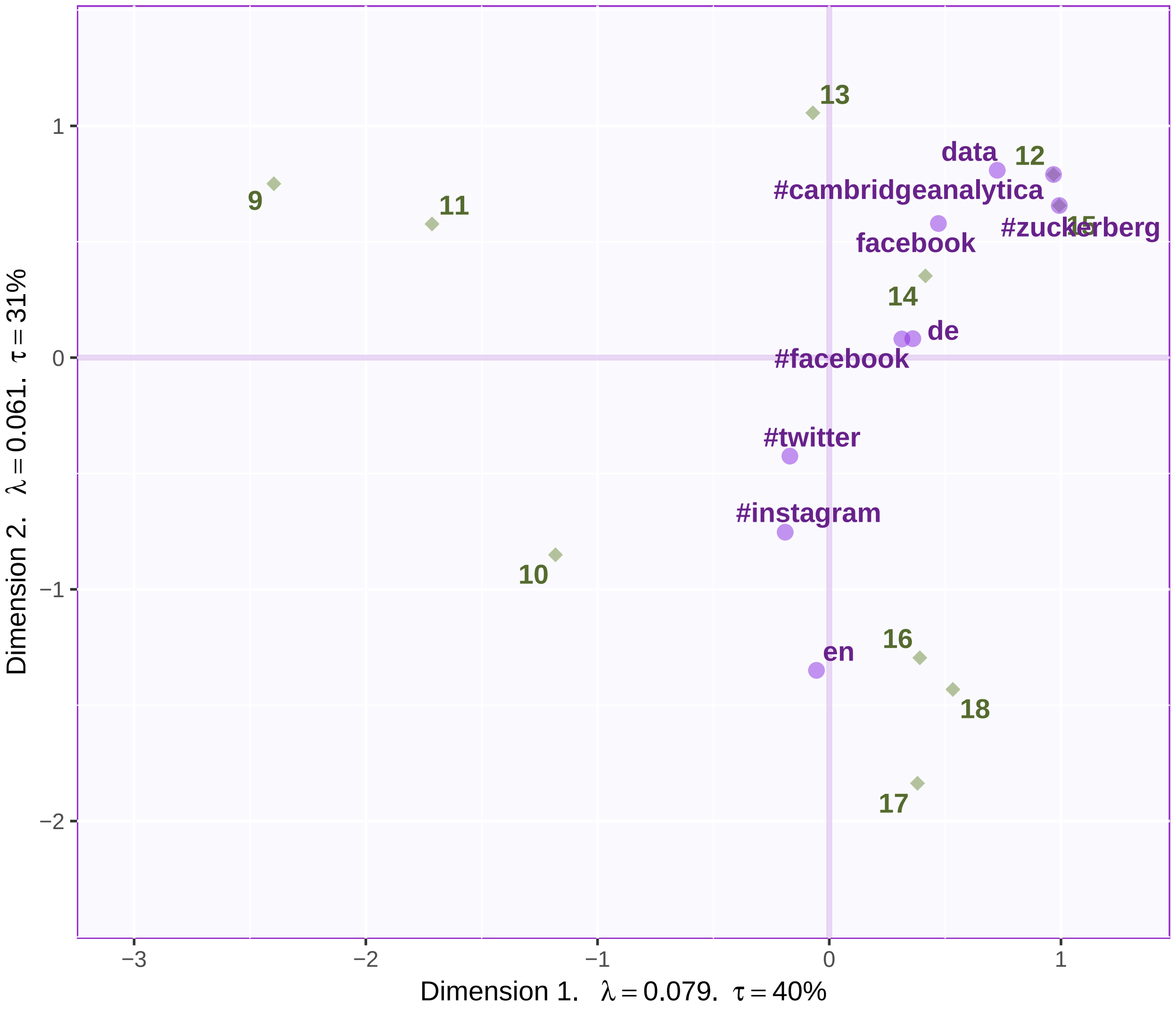
```
#### Asymmetric Plot

map.IJ.asym <- asymMap$baseMap + asymMap$I_labels +
  asymMap$I_points + asymMap$J_labels +
  asymMap$J_points + labels4CA #+ legend$zeMap_dots + legend$zeMap_text
print(map.IJ.asym)
```



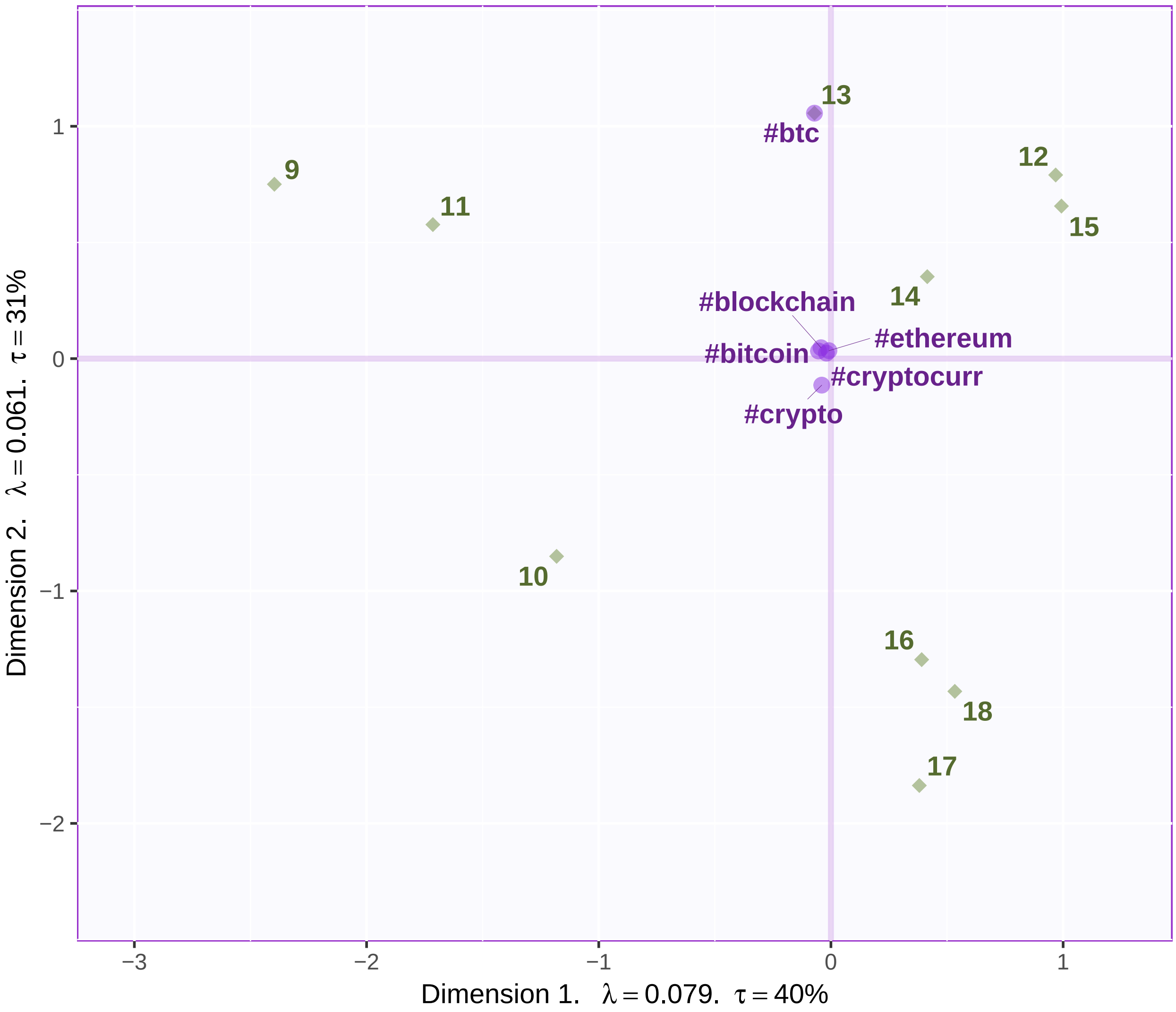
```
tweets_eth_supp <- supplementaryRows(tweets_eth,resCA.asym)
asymMap_supp  <- createFactorMapIJ(tweets_eth_supp$fii,Fj,
                             #col.points.i = color4Authors,
                             #col.labels.i = color4Authors
