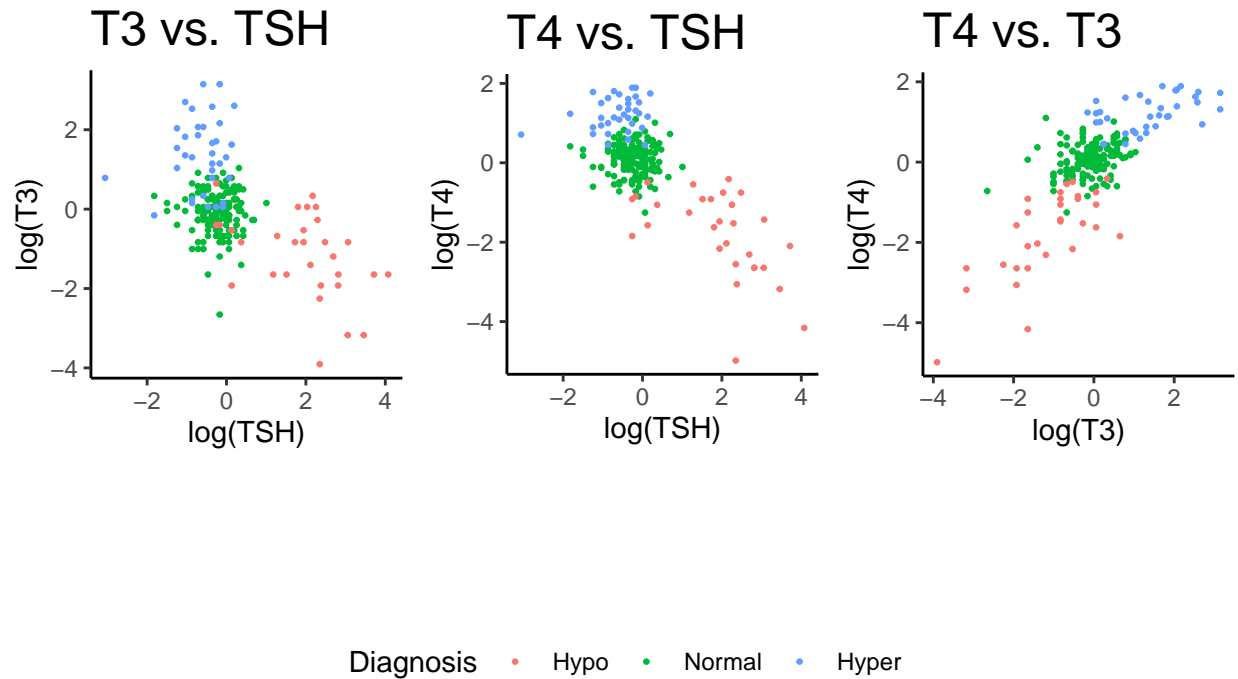# Thyroid Example

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2024-03-01

Data

Model Summary

```
##
## Frequency of MCMC iterations finding K groups:
##     1     2     3     4     5     6
##     1    40 10414  1458    82     5
##
## Percentage of MCMC iterations finding K groups:
##    1    2    3    4    5    6
##  0.0  0.3 86.8 12.2  0.7  0.0
##
```