                             )

map.IJ.asym <- asymMap$baseMap + #asymMap$I_labels +
  #asymMap$I_points +
  asymMap$J_labels +
  asymMap$J_points + labels4CA + #+ legend$zeMap_dots + legend$zeMap_text
  asymMap_supp$I_points + asymMap_supp$I_labels

print(map.IJ.asym)
```



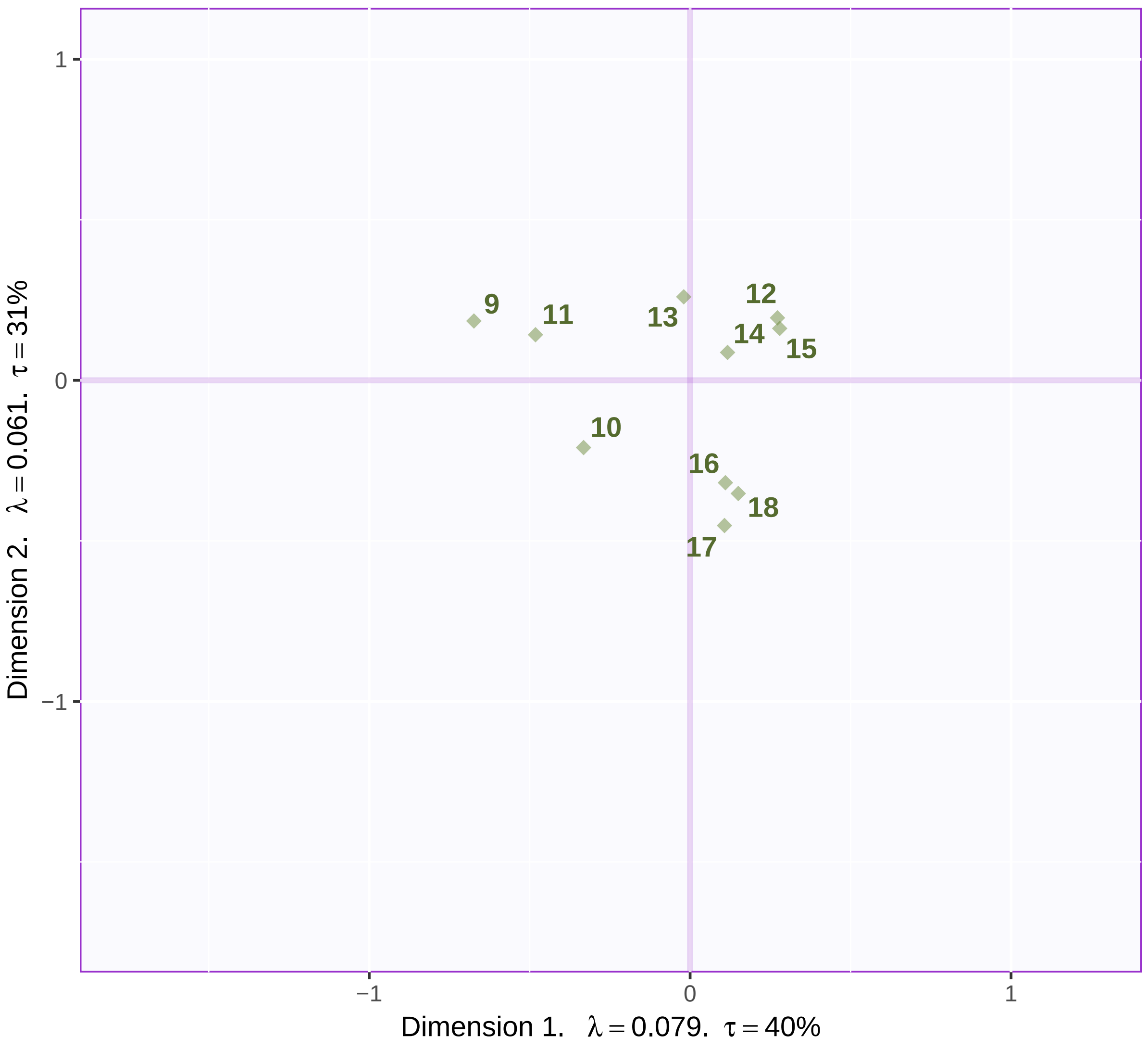
```
tweets_facebook_supp <- supplementaryRows(tweets_facebook,resCA.asym)
asymMap_supp  <- createFactorMapIJ(tweets_facebook_supp$fii,Fj,
                              #col.points.i = color4Authors,
                              #col.labels.i = color4Authors