```
##   *Note that above frequency summaries of MCMC iterations were made before burn-in or thresholds were
##           All inference on phi will be made after accounting for burn-in and thresholding.
##
##   K = 3  n_k = 8715 after burn-in and thresholding
##           Mean Median Empirical SE  2.5% 97.5%
## mu_1_1  0.11   0.11            0.00  0.02  0.19
## mu_1_2 -0.05  -0.05            0.00 -0.13  0.03
## mu_1_3 -0.24  -0.24            0.00 -0.32 -0.16
## mu_2_1  1.26   1.26            0.03  0.91  1.61
## mu_2_2  1.68   1.68            0.04  1.27  2.07
## mu_2_3 -0.67  -0.67            0.03 -1.00 -0.34
## mu_3_1 -1.86  -1.86            0.06 -2.32 -1.39
## mu_3_2 -1.32  -1.32            0.06 -1.78 -0.85
## mu_3_3  2.08   2.08            0.06  1.59  2.56
##             Mean Median Empirical SE 2.5% 97.5%
## sigma_1_1 0.26   0.26            0.00 0.23  0.30
## sigma_2_1 0.71   0.69            0.02 0.50  0.99
## sigma_3_1 1.45   1.42            0.06 1.05  1.99
##
##   K = 4  n_k = 1210 after burn-in and thresholding
##           Mean Median Empirical SE   2.5% 97.5%
## mu_1_1  0.11   0.11            0.00   0.02  0.19
## mu_1_2 -0.05  -0.05            0.00  -0.13  0.03
## mu_1_3 -0.24  -0.24            0.00  -0.33 -0.16
## mu_2_1  1.26   1.26            0.03   0.90  1.61
## mu_2_2  1.69   1.69            0.04   1.29  2.09
## mu_2_3 -0.65  -0.65            0.03  -1.00 -0.29
## mu_3_1 -1.78  -1.78            0.06  -2.23 -1.26
## mu_3_2 -1.25  -1.25            0.06  -1.73 -0.78
## mu_3_3  2.08   2.08            0.06   1.58  2.55
## mu_4_1 -2.28  -2.29           44.87 -13.72  7.85
## mu_4_2 -1.42  -1.53           36.19 -13.64  9.63
## mu_4_3  0.94   1.01           33.39  -9.55 10.84
##             Mean Median Empirical SE 2.5%   97.5%
## sigma_1_1  0.26   0.26             0.00 0.23    0.30
## sigma_2_1  0.69   0.68             0.02 0.48    0.97
## sigma_3_1  1.33   1.31             0.05 0.93    1.84
## sigma_4_1 26.26   8.50         12152.89 2.14  144.65
##
##   Summary function runtime is 0.2325816 mins

## $S
## [1] 12000
##
## $alpha
## [1] 1
##
## $a
## [1] 1
##
## $b
## [1] 10
##
## $mu0
```

```
##      [,1]
## [1,]    0
## [2,]    0
## [3,]    0
##
## $k_init
## [1] 1
##
## $d
## [1] 1
##
## $f
## [1] 1
##
## $g
## [1] 1
##
## $h
## [1] 10
##
## $r
## [1] 3.157731
##
## $mod_type
## [1] "conjDEV"
##
## $split_merge
## [1] FALSE
##
## $sm_iter
## [1] 5

## [[1]]
##         Mean Median Empirical SE  2.5% 97.5%
## mu_1_1  0.11   0.11         0.00  0.02  0.19
## mu_1_2 -0.05  -0.05         0.00 -0.13  0.03
## mu_1_3 -0.24  -0.24         0.00 -0.32 -0.16
## mu_2_1  1.26   1.26         0.03  0.91  1.61
## mu_2_2  1.68   1.68         0.04  1.27  2.07
## mu_2_3 -0.67  -0.67         0.03 -1.00 -0.34
## mu_3_1 -1.86  -1.86         0.06 -2.32 -1.39
## mu_3_2 -1.32  -1.32         0.06 -1.78 -0.85
## mu_3_3  2.08   2.08         0.06  1.59  2.56
##
## [[2]]
##         Mean Median Empirical SE   2.5% 97.5%
## mu_1_1  0.11   0.11         0.00   0.02  0.19
## mu_1_2 -0.05  -0.05         0.00  -0.13  0.03
## mu_1_3 -0.24  -0.24         0.00  -0.33 -0.16
## mu_2_1  1.26   1.26         0.03   0.90  1.61
## mu_2_2  1.69   1.69         0.04   1.29  2.09
## mu_2_3 -0.65  -0.65         0.03  -1.00 -0.29
## mu_3_1 -1.78  -1.78         0.06  -2.23 -1.26
## mu_3_2 -1.25  -1.25         0.06  -1.73 -0.78
```

```
## mu_3_3  2.08   2.08             0.06   1.58  2.55
## mu_4_1 -2.28  -2.29            44.87 -13.72  7.85
## mu_4_2 -1.42  -1.53            36.19 -13.64  9.63
## mu_4_3  0.94   1.01            33.39  -9.55 10.84

## [[1]]
##           Mean Median Empirical SE 2.5% 97.5%
## sigma_1_1 0.26   0.26          0.00 0.23  0.30
## sigma_2_1 0.71   0.69          0.02 0.50  0.99
## sigma_3_1 1.45   1.42          0.06 1.05  1.99
##
## [[2]]
##            Mean Median Empirical SE 2.5%  97.5%
## sigma_1_1  0.26   0.26          0.00 0.23   0.30
## sigma_2_1  0.69   0.68          0.02 0.48   0.97
## sigma_3_1  1.33   1.31          0.05 0.93   1.84
## sigma_4_1 26.26   8.50      12152.89 2.14 144.65

## NULL

##
##    1    2    3    4    5    6
##  0.0  0.3 86.8 12.2  0.7  0.0

## Time difference of 104.433 mins

##
##  Empirical Means

## # A tibble: 3 x 4
##   Diagnosis      T4      T3     TSH
##   <fct>       <dbl>   <dbl>   <dbl>
## 1 Hypo        -1.80   -1.16    1.91
## 2 Normal     0.0738 -0.0883  -0.237
## 3 Hyper       1.22    1.38   -0.625

##
##  Empirical Vars

## # A tibble: 3 x 4
##   Diagnosis    T4    T3   TSH
##   <fct>     <dbl> <dbl> <dbl>
## 1 Hypo       1.20  1.15  1.38
## 2 Normal    0.157 0.289 0.192
## 3 Hyper     0.174 0.865 0.391
```
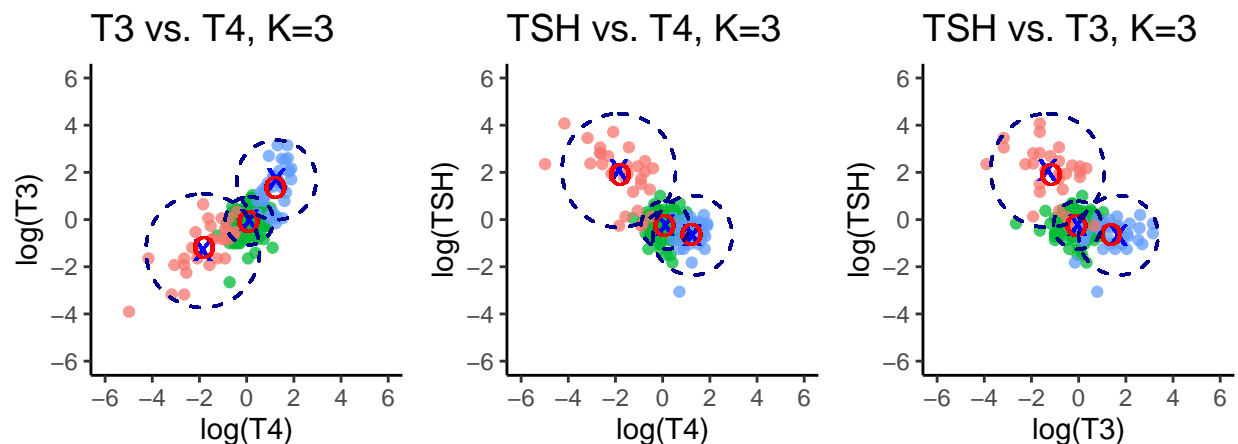
Figure with three scatter plots titled "T3 vs. T4, K=3", "TSH vs. T4, K=3", and "TSH vs. T3, K=3"

```
## Saving 6.5 x 4.5 in image

## null device
##           1

## Saving 7 x 7 in image

## null device
##           1

## Saving 7 x 7 in image

## null device
##           1