                              )

map.IJ.asym <- asymMap$baseMap + #asymMap$I_labels +
  #asymMap$I_points +
  asymMap$J_labels +
  asymMap$J_points + labels4CA + #+ legend$zeMap_dots + legend$zeMap_text
  asymMap_supp$I_points + asymMap_supp$I_labels

print(map.IJ.asym)
```

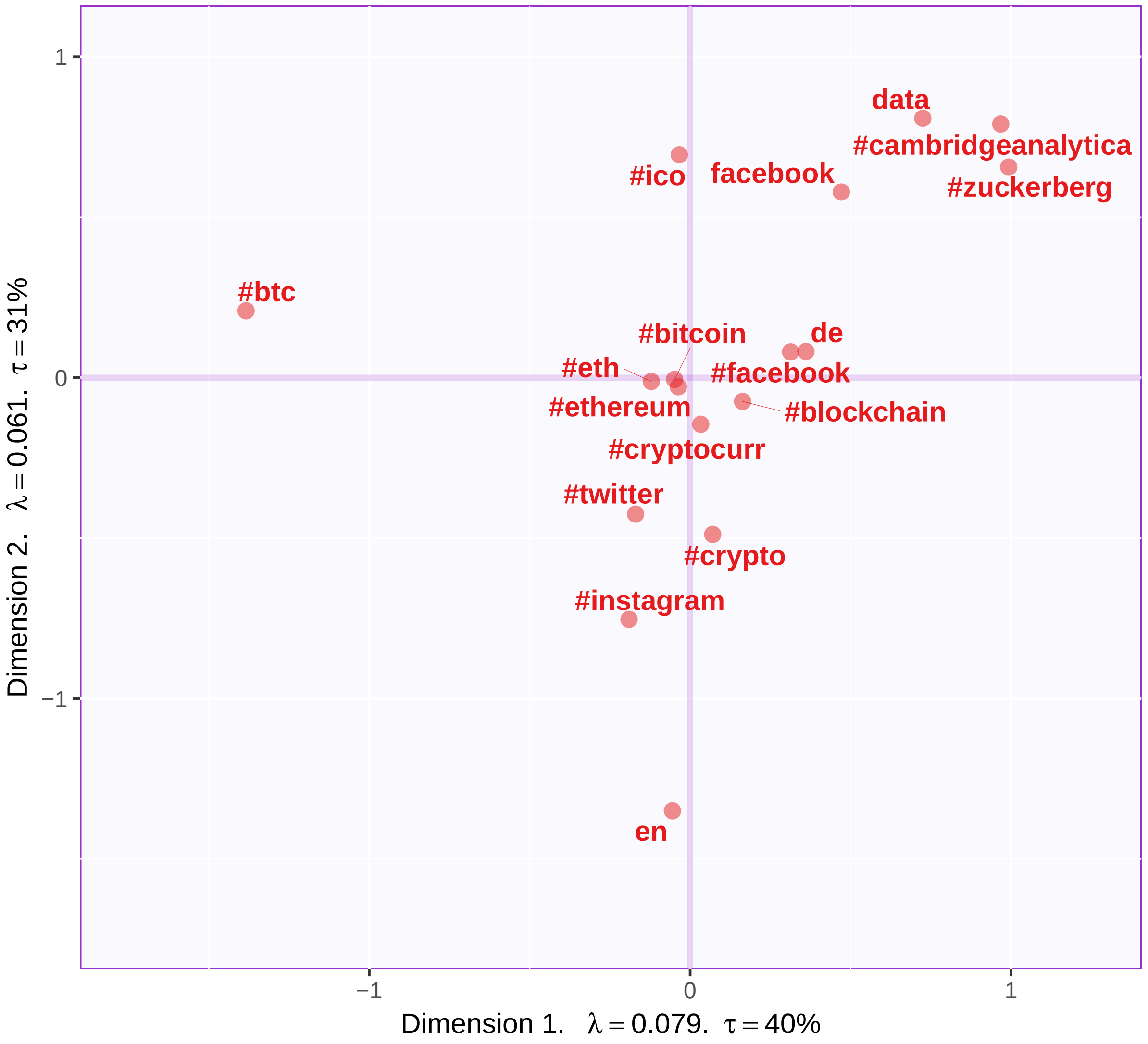


```
tweets_bitcoin_supp <- supplementaryRows(tweets_bitcoin,resCA.asym)
asymMap_supp  <- createFactorMapIJ(tweets_bitcoin_supp$fii,Fj,
                             #col.points.i = color4Authors,