##
##   Frequency of MCMC iterations finding K groups:
##      1     2     3     4     5     6     7     8     9
##     29  1399  5585  3727  1025   192    35     5     3
##
##   Percentage of MCMC iterations finding K groups:
##      1     2     3     4     5     6     7     8     9
##    0.2  11.7  46.5  31.1   8.5   1.6   0.3   0.0   0.0
##
##   *Note that above frequency summaries of MCMC iterations were made before burn-in or thresholds were
##           All inference on phi will be made after accounting for burn-in and thresholding.
##
##   K = 2  n_k = 1218 after burn-in and thresholding
##           Mean Median Empirical SE  2.5% 97.5%
```

```
## mu_1_1  0.15    0.19           0.03 -0.26  0.40
## mu_1_2  0.06    0.09           0.03 -0.30  0.34
## mu_1_3 -0.21   -0.25           0.03 -0.43  0.19
## mu_2_1 -0.89   -0.73           1.36 -2.71  1.36
## mu_2_2 -0.47   -0.33           1.50 -2.16  1.78
## mu_2_3  1.10    0.99           1.14 -0.75  2.84
##             Mean Median Empirical SE 2.5% 97.5%
## sigma_1_1 0.49    0.46            0.05 0.22  0.99
## sigma_2_1 2.10    1.67           17.11 0.63  4.16
##
##  K = 3  n_k = 4654 after burn-in and thresholding
##          Mean Median Empirical SE  2.5% 97.5%
## mu_1_1  0.11    0.12           0.02 -0.19  0.39
## mu_1_2 -0.01   -0.02           0.03 -0.29  0.31
## mu_1_3 -0.23   -0.24           0.02 -0.45  0.08
## mu_2_1  0.61    0.73           1.96 -1.57  1.74
## mu_2_2  0.91    0.92           1.24 -1.25  2.31
## mu_2_3 -0.28   -0.44           2.19 -1.13  1.92
## mu_3_1 -1.73   -1.80           4.45 -3.62 -0.07
## mu_3_2 -1.26   -1.27           3.93 -2.95  0.21
## mu_3_3  1.88    1.99           1.10  0.02  3.43
##             Mean Median Empirical SE 2.5% 97.5%
## sigma_1_1 0.33    0.27            0.02 0.21  0.77
## sigma_2_1 1.72    0.80          204.76 0.40  5.16
## sigma_3_1 3.13    1.54         4732.25 1.01  6.74
##
##  K = 4  n_k = 3017 after burn-in and thresholding
##          Mean Median Empirical SE  2.5% 97.5%
## mu_1_1  0.12    0.12           0.02 -0.18  0.39
## mu_1_2 -0.01   -0.02           0.03 -0.30  0.32
## mu_1_3 -0.23   -0.24           0.02 -0.46  0.06
## mu_2_1 -0.83   -0.49           7.20 -5.85  3.02
## mu_2_2 -0.57   -0.40           5.27 -5.18  3.30
## mu_2_3  0.71    0.47           7.82 -2.98  4.83
## mu_3_1  0.82    0.93           3.52 -0.64  1.94
## mu_3_2  1.18    1.27           1.27 -0.35  2.73
## mu_3_3 -0.40   -0.49           1.86 -1.33  1.21
## mu_4_1 -1.85   -1.83           0.77 -3.71 -0.41
## mu_4_2 -1.35   -1.31           0.67 -2.99 -0.06
## mu_4_3  1.98    2.04           0.78  0.40  3.48
##             Mean Median Empirical SE 2.5% 97.5%
## sigma_1_1 0.32    0.27            0.02 0.21  0.69
## sigma_2_1 6.38    1.75         2699.50 0.33 30.63
## sigma_3_1 2.59    0.79         3214.14 0.44  5.84
## sigma_4_1 2.04    1.57            4.93 0.94  6.33
##
##  K = 5  n_k = 863 after burn-in and thresholding
##          Mean Median Empirical SE  2.5% 97.5%
## mu_1_1  0.11    0.12           0.02 -0.21  0.39
## mu_1_2 -0.02   -0.02           0.02 -0.32  0.31
## mu_1_3 -0.23   -0.24           0.02 -0.45  0.09
## mu_2_1  0.74    0.79           0.55 -0.48  1.93
## mu_2_2  0.99    1.07           1.21 -0.54  2.64
## mu_2_3 -0.40   -0.44           0.47 -1.37  0.73
```

```
## mu_3_1 -0.01    0.26             9.12 -5.32   4.95
## mu_3_2  0.24    0.41            10.82 -5.25   4.42
## mu_3_3  0.18   -0.18             7.81 -3.65   5.45
## mu_4_1 -1.52   -1.54             0.69 -3.23  -0.06
## mu_4_2 -1.00   -1.05             0.54 -2.29   0.47
## mu_4_3  1.67    1.79             0.67  0.05   3.06
## mu_5_1 -1.89   -1.85            19.41 -6.14   2.32
## mu_5_2 -0.99   -1.40            24.04 -5.84   3.52
## mu_5_3  1.52    1.85            10.73 -2.73   5.59
##             Mean Median Empirical SE 2.5% 97.5%
## sigma_1_1  0.32   0.28             0.02 0.21   0.62
## sigma_2_1  1.32   0.78             5.01 0.33   5.37
## sigma_3_1  7.61   2.09          1069.49 0.57 42.98
## sigma_4_1  1.82   1.55             2.36 0.78   4.45
## sigma_5_1 16.24   2.69         44390.68 1.02 40.02
##
##  Split/Merge MH Steps:
## # A tibble: 2 x 3
##   move_type Accept_Prob Count
##   <fct>           <dbl> <int>
## 1 MERGE           0.979  1216
## 2 SPLIT           0.013  1184
##
##  Summary function runtime is 1.475621 mins

## Saving 6.5 x 4.5 in image
## Saving 6.5 x 4.5 in image
```

no. components K, DEV without SM

no. components K, DEV with SM
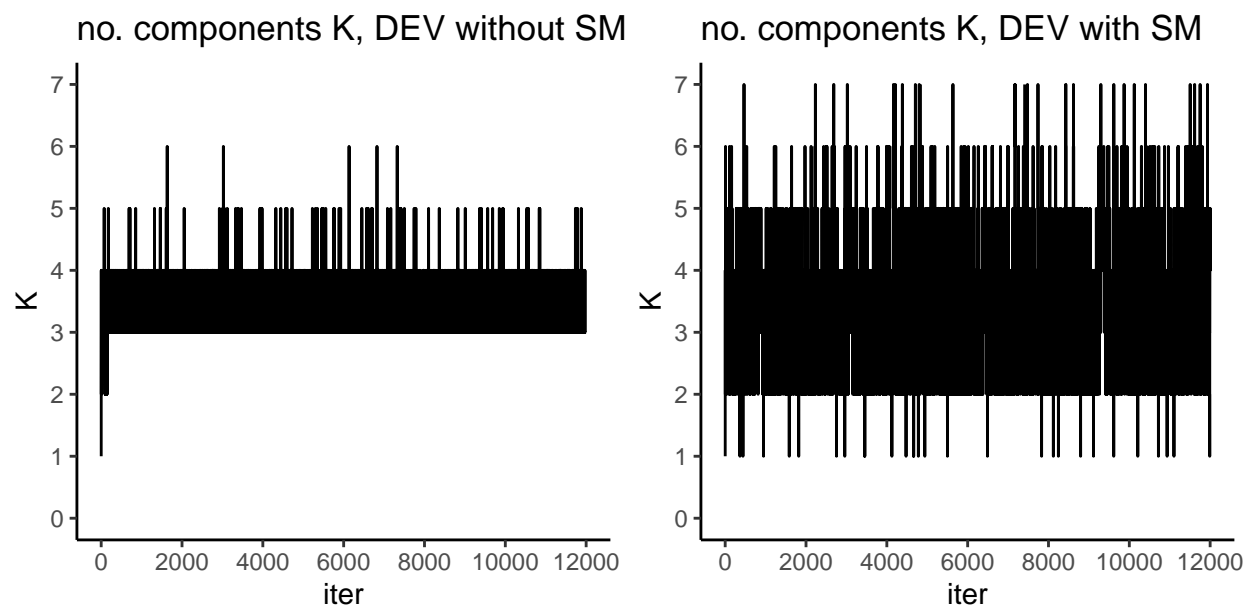
```
## Saving 6.5 x 4.5 in image

## null device
##           1

## $S
## [1] 12000
##
## $alpha
## [1] 1
##
## $a
## [1] 1
##
## $b
## [1] 10
##
## $mu0
##        [,1]
## [1,]    0
## [2,]    0
## [3,]    0
##
## $k_init
## [1] 1
##
## $d
```

8

```
## [1] 1
##
## $f
## [1] 1
##
## $g
## [1] 1
##
## $h
## [1] 10
##
## $r
## [1] 2.98024
##
## $mod_type
## [1] "conjDEV"
##
## $split_merge
## [1] TRUE
##
## $sm_iter
## [1] 5

## [[1]]
##          Mean Median Empirical SE  2.5% 97.5%
## mu_1_1  0.15   0.19         0.03 -0.26  0.40
## mu_1_2  0.06   0.09         0.03 -0.30  0.34
## mu_1_3 -0.21  -0.25         0.03 -0.43  0.19
## mu_2_1 -0.89  -0.73         1.36 -2.71  1.36
## mu_2_2 -0.47  -0.33         1.50 -2.16  1.78
## mu_2_3  1.10   0.99         1.14 -0.75  2.84
##
## [[2]]
##          Mean Median Empirical SE  2.5% 97.5%
## mu_1_1  0.11   0.12         0.02 -0.19  0.39
## mu_1_2 -0.01  -0.02         0.03 -0.29  0.31
## mu_1_3 -0.23  -0.24         0.02 -0.45  0.08
## mu_2_1  0.61   0.73         1.96 -1.57  1.74
## mu_2_2  0.91   0.92         1.24 -1.25  2.31
## mu_2_3 -0.28  -0.44         2.19 -1.13  1.92
## mu_3_1 -1.73  -1.80         4.45 -3.62 -0.07
## mu_3_2 -1.26  -1.27         3.93 -2.95  0.21
## mu_3_3  1.88   1.99         1.10  0.02  3.43
##
## [[3]]
##          Mean Median Empirical SE  2.5% 97.5%
## mu_1_1  0.12   0.12         0.02 -0.18  0.39
## mu_1_2 -0.01  -0.02         0.03 -0.30  0.32
## mu_1_3 -0.23  -0.24         0.02 -0.46  0.06
## mu_2_1 -0.83  -0.49         7.20 -5.85  3.02
## mu_2_2 -0.57  -0.40         5.27 -5.18  3.30
## mu_2_3  0.71   0.47         7.82 -2.98  4.83
## mu_3_1  0.82   0.93         3.52 -0.64  1.94
## mu_3_2  1.18   1.27         1.27 -0.35  2.73
```