                             #col.labels.i = color4Authors
                             )

map.IJ.asym <- asymMap$baseMap + #asymMap$I_labels +
  #asymMap$I_points +
  asymMap$J_labels +
  asymMap$J_points + labels4CA + #+ legend$zeMap_dots + legend$zeMap_text
  asymMap_supp$I_points + asymMap_supp$I_labels

print(map.IJ.asym)
```


13
#btc
9
11
12
15
#blockchain
14
#ethereum
#bitcoin
#cryptocurr
#crypto
10
16
18
17
1
0
−1
−2
−3
−2
−1
0
1
Dimension 2. λ = 0.061. τ = 31%
Dimension 1. λ = 0.079. τ = 40%

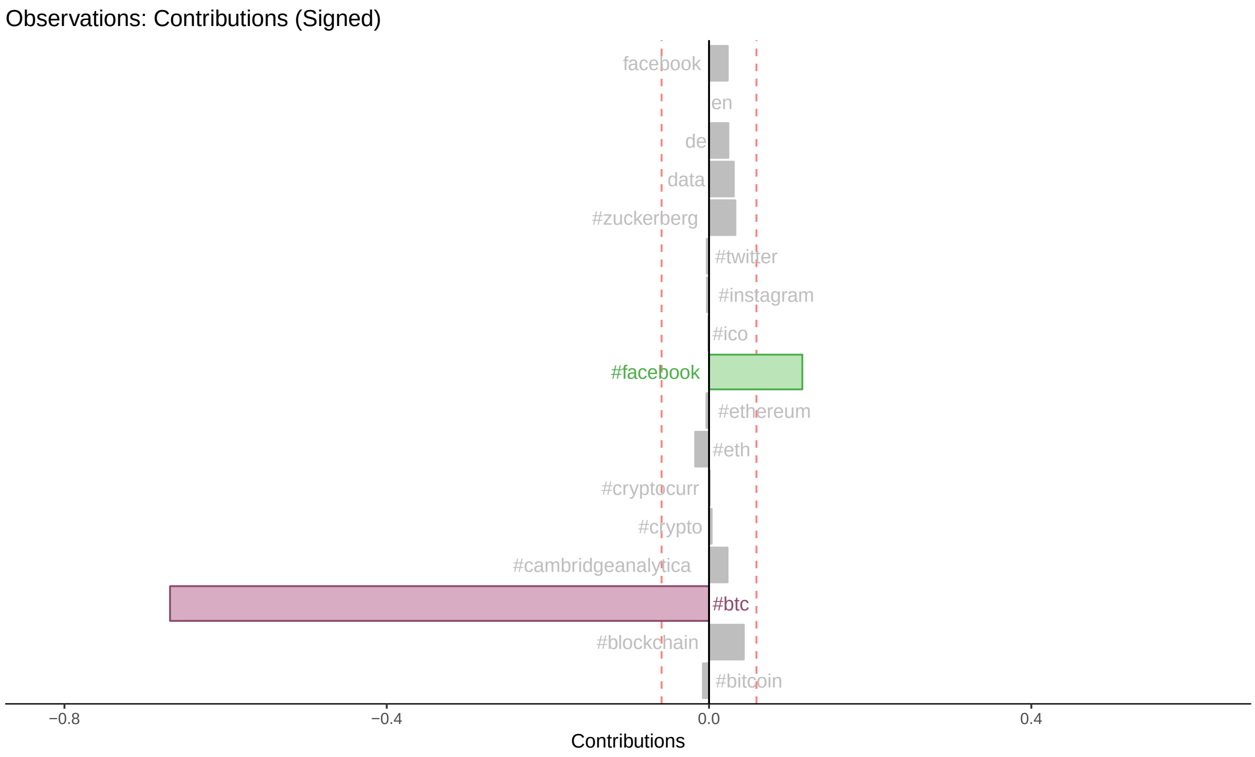
**Symmetric Plot**





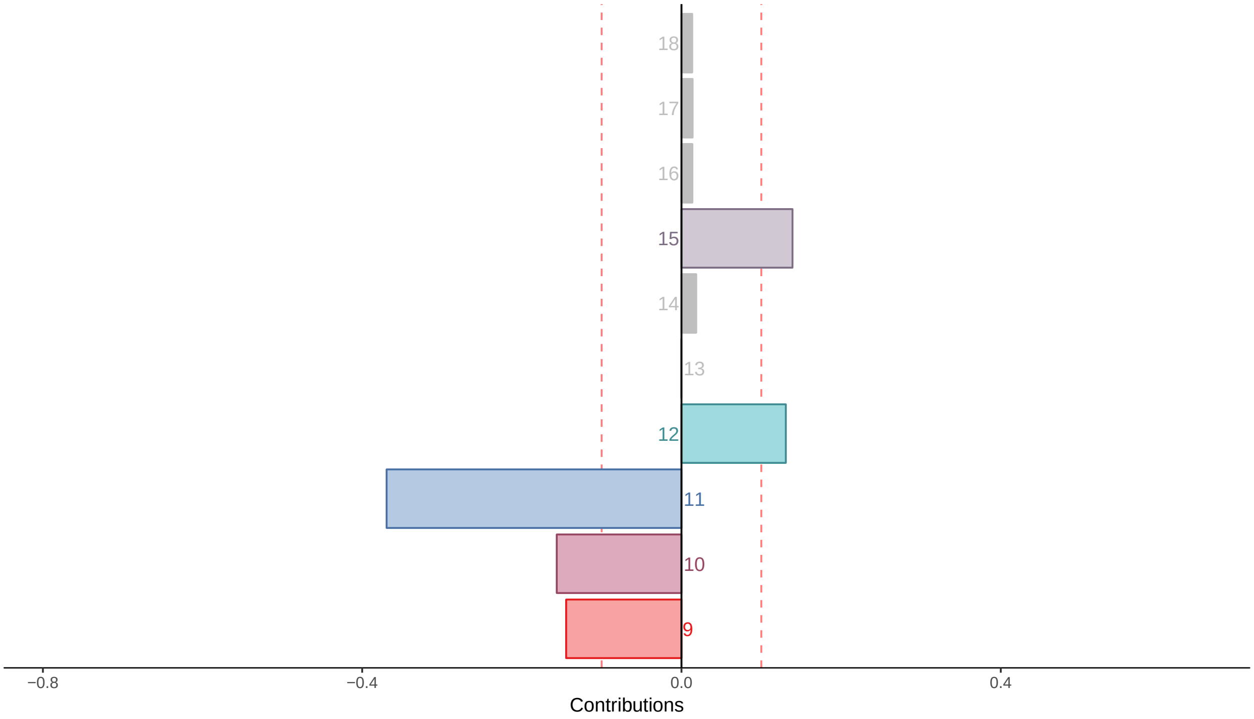
### Most Contributing Variables

```
PTCA4CATA::PrettyBarPlot2(ctr.I[,1],
                       threshold = 1 / NROW(ctr.I),
                       font.size = 4,
                       color4bar = gplots::col2hex(color4I),
                       color4ns = 'grey',
                       main = 'Observations: Contributions (Signed)',
                       ylab = 'Contributions', ylim = c(1.2*min(ctr.I),
                        1.2*max(ctr.I) ),
                       horizontal = FALSE )
```



```
PTCA4CATA::PrettyBarPlot2(ctr.J[,1],
                       threshold = 1 / NROW(ctr.J),
                       font.size = 4,
                       color4bar = gplots::col2hex(color4J),
                       color4ns = 'grey',
                       main = 'Observations: Contributions (Signed)',
                       ylab = 'Contributions', ylim = c(1.2*min(ctr.J),
                        1.2*max(ctr.J) ),
                       horizontal = FALSE )
```

Observations: Contributions (Signed)


Contributions