```
## mu_3_3 -0.40  -0.49         1.86 -1.33  1.21
## mu_4_1 -1.85  -1.83         0.77 -3.71 -0.41
## mu_4_2 -1.35  -1.31         0.67 -2.99 -0.06
## mu_4_3  1.98   2.04         0.78  0.40  3.48
##
## [[4]]
##          Mean Median Empirical SE  2.5% 97.5%
## mu_1_1  0.11   0.12         0.02 -0.21  0.39
## mu_1_2 -0.02  -0.02         0.02 -0.32  0.31
## mu_1_3 -0.23  -0.24         0.02 -0.45  0.09
## mu_2_1  0.74   0.79         0.55 -0.48  1.93
## mu_2_2  0.99   1.07         1.21 -0.54  2.64
## mu_2_3 -0.40  -0.44         0.47 -1.37  0.73
## mu_3_1 -0.01   0.26         9.12 -5.32  4.95
## mu_3_2  0.24   0.41        10.82 -5.25  4.42
## mu_3_3  0.18  -0.18         7.81 -3.65  5.45
## mu_4_1 -1.52  -1.54         0.69 -3.23 -0.06
## mu_4_2 -1.00  -1.05         0.54 -2.29  0.47
## mu_4_3  1.67   1.79         0.67  0.05  3.06
## mu_5_1 -1.89  -1.85        19.41 -6.14  2.32
## mu_5_2 -0.99  -1.40        24.04 -5.84  3.52
## mu_5_3  1.52   1.85        10.73 -2.73  5.59

## [[1]]
##           Mean Median Empirical SE 2.5% 97.5%
## sigma_1_1 0.49   0.46         0.05 0.22  0.99
## sigma_2_1 2.10   1.67        17.11 0.63  4.16
##
## [[2]]
##           Mean Median Empirical SE 2.5% 97.5%
## sigma_1_1 0.33   0.27         0.02 0.21  0.77
## sigma_2_1 1.72   0.80       204.76 0.40  5.16
## sigma_3_1 3.13   1.54      4732.25 1.01  6.74
##
## [[3]]
##           Mean Median Empirical SE 2.5% 97.5%
## sigma_1_1 0.32   0.27         0.02 0.21  0.69
## sigma_2_1 6.38   1.75      2699.50 0.33 30.63
## sigma_3_1 2.59   0.79      3214.14 0.44  5.84
## sigma_4_1 2.04   1.57         4.93 0.94  6.33
##
## [[4]]
##           Mean Median Empirical SE  2.5% 97.5%
## sigma_1_1  0.32   0.28         0.02 0.21  0.62
## sigma_2_1  1.32   0.78         5.01 0.33  5.37
## sigma_3_1  7.61   2.09      1069.49 0.57 42.98
## sigma_4_1  1.82   1.55         2.36 0.78  4.45
## sigma_5_1 16.24   2.69     44390.68 1.02 40.02

## # A tibble: 2 x 3
##   move_type Accept_Prob Count
##   <fct>           <dbl> <int>
## 1 MERGE           0.979  1216
## 2 SPLIT           0.013  1184
```

```
##
##    1    2    3    4    5    6    7    8    9
##  0.2 11.7 46.5 31.1  8.5  1.6  0.3  0.0  0.0

## Time difference of 243.0313 mins

## Saving 7 x 7 in image

## null device
##          1

## Saving 7 x 7 in image

## null device
##          1
```

Adj RAND Index

```
##     Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   0.0000  0.6951  0.7205  0.7169  0.7388  0.8437

##     Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
## -0.1139  0.3104  0.4387  0.4519  0.6218  0.9137
